

## SECTION 14240

### HYDRAULIC ELEVATORS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### 1.2 GENERAL DESCRIPTION:

- A. This provides design guidelines for the fabrication, installation, and testing of [number of units] In-ground hydraulic elevator(s) at [Insert Station Name].
- B. Related Sections include the following:
  - 1. Section 03300 "Cast-in-Place Concrete" for setting sleeves, inserts, and anchoring devices in concrete.
  - 2. Section 05100 "Structural Steel" for attachment plates, angle brackets, and other preparation of structural steel to support elevator equipment and components.
  - 3. Section 05500 "Miscellaneous Metals" for related items such as pit ladders.
  - 4. Section 08111 "Access Doors and Frames" for wall and ceiling access panels and access doors in elevator enclosures.
  - 5. Section 09900 "Painting" for car guiderails, the elevator brackets that secure car rails in place, the elevator pit where there is exposed concrete, and any other exposed structural elements such as concrete that exists within the elevator shaft that requires painting.
  - 6. Section 13700 "Electronic Access Control System (EACS)" for coordination of the installation of the card reader access for all controller rooms.
  - 7. Division 16 Sections for electrical service to elevators, including disconnect switches.
  - 8. Section 16750 "Elevator Emergency Intercom System" for the emergency telephone inside the elevator cab.
  - 9. Section 16840 "Closed Circuit Television Systems" for coordination of the installation of the security cameras installed within the elevator cab.

##### 1.3 ELEVATOR DEFINITIONS:

- A. Heavy duty elevator: An elevator designed specifically for the harsh environment and duty load cycles common to transportation system usage.
- B. 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.
- C. Elevator, passenger - an elevator used primarily to carry persons other than the operator and persons necessary for loading and unloading.

- D. Elevator, hydraulic - a power elevator in which the energy applied, by means of a liquid under pressure, in a hydraulic jack.
- E. Defective Elevator Work: Operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; the need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
- F. Contractor: The General Contractor.
- G. Installer: The responsible party who installs the elevator.
- H. OEM: Original Equipment Manufacturer.
- I. Owner: The owner in control of the facility.
- J. Dwell time: The period of time the elevator is at a landing with the doors fully open, passengers transfer and doors begin to close.
- K. 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.
- L. 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.
- M. Interim Maintenance: Planned monthly maintenance during the warranty period.
- N. Beneficial Use: When the elevator is placed into service, may be prior to the site being ready for public use.
- O. Revenue Service: The station or facility opening date.
- P. Notice to Proceed (NTP): within this document shall mean the date which the elevator installer is notified to proceed with the project.
- Q. Authority Having Jurisdiction (AHJ): as defined by ASME A17.1.
- R. MBTA: Massachusetts Bay Transportation Authority (Owner).
- S. SDS: Safety Data Sheets, as defined by OSHA.
- T. OSHA: Occupational Safety and Health Administration.

#### 1.4 Acronyms

- A. DF1: Full Duplex Serial Protocol.
- B. OEM: Original Equipment Manufacturer.
- D. SCADA: Supervisory Control and Data Acquisition.

#### 1.5 TEMPORARY AND PERMANENT ELECTRICAL POWER SERVICES:

Contractor shall provide and coordinate the following:

- A. Temporary power for installation shall be made available to Installer at the time of the installation. Permanent power shall be made available for testing. All power shall be provided at no cost to Installer.
- B. For the elevator drive systems: 480 volts [as applicable], 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. For lighting and GFCI receptacles: 120 volts, 1 phase, 3 wire, 60 Hertz terminating at the elevator machine location.
- E. Separate disconnect for cab lighting and wiring to cab: 120 volts, 1 phase, 3 wire, 60 Hertz terminating in a disconnect switch within sight of the controller.
- F. Separate service for sill heaters, heat trace for oil lines, oil coolers, tank heaters, and other ancillary equipment.

1.6 APPLICABLE CODES, STANDARDS, ORGANIZATIONS AND PUBLICATIONS:

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

- A. American Society of Mechanical Engineers (ASME)
  - 1. ASME A17.1 2004, A17.2.3, A17.5 (hereafter referred to as the Code) (Edition to be determined by MA 524 CMR 13.00).
  - 2. ASME B31.1, Power Piping.
- B. National Fire Protection Association (NFPA)
  - 1. NFPA No. 130, "Fixed Guideway Transit and Passenger Rail Systems".
  - 2. NFPA No. 13, 70 and 72.
- C. National Electrical Code (NEC).
- D. American Public Transit Association (APTA) Hydraulic elevator design guidelines.
- E. IEEE 519 Standard Practices and Requirements for Harmonic Control in Electrical Power Systems.
- F. American Welding Society (AWS).
- G. American Society of Testing and Material (ASTM).
- H. International Standards Organization, ISO 281/I-1997.
- I. American Federation of Bearing Manufacturers Association, AFBMA, Std. 9 and 11.
- J. National Electrical Manufacturers Association (NEMA).
- K. The American Insurance Association.
- L. Occupational Safety & Health Act (OSHA).
- M. International Code Council/ American National Standards Institute, (ICC/ANSI), A117.1-2004 minimum or current guideline as applicable.
- N. American Disabilities Accessibility Guidelines for Buildings and Facilities (ADAAG), 2004 minimum or current guideline as applicable.
- O. International Building Code, 2009 minimum or current code as applicable.

- P. Massachusetts Architectural Access Board (MAAB), 521 CMR 28.00.
- Q. Massachusetts State Building Code, 780 CMR.
- R. Massachusetts Elevator Regulations, 524 CMR.
- S. Boston Center for Independent Living Settlement Agreement (BCIL).
- T. Massachusetts Bay Transportation Authority (MBTA) 9<sup>th</sup> Revision Elevator Design Standards.
- U. Any additional requirements imposed by local agencies shall be incorporated into elevator installations.
- V. In case of a conflict between codes, regulations, or standards, the most stringent requirement shall take precedence.
- W. The elevator installer shall be licensed and strictly governed by local and governmental authorities of this area in order to perform this work.

1.7 SUBMITTALS:

- A. Submit OEM's product data and samples for the system proposed for use. Product data shall include, but not be limited to the following:
  - 1. Electrical characteristics and connection requirements.
  - 2. Expected heat dissipation of elevator equipment in machine room (i.e. BTU's/hr.) based on 120 cycles per hour.
  - 3. Maintenance programs: within sixty (60) days after notice to proceed, and prior to installation, contractor shall submit to MBTA Engineering and Maintenance and Design and Construction Departments detailed interim and revenue service maintenance programs, showing functions to be performed and their scheduled frequency. MBTA departments must approve said programs.
  - 4. Machine and pump performance data sheets.
  - 5. Pre-acceptance test forms.
  - 6. Optical fiber installation training and/or experience of contractor.
- B. Shop Drawings: Eight (8) copies of the shop drawings shall be provided by the Installer, including two (2) copies delivered to MBTA Engineering and Maintenance for review by staff and consultant. Submit approval layout drawings to scale. Drawings shall include, but not be limited to the following:
  - 1. Car, guide rails, buffers and other components in hoistway.
  - 2. Maximum rail bracket spacing.
  - 3. Maximum loads imposed on guide rails requiring load transfer to the 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 & Hall signal and operating fixtures.
  9. Remote wiring layouts for each elevator.
  10. Refuge space on top of car and pit.
  11. Machine/Pump Room area, pit and hoistway layout.
  12. Cab design, dimensions and layout.
  13. Hoistway-door and frame details.
- C. Complete assembly detail of machine/pump, hydraulic tank mounting, with all load calculations.
- D. Samples of materials and products requiring color or finish selection.

#### 1.8 OPERATING AND MAINTENANCE MANUALS:

- A. Maintenance Manuals: Prior to installation, Contractor shall submit two (2) complete sets of operation and maintenance manuals for approval. After MBTA Engineering and Maintenance Dept. and MBTA Engineer's approval and prior to the beginning of acceptance testing, four (4) sets of the approved manuals shall be provided by the Contractor. The manuals shall include the following:
1. Complete table of contents.
  2. Complete instructions regarding operation and maintenance of the elevator equipment. Included will be complete illustrated, exploded views of all assemblies, and a complete, illustrated, exploded view for identifying all system parts. Maintenance plans, procedures and frequency shall be in accordance with the MBTA Vertical Transportation Maintenance Agreement as identified in Section 1.10 Acceptance and Warranty E.3.a.2). Owner will provide access to this document at request.
  3. Complete nomenclature of replaceable parts, part numbers, current cost, and warehouse location. If product source is another vendor, Contractor shall include name and address of other vendor.
  4. Sample copies of a proposed preventive maintenance chart.
  5. Descriptions of safety devices.
  6. Safety rules, tests, and procedures, including testing of all systems and subsystems.
  7. Procedures for adjusting all elevator components, including pictorials.
  8. Troubleshooting techniques.
  9. Detailed lubrication and cleaning schedule indicating weekly, monthly, quarterly, semiannual, and annual lubrication; and a description of each lubrication point, lubrication type, and specification.
  10. Control and schematic electrical wiring diagrams of controller, including wiring of safety devices to connections with remote indication and control panels for the elevator.

11. Electrical layout showing placement of lighting, light switches, receptacles, light fixtures, disconnect switches, and convenience outlets in machinery room and pits.
12. Complete detailed drawings and wiring diagram of elevator system.
13. The Installer shall be required to provide certification, in writing and signed by an officer of the organization, that the Owner shall be provided with copies of any and all information, correspondence, bulletins, newsletters, manuals, techniques, procedures, drawings, sketches and any other 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.
  - a. All of the above referenced shall be provided as it pertains to the original installation and for a period of ten (10) years after final acceptance of the elevator.
  - b. The referenced material shall be provided within thirty (30) days of publication or internal distribution by the elevator manufacturer. The material, even if labeled PROPRIETARY, shall be delivered to the Engineer without prejudice or delay and at no additional cost.
14. The entire manual, all software upgrades and service tools for elevators shall be also provided in an electronic format on CD-ROM that is acceptable to the MBTA Engineering and Maintenance.
15. SDS 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 Installer shall allow 6 (six) weeks for review of SDS.

#### 1.9 QUALITY ASSURANCE:

- A. OEM's Qualification: Regularly engaged for the past five years in the manufacture of major components for hydraulic passenger elevators. As a standard of quality the elevator equipment design and installation shall comply with the code.
- B. Installer's Qualifications: OEM's representative or authorized agent of elevator equipment OEM who is trained and approved for installation of units required for this Project.
- C. Source Limitations: Obtain elevators through an approved source and preferably from a single manufacturing plant. Buy American provisions are stipulated in the General Terms and Conditions of this Contract.
- D. 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.
- E. The elevator subcontractor shall guarantee the materials and workmanship of the apparatus furnished under these specifications and will make good any defects not due to ordinary wear and tear or improper use or careless, which may develop within one (1) year from date of completion of each elevator, inclusive of all labor and traveling expenses. Labor shall be inclusive of any and all overtime work that may be necessary to meet the scheduling requirements of the MBTA.
- F. Labeling Requirements:

1. Every elevator shall be clearly marked with rated load and speed, manufacture serial number, and the designated Owner's identification.
  2. Machine/pump room doors shall be labeled with permanent signage.
  3. Provide an Elevator "Out of Service" sign in accordance with the current edition of the MBTA Graphics Standard.
- G. Requirements of Regulatory Agencies.
1. Application, Permits, Inspections, and Tests.
    - a. 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.
    - b. Contractor shall notify the proper inspectors to witness required testing.
- H. Testing: Perform all required testing as per paragraphs 3.3 and 3.4 of this specification.

1.10 DELIVERY, STORAGE AND HANDLING:

- A. Store materials in original protective packaging in a dry and protected area.
- B. Protect equipment exposed finishes during transportation storage and erection against damage and stains.
- C. Deliver components with factory-installed wooden skids and lifting lugs; pack components in factory-fabricated protective containers.
- D. Handle components carefully to avoid damage to components, enclosures, and finish.
- E. Store components in clean, dry areas and protect them from weather. Storage shall be in areas designated by the Engineer.
- F. Comply with the OEM's rigging instructions for unloading components; and moving components to their final location for installation.
- G. Equipment to be stored off site within fifty (50) miles of site until installation.

1.11 ACCEPTANCE AND WARRANTY:

- A. All acceptance tests must be completed as specified in contractual documents and technical specifications, reference paragraph 3.3 this specification.
- B. To coincide with the MBTA Vertical Equipment Transition Plan, the OEM shall warrant in writing that all equipment manufactured and installed under this specification, for a period of twelve (12) months from the date of Final Payment (Acceptance) by the Owner, be free of defects in design, materials, and workmanship, under normal use and service.
- C. The warranty shall include materials and labor necessary to correct defects.
- D. Defects shall include, but not be limited to, noisy, rough, or substandard operation; loose, damaged, and missing parts; and fluid leaks.
- E. Warranty Maintenance Requirements:
  1. The installer shall provide twelve (12) month preventive maintenance service to coincide with the warranty period.

2. The installer shall provide an interim maintenance service prior to being added into the Owner's maintenance program.
3. This interim maintenance shall start at the final equipment acceptance and at the time of issuance of the Certificate for Operation by the State of Massachusetts Elevator Inspector. Interim maintenance shall be provided for a period of twelve (12) months. Tasks included:
  - a. Inspection of completed installation and periodic testing to maintain elevator in completely operable condition.
  - b. Perform service/maintenance of each elevator in accordance with the MBTA Vertical Transportation Maintenance Agreement and as follows:

4. Hydraulic Elevator Work

The preventive maintenance, service, repair, inspection and testing work specified hereafter shall be considered the minimum work requirements for hydraulic elevators and associated systems and equipment included in this contract as part of the contract base scope and as included in the contract base price. If additional preventive maintenance, service, repair, inspection or testing is required for safe, reliable operation as directed by The Authority or as may be required in accordance with the original equipment manufacturer's specifications, instructions or applicable codes, laws or regulations, the Contractor shall perform that required work at no additional costs to The Authority at any time throughout the duration of the contract. In support of the aforementioned, the following list of standards is not meant to be all-inclusive but to serve as an outline for the nature of hydraulic elevator work required in this contract at periodic intervals. The goal for this agreement is uninterrupted elevator service, with allowances for preventive maintenance and scheduled inspections. Note the work performed, fill out log book entry form, and provide other documentation requirements as shown.

5. Hydraulic Elevator Monthly Requirements:

- a. Observe operation of elevator throughout its full range and at all floors that it serves to test controls, safety devices, leveling, etc. If creep is excessive, determine the cause and correct.
- b. Check door operation. Clean and lubricate linkages, gears, motors, checks, check keys, set screws, contacts, chains, cams, etc. Clean, adjust or repair as required electronic door operation system (as applicable).
- c. Check and clean car door clutch assembly.
- d. Check door protective devices and fastenings for operation and tightness. Adjust or repair as required.
- e. Check car door rollers, eccentrics and gibs. Adjust or repair as required.
- f. Check car. Clean, lubricate and adjust car door tracks, pivot points, hangers, car grille and stile channels and car top exits.



- g. Inspect and test the emergency intercom and/or telephone devices and the emergency alarms or bells. Comply with Authority policies and procedures regarding the aforementioned equipment and notify the MCC, X5278 of any defects or problems discovered. Perform required adjustments or repairs.
- h. Thoroughly inspect ADA fixtures, appliances, devices, components and equipment. Perform repairs as required.
- i. Service guide rail lubricators.
- j. Observe operation of motor and pump, oil lines, tank, controls, pistons, etc. Perform adjustments or repairs as required.
- k. Inspect and thoroughly test the firefighter's service, medical and hospital emergency service systems for proper operation. Perform adjustments or repairs as required.
- l. Check packing glands and seals of valves and cylinders; tighten to prevent loss of fluid or repair/replace as required.
- m. Visually inspect controller, contacts, relays, resistance tubes, grids, fuses, holders, controller connections and alignment of switches. Clean and make adjustments and replace components as required.
- n. Clean machine room and machine room floor.
- o. Inspect, adjust, repair or replace as required: car interior, floor, walls, sills, ceiling, car interior appurtenances, car ventilation system, hall and car call buttons, hall lanterns, all car station buttons and switches and elevator out-of-service flip down signs.
- p. Inspect, test, repair or replace as required float switches in pits, machine rooms and machine spaces.
- q. Inspect hoistway and pit, including buffers. Clean and lubricate equipment as required.
- r. Inspect and test as required sump pumps including float switches in pits, machine rooms and machine spaces. Sump pumps found to be inoperable shall be reported to Maintenance Control Center, X5278 for repair and replacement. Contractor shall provide support as necessary, as part of base contract price.

6. Hydraulic Elevator Quarterly Requirements

Hydraulic elevator quarterly requirements shall include the monthly requirements listed above, plus the following:

- a. Check leveling operation. Clean and adjust creep and leveling switches, cams, etc. Perform adjustments or repairs as required for proper leveling.
- b. Check hoistway doors. Clean, lubricate and adjust tracks, hangers and eccentrics, linkage gibs and interlocks.
- c. Check car doors. Clean, lubricate and adjust pivot points, moving parts, chains, tracks, sheaves and contacts.
- d. Thoroughly clean all car light fixtures.
- e. Visually inspect and clean safety parts, pivots, set screws, switches, etc. Lubricate moving parts to assure their proper operation.
- f. Clean, adjust and lubricate car shoes or roller guides.
- g. Clean sides of hoistway, door and car glass (interior and exterior).
- h. Empty and clean oil drip pans and devices and replace any approved absorbent materials in the pit and discard waste material in an approved, legal manner. Dispose of waste oil and material in accordance with applicable code(s) and law(s) at a licensed disposal facility approved by the Authority. The contractor shall supply proof of licensing to the Authority for approval.
- i. Perform a general inspection of machinery, motors, pumps, piping, valves, bearings, seals, etc. and lubricate as required.
- j. Check oil reservoir level and add proper oil, if required, in accordance with the original equipment manufacturer's specifications and instructions.
- k. Inspect and lubricate machinery contacts, linkages and gearing.
- l. Examine piping, valves, couplings, screens, etc. and correct for excess leakage.
- m. Inspect, clean and lubricate as required controllers, selectors, relays, contacts, connections, switches, traveling cables, etc.
- n. Ride car and observe operation of doors, door opening force, door timing, leveling and opening devices, selector control mechanisms, car station and hall buttons, position indicators, etc. for smoothness and proper function. Perform adjustments or repairs as required.
- o. Inspect condition and lubrication of rails, as applicable. Service lubricators.

- p. Inspect all push button, indicator and signal lamps and lights in each car and hall, machine room, pit, landing areas etc. for normal and emergency lighting. Replace lamps and lights and perform repairs as required.
- q. Clean pit, empty drip pans and remove rubbish, trash, debris, etc. Examine piston packings and seals and correct excess leakage. Discard waste material in an approved, legal manner.
- r. Inspect hall and landing area lighting at each floor or level. Notify the MCC X5278 of any defects or problems discovered. Provide written notification to the superintendent.
- s. Inspect, clean and adjust as required hoistway and car leveling, creep, stop and limit switches and cams.
- t. Complete and provide to the Authority a detailed inspection form.
- u. Clean controller with blower or vacuum and inspect each of the switches, relays, timers, contacts, hinge pins, etc. for wear and adjust and lubricate. Check voltages, resistance tubes and grids. Check resistors for indications of overheating and if overheating is found, locate and correct the problem. Check oil in overload relays, settings and operation of overloads (manual and automatic) and adjust as required. Clean and inspect fuses, holders and controller connections. Check and adjust electronic components, protective circuits and devices on controller.
- v. Examine, clean and adjust guide rails, cams and fastenings.
- w. Check inertia of doors on door closers and adjust as required. Observe operation of checks, interlocks, guides, hanger wheels and close cables, etc. and adjust or replace as required.
- x. Inspect and test for proper operation of limit and terminal devices and switches. Perform repairs as required.
- y. Check car stile channels, frame and cam supports for bends or cracks. Perform repairs as required. Clean car grille and stile channels.
- z. Check car door operation. Clean and lubricate pivot points, moving parts, chains, tracks, sheaves and contacts. Check shaft bearings, tapered pins, alignment and operation of cams and rollers. Perform adjustments or repairs as required.
- aa. Check hoistway door operation. Fill and adjust checks and door eccentrics. Check bottom gibs, struts, sills, headers, bumpers and fastenings. Adjust door contacts as required. Clean, lubricate and adjust chains and sheaves.

- bb. Inspect, clean and repair as required car gate up-thrust, sill grooves and bottom guides.
- cc. Check adjustment of car shoes or roller guides. Adjust and lubricate (as applicable) as required including guide shoe stems. Check car clearance and safety shoes and adjust as required.
- dd. Check car operating stations, hall buttons and indicators and their associated connections, contacts, springs and wiring. Clean and lubricate as required.
- ee. Inspect, test and repair or replace as required elevator safety and emergency systems including batteries, lighting, battery lowering devices, glass-break security systems, and firefighter's service.
- ff. Inspect, clean and adjust contacts and switches on car operating box.
- gg. Check car frame, cams, supports and car steadying plates. Check pivot points, sheaves, guides and track for wear. Lubricate as required.
- hh. Inspect, test and repair or replace as required hoistway, car and machine room ventilation equipment and associated mechanical and electrical components.
- ii. Thoroughly clean car guide rails using a non-flammable or high flash point solvent to remove lint, dust and excess lubricant.
- jj. Inspect traveling cable insulation, performance, hangers and junction box connections. Perform repairs or replacement as required.

7. Hydraulic Elevator Semi-Annual Requirements.

Hydraulic elevator semi-annual requirements shall consist of the following:

- a. Twice yearly- once in April and once in October of each year- thoroughly clean, brush down and vacuum entire hoistway and car including car tops, sides, bottoms, door sills (entire length), hoistway walls (including glass), overhead and divider beams, pits and associated areas of materials foreign to the elevators (i.e. pigeon droppings, dust, dirt, debris, etc.) and dispose of waste material in an approved, legal manner.

8. Hydraulic Elevator Annual Requirements.

Hydraulic elevator annual requirements shall include the quarterly requirements listed above, plus the following:

- a. Thoroughly test and re-adjust equipment for proper creep, leveling, acceleration and stopping operations.

- b. A sample of the hydraulic fluid of each elevator system shall be obtained by the Contractor and tested by a certified laboratory (i.e. as approved by The Authority) at no additional costs to The Authority at any time throughout the duration of the contract. That test shall confirm that the hydraulic fluid of each elevator system complies with the original equipment manufacturer's minimum specifications and requirements. The certified laboratory shall perform the test and provide a full report of the results for each elevator system, one (1) copy of which for each elevator system shall be furnished to The Authority, within fourteen (14) days after receipt of the corresponding fluid sample. Work shall be scheduled and performed in a manner and time that shall not impact passengers or Authority operations, as specified elsewhere in this section.
- c. In the event that the certified laboratory test results indicate the hydraulic fluid of any elevator system does not meet the original equipment manufacturer's minimum specifications and requirements (i.e. as determined by The Authority) at any test interval throughout the duration of the contract, the hydraulic fluid of the corresponding elevator system shall be entirely drained and replaced with new fluid (in accordance with the original equipment manufacturer's specifications and instructions). The hydraulic tanks shall be thoroughly cleaned of sediment, dirt, sludge and foreign materials. Dirt, sludge and foreign materials shall be cleaned from pumps, screens, valves, seals, packings, pistons, etc. System filters shall be replaced and any contaminated, worn or leaking components shall be replaced. The system shall be primed and thoroughly tested to assure proper function and operation without leaks. Resultant waste oil, debris, materials, etc. shall be discarded in an approved, legal manner. Work shall be scheduled and performed by the Contractor in a manner and time that shall not impact passengers or Authority operations, as specified elsewhere in this section. The Contractor shall prove to the satisfaction of The Authority the system and equipment function as designed with sound integrity. A full report for each elevator system that includes work start and finish dates and times, work performed, components replaced and system test results shall be furnished to The Authority, as specified elsewhere in this section.
- d. The aforementioned hydraulic fluid renewal and associated work shall be performed by the Contractor, as directed by The Authority in response to a certified laboratory test result that indicates non-compliance to the original equipment manufacturer's minimum specifications and requirements at any test interval throughout the duration of the contract, regardless of similar previous or future planned work.

- e. Thoroughly clean each elevator pit, machine area and machine room. Paint machine room floors. Confirm the use of all cleaning agents and paints with MBTA Engineering and Maintenance & their Consultant along with making necessary arrangements with Owner in order to minimize any inconvenience.
  - f. Check elevator shaft, machine room and machine areas for settling, structural cracks, obvious or visible defects and notify the MCC X5278 of any problems discovered.
  - g. Perform safety tests and inspections as required by applicable codes, laws and regulations as specified in the appropriate section elsewhere in this contract.
9. Perform any required work without removing elevator from service during peak traffic periods. Peak traffic periods are considered between the hours of 6:00 a.m. to 9:30 a.m. and 3:00 p.m. to 6:30 p.m.
  10. Provide twenty (24) hour emergency service during the maintenance period consisting of a prompt response (onsite within 45 minutes) to emergency request by telephone or otherwise from Owner or designated representative if an elevator is inoperable or in case of injury, entrapment, or potential injury to persons. Entrapment response time onsite is 30 minutes.
  11. Unlimited regular and overtime callbacks are included, at no cost, with a required onsite response time of one (1) hour. Callback repairs shall not be combined with preventative maintenance.
  12. Response time is to mean from when call/communication is received until certified technician is on site.
  13. Reporting: Detailed monthly records of tasks performed including names of individuals performing the tasks, date and time performed, and other pertinent data. Installer is required to conform to the requirements of the Owner's data base maintenance system. All reports and logs shall be turned over to MBTA Engineering and Maintenance on a monthly basis for review.

1.12 GUARANTEES:

- A. Notwithstanding the Specifications forming a part of this Contract, any inspection or approval of the Work by the Engineer, or the existence of any patent or trade name, the Contractor nevertheless unconditionally guarantees that the equipment furnished and installed hereunder shall be of the best quality and shall be fully fit for the purpose for which it is intended.

1.13 SPARE PARTS AND STOCK:

- A. Spare Parts: The Contractor shall install a locked storage cabinet in each elevator machine room with a key specified by the MBTA Engineering and Maintenance Dept. The locked cabinet shall contain the following listed spare parts upon the completion of the elevator installation:
  1. Four (4) hoistway door rollers.

2. Two (2) car door rollers.
3. Four (4) hoistway door gibs.
4. Four (4) cab door gibs.
5. One (1) electronic door detector.
6. One (1) set of replacement lights for the elevator cab.
7. One (1) box of each type of fuses.
8. Two (2) complete door interlock assemblies.
9. One (1) door operator motor.
10. Two (2) complete pushbutton assemblies for car operating station and hall stations.

1.14 DESIGN CRITERIA:

A. General

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

B. Operational Requirements

1. Hours of operation shall be considered as twenty-four (24) hours per day, seven (7) days per week.
2. Elevator components shall be designed based on the following applied duty cycle during operation:
  - a. Three (3) Hours with 100% Rated Load.
  - b. Six (6) Hours with 50% Rated Load.
  - c. Fifteen (15) Hours with 25% Rated Load.
3. Maximum dwell time per landing in these calculations shall be no more than 10 seconds.

1.15 ENVIRONMENTAL REQUIREMENTS:

- A. 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 dry bulb temperature range of minus twenty-five (-25) to plus one hundred and twenty (+120) degrees Fahrenheit.
- B. Sound Level: Elevators shall be designed to operate at or below a sixty-five (65) decibels sound level, measured five (5) feet above the elevator cab floor at any location, with the elevator operating normally, either free running or under load. For multiple elevator installations, the noise measurements shall be made with only one (1) elevator unit in operation, but with the entire installation complete and in operating condition. An ambient level not to exceed forty-nine (49) decibels shall be maintained prior to units being turned on.
- C. Seismic Zone Requirements: The elevator shall be designed to comply with seismic zone 2 requirements of MA 524 & 780 CMR 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. 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.

E. Ride Quality:

1. All elevators shall have a maximum decibel reading of 70 Dba with the doors closed during a run in the up direction, measured 5 feet above the floor in the center of the cab.
2. All elevators shall have a maximum vibration of 30 milli-g's in the X, Y and Z axis measured with an A95 filter.

1.16 COORDINATION REQUIREMENTS:

- A. Alterations: Contractor shall coordinate any alterations required to accommodate elevators with the Authority.
- B. Floor finish in cab: Contractor shall coordinate with other appropriate contractors and/or trades.
- C. Electrical: The Contractor shall coordinate all trades regarding the installation of CCTV, communications, smoke detectors, power and cab lighting requirements.
- D. Pit Drainage: Provide a means to prevent water from accumulating in the pit for outdoor elevators and indoor elevators. See Civil/Structural Design Requirements.
- E. Rigging Plan: Installer shall supply a detailed rigging plan that is approved by the Owner. Rigging plans to include, but not limited to, path of entry/egress, imposed loading on floor surfaces and structures, product data of devices to be utilized in the rigging process with reference dimensions and lifting capacities. Rigging plans to be signed and sealed by a professional engineer registered in the State of Massachusetts.
- F. Safety Training: Installer shall attend appropriate safety training programs provided by the Owner at no extra cost.
- G. As-Built Drawings: Contractor is responsible to provide revised Contract Drawings to reflect the actual as built condition including all structural, architectural, electrical, mechanical and plumbing connections to the elevators.
- H. Keys/Access/Lock Cylinders:
  1. All locks and keys shall be as per Owner's current standard lock requirements and approval from MBTA Engineering and Maintenance Department. The current cylinder is an Allen Bradley Water Proof 800 F Series 2MM #455.
  2. In addition, machine rooms shall have proximity card access readers for the door per Owner's requirements.
  2. Contractor shall verify with the Engineer that the requirements for hardware have not been amended or superseded.



3. Contractor shall provide the Engineer with length, finish, and camming requirements of each cylinder required.
- I. Methodology: The contractor shall meet with the Owner and provide a written method of installation for approval.
- J. Installer is required to coordinate and absorb all costs and efforts to secure required variances for the elevator installations applicable.
- K. Protection: During installation and until the elevator system(s) are fully operational and accepted for public use under the warranty period by the MBTA, the Contractor shall make all necessary provisions to protect all elevator components from damage, deterioration, and adverse environmental conditions. The Contractor shall not use or allow the use of the elevator(s) for construction purposes for activities such as hauling materials or worker transport during construction.

## **PART 2 - PRODUCTS**

### **2.1 ACCEPTABLE MANUFACTURER:**

- A. Subject to compliance with the requirements of this Section, provide hydraulic elevators of one of the following manufacturers:
  1. Canton Elevator.
  2. Global Tardif Elevator Manufacturing Group Inc.-Vision Lift.
  3. Minnesota Elevator Inc. (MEI).
  4. Approved equal.
- B. Subject to compliance with the requirements of this Section, provide elevator cabs as specified.

### **2.2 MATERIAL:**

- A. Except where product conformance to specific standards is indicated on the Contract Drawings and in ASME/ANSI A17.1, OEM's standard materials and equipment may be used in elevator construction, subject to approval. Materials cited below are intended to establish the standard of quality for comparable materials used by the manufacturer.
- B. Structural Shapes, Plates, Sheets, and Tubing: ASTM A36 Steel.
- C. Sheet Steel: ASNI/ASTM A446, Grade B.
- D. Stainless Steel: ASTM A167, Type 316L.
  1. Stainless steel with embossed texture to be rolled into exposed surface. Location as noted herein.
  2. Type 316L, #4 finish. Located as noted herein.
- E. Aluminum: ASTM B211 or ASTM B221, Alloy 6061, T6.
- F. Transparent Glazing Panels: 9/16 inch (14 mm) minimum laminated safety glass conforming to the requirements of ANSI Z97.1 and 16CFR Part 1201.

2.3 SPECIAL FEATURES:

A. General:

1. Elevator shall be of size, arrangement, capacity and shall comply with design criteria specified in this Section and as shown on the Contract Drawings, and in accordance with the requirements of the 524 CMR Section 35.0, hereinafter in this Section the "Code".
2. Provide all material and equipment necessary for the complete execution of all elevator work as specified in this Section and as shown on the Contract Drawings.
3. Provide hoistway guards for protecting hoistway during construction. Hoistway protection shall include high solid panels surrounding each hoistway opening at each floor.
4. All electric equipment, conduit, fittings and wiring shall conform to the requirements of ANSI/NFPA No. 70 National Electric Code, MA 527 CMR.
5. Provide concrete inserts and other similar anchoring devices for the installation of guide rails, machinery and other elevator components. Epoxy ceiling anchors or epoxy side wall anchors are not permitted.
6. Clearance around equipment located in each elevator control room and machine area shall comply with the applicable provisions of ANSI/NFPA No. 70 National Electrical Code, MA 524 CMR, MA 527 CMR.
7. Each elevator system is to be provided with a maintenance communication system that provides for communication from within each elevator car enclosure, car top and control room.
8. Provide special control and notification instrumentation required by code officials for low overhead conditions that are not code compliant and require variances.

2.4 SUMMARY OF FEATURES:

A. [Insert Station Name]: Elevator Quantity: [Insert Quantity]

- |                              |                         |
|------------------------------|-------------------------|
| 1. Elevator Use:             | Passenger               |
| 2. Contract Load, in pounds: | [Insert Capacity]       |
| 3. Contract Speed, in FPM    | 100 (with full load)    |
| 4. Travel Distance:          | [Insert Rise]           |
|                              | Per contract drawings   |
| 5. Car Size:                 | Per contract drawings   |
| 6. Serves:                   | [Insert Service Levels] |
| 7. Number of Stops:          | [Insert Stops]          |
| 8. Number of Openings:       | [Insert Openings]       |
| 9. Operation:                | Selective/Collective    |
| 10. Machine Location:        | [Insert Location]       |

- |     |  |  |
|-----|--|--|
| 11. | Machine/Pump Type:   | Dry/ Non Submersible Type  |
| 12. | Motor Horse Power:   | [Insert Motor HP]  |
| 13. | Power Supply:  | 480V [as applicable], 60Hz, 3Phase   |
| 14. | Lighting/ Signal Power Supply:   | 120V, 60Hz, 20A  |
| 15. | Ancillary/Auxiliary Power Supply:  | 120V, 60Hz, Amperage   |
| 16. | Car/Hoistway Door Size:  | Per contract drawings  |
| 17. | Car/Hoistway Door Type:  | Per contract drawings  |
| 18. | Car/Hoistway Door Operation:   | Power High-speed, heavy duty<br>Maximum opening speed 3.0 fps                        |
| 19. | Hoistway Entrance:   | New, as specified.   |
| 20. | Cab Enclosure:   | New, as specified.   |
| 21. | Cab Finished Flooring:   | Poured Acrylic Epoxy by others   |
| 22. | Door-Reversal Device:  | Non Contact (Weather Resistant)<br>door reversal device                              |
| 23. | Car Operating Panel:   | Type 316L stainless Steel #4<br>Finish with vandal resistant features                |
| 24. | Car Direction Indicator  | Type 316L stainless Steel #4<br>finish with vandal resistant features                |
| 25. | Hall Call Stations:  | Single riser<br>Type 316L stainless steel #4<br>Finish with vandal resistant buttons |
| 26. | Communication System:  | “Hands-Free” VPP Phone   |
| 27. | Provide keyed switch in hall pushbutton station as directed to shut down elevator.<br>Allen Bradley 800 F Series 2MM #455 Key. |  |
| 28. | Maintenance Term:  | One (1) year after MBTA acceptance for<br>public use.                                |

B. [Insert Data Sets from 2.4.A as required for additional Elevators].

## 2.5 DOOR OPERATOR EQUIPMENT:

- A. Provide a water resistant heavy duty door operator with encoderless variable voltage variable frequency VVVF drive. Closed loop door operator designed to operate car and hoistway doors simultaneously at the speed specified. Door shall open automatically when car stops at landing to discharge passengers or to answer valid calls and close automatically after predetermined time interval has elapsed. The doors shall be capable of smooth and quiet operation without slam or shock. Door operator to have 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.
10. Cab Door Switch and Restrictor. The doors on cab doors shall be equipped with approved cab gate switch and door restrictor of the cab unit system type tested as required by the Code.
  - a. Gate Switch shall prevent operation of the car away from a landing until doors are locked in the closed position. Gate switch shall be water resistant. Door restricting device shall prevent doors from opening at any position within the hoistway and or landing from the cab side unless car is at rest at that landing, or is in the leveling zone and stopping at that landing.

-OR-

10. Cab Door Interlock. The doors on cab doors shall be equipped with approved cab door interlocks of the cab unit system type tested as required by the Code.
  - a. Interlock shall prevent operation of the car away from a landing until doors are locked in the closed position. Interlock shall prevent doors from opening at any position within the hoistway and or landing from the cab side unless car is at rest at that landing, or is in the leveling zone and stopping at that landing.
  - b. Cab door unlocking devices shall conform to the requirements of the Code and shall be provided to permit authorized persons to gain access to hoistway when car is away from landing.
  - c. Provide an electric contact mounted on the car that will prevent the car from moving away from landing unless car doors are closed.

B. Door Protection: Electronic Entrance Detector Screen: Provide TriTronics electronic door detector device, which projects an infrared curtain of light guarding the door opening. Arrange to reopen doors if one beam of the curtain is penetrated. Unit shall have transmitters and receivers spaced at a minimum distance to provide the maximum amount of protection within the height of the doorway. Systems, which have the availability to turn Off or On individual zones within the curtain, will not be allowed.

## 2.6 HOISTWAY EQUIPMENT:

### A. Guide Rails:

1. Guides shall be steel T-section rails. Rail surfaces shall be machined smooth to insure proper operation of guides. Rail ends shall be accurately machined with tongue and matching groove centrally located on web. Non-wearing rail surfaces

are to be painted at the completion of the elevator in color selected by the Architect.

2. Guides shall be joined and installed in accordance with Section 2.23 of the Code.
  3. Guide rails are not to be in view from within the elevator cab.
- B. Car Buffers: Spring type with blocking and support.
- C. Stop Switch: An enclosed stop switch, mounted in the pit of each elevator in accordance with the Code, shall prevent operation of elevator when switch is activated.
- D. Terminal Limits: Limit switches shall slowdown and stop the car at the terminals if the primary automatic stopping system fails.

## 2.7 MACHINE COMPONENTS:

### A. Drive System:

1. General: Provide a hydraulic drive system. The drive system shall consist of a hydraulic power unit and jack assembly capable of lifting the gross load to the height indicated in the Contract Drawings. Submersible power units are not acceptable. The motor and pump shall be designed specifically for hydraulic elevator operation. The maximum operating pressure shall not exceed 400 psi.
2. Hydraulic Power Unit: Power unit shall be of a compact, self-contained integral design consisting of an electric motor, hydraulic oil pump, hydraulic oil control unit, hydraulic oil tank, and all necessary piping connection. The motor shall be mounted on a rubber isolated inner base with removable drip pan, and enclosed with sound insulated sheet steel panels. A structural steel outer base shall support hydraulic oil tank.
3. Motor:
  - a. Motor shall be of the drip-proof, squirrel cage, induction type complying with NEMA Design D torque classification, Class B insulation and be designed for one hundred twenty (120) starts per hour.
  - b. Motor shall have reduced voltage starting and shall be of energy efficient and low noise operation.
  - c. Motor shall be of heavy-duty construction and shall be designed for hydraulic elevator service with intermittent duty cycle rating.
  - d. Motor shall be provided with starter and thermal overload protection for each phase.
  - e. Motor shall be labeled by the manufacturer with NEMA minimum efficiency marking standard in accordance with NEMA MG-1-12.53b.
4. Hydraulic Oil Pump: Hydraulic oil pump shall be of the heavy-duty positive displacement type, designed for steady discharge with minimum pulsations. Pump shall be belt or direct driven by the electric motor.
5. Hydraulic Oil Control Unit: Hydraulic oil control unit design shall be suitable for operation under the required pressures and shall perform all necessary functions for safe and proper hydraulic elevator operation. Unit shall be fully adjustable to optimize elevator performance and smooth operation. Adjustments

shall be accessible and made without removing unit from oil lines. Unit shall be a single compact assembly of the following:

- a. Main valve section shall consist of bypass, lowering and check valves to control down speed and up and down leveling. Check valves shall comply with Rule 3.19.2.2 of the Code.
- b. Control section shall consist of solenoid valves that direct the main valve section and control up and down starting, transition from full speed to leveling speed, up and down stops, pressure relief valve, manual lowering valve.
- c. Relief valve shall comply with Rule 3.19.2.1 of the code.
- d. Manual lowering valve shall comply with Rule 3.19.2.3 of the Code.

6. Hydraulic Oil Tank:

- a. Hydraulic oil tank shall be of the atmosphere storage and discharge type sized to store the volume of oil required to lift the elevator car to the top landing, plus additional reserve capacity to prevent the entrance of air or other gas into the hydraulic system. Provide all initial supply of oil sufficient for proper operation.
- b. Tank shall be designed and constructed to meet or exceed the factor of safety requirements of Rule 3.24.2.2 of the Code.
- c. Tank shall be equipped with a removable cover, protected vent opening, drain valve, and at least one oil level gauge glass. Oil level gauge glass shall comply with Rule 3.24.3.3 of the Code.
- d. The oil temperature and viscosity shall be automatically kept within the elevator manufacturer's recommended limits.

7. For Direct Plunger (In ground) Type Hydraulic Elevator:

a. Jack Assembly:

- 1) Jack assembly shall consist of a plunger and cylinder of ASTM A53, Grade B, extra heavy steel pipe and shall comply with all applicable requirements of Sections 3.18 and 8.2.8 of the Code.
- 2) Jack assembly shall be complete with hydraulic oil pipe connection to cylinder, plunger connection to elevator car, cylinder head, self-adjusting and leak proof packing, stop rings, scavenger line to return hydraulic oil seeped from packing back to tank and means shall be provided on cylinder for air and gas relief.
- 3) Provide a positive displacement, rotary type oil return scavenger pump. Mount the scavenger pump off the pit floor and connect it to the jack unit and the oil tank with copper tubing.
- 4) Protect cylinder of the jack unit with two coats of pipe mastic interspaced with a spiral wrapping of fiberglass wrap and a final outside wrap of heavy kraft paper. The protection shall be Roskote "Mastic", Royston "Glass-Wrap", or approved equal.

- 5) An elevator well hole shall be provided as required. Access to the well hole location is the responsibility of the elevator contractor. Refer to the structural drawings for possible concrete foundation location under the elevator pit. No additional compensation beyond the contract amount will be allowed for this condition. Proper disposal of the well hole spoils is the responsibility of the elevator contractor. Provide double casing for elevator well hole, as shown on the Contract Drawings. The cylinder well, including the casings shall be sunk into the ground. Utilize a Schedule 40 PVC watertight well hole liner and incorporate water stop ring in the elevator pit construction. Well hole is to be provided by the Elevator Contractor.
- 6) Jack unit shall be set plumb in the well hole and then the annular space between the jack unit and PVC liner shall be filled with clean, dry sand to within 4 inches of the PVC liner.
- 7) Provide a pressure sensitive, mechanically actuated seismic safety valve, conforming to ASME A17.1, Rule 8.4.11. Connect valve directly to jack assembly inlet.

8. Ancillary Equipment:

- a. Hydraulic Oil Cooler: Provide hydraulic oil cooler to maintain hydraulic oil at the OEM's recommended optimum operating temperature. Hydraulic oil cooler shall be manufactured by Minnesota Elevator Inc. (MEI) and or approved equal. Hydraulic oil cooler shall be provided with the following:
  - 1) ¾ HP single phase ball bearing motor.
  - 2) 8 GPM, 75 PSI cast iron pump.
  - 3) Adjustable thermostat control. Control to be mounted next to adjacent wall and in proximity of hydraulic tank and hydraulic oil cooler.
  - 4) Single fan radiator.
  - 5) Electrical box for direct wiring to 115VAC, 20 Amp separate circuit.
  - 6) 10 micron filter in hydraulic oil line.
  - 7) Filter head with sight gauge to indicate when the filter needs to be changed.
  - 8) Heavy gauge frame construction.
  - 9) All fittings and hardware needed for wall mount installation.
- b. Tank Heater: Provide internal tank heater to maintain hydraulic oil at the OEM's recommended optimum operating temperature. Tank heater shall be manufactured by Elevator Equipment Company (EECO) and or approved equal. Tank heater shall be provided with the following:
  - 1) Thermostatically controlled. Control to be mounted next to adjacent wall and in proximity of hydraulic tank.

- 2) Electrical box for direct wiring to 115VAC, 30 Amp separate circuit.
- 3) Direct mounting to hydraulic tank.

## 2.8 CONTROLLER COMPONENTS:

- A. An Allen Bradley Control Logix, or approved equal, PLC controller that supports DF1 communication over Ethernet /TCP/IP shall be designed to accomplish the type of elevator operation as indicated herein. Controller shall govern starting, stopping and direction of travel of the elevator. PLC shall also meet the requirements of MBTA PLC Specification No. 16790.
- B. Controller shall protect the motor against current overload, phase reversal, and phase failure. A reverse phase relay shall be provided on the controller. Controller shall automatically open the power supply, and bring the car to rest if any of the safety devices fail to operate or if the power fails.
- C. Selective Collective Operation: As defined by ASME A17.1 and shall be the pressure upon one or more car buttons shall send the car to the designated landings in the order in which the landings are reached by the car, irrespective of the sequence in which the buttons are pressed, provided the hoistway door interlock and car door switch circuits are completed. During this operation, the car shall also answer calls from the landings, which are in the prevailing direction of travel. Each landing call shall be canceled when answered.
  1. Operation shall be automatic by means of the car and landing buttons. Stops registered by the momentary actuation of the car or landing buttons shall be made in the order in which the landings are reached in each direction of travel after the buttons have been actuated. All stops shall be subject to the respective car or landing button being actuated sufficiently in advance of the arrival of the car at that landing to enable the stop to be made. The first car or landing button actuated shall establish the direction of travel for an idle car.
  2. UP" landing calls shall be answered while the car is traveling in the up direction and "DOWN" landing calls shall be answered while the car is traveling down. The car shall reverse after the uppermost or lowermost car or landing calls has been answered, and proceed to answer car calls and landing calls registered in the opposite direction of travel.
  3. If the car without registered car calls arrives at a floor where both up and down hall calls are registered, it shall initially respond to the hall call in the direction that the car was traveling. If no car call or hall call is registered for further travel in that direction, the car shall close its doors and immediately reopen them in response to the hall call in the opposite direction. Direction lanterns, if provided, shall indicate the changed direction when the doors reopen.
- D. Controller to include programmable automatic dispatching system to enter a call to the opposite terminal landing upon entry of a patron into the elevator cab. Automatic dispatching shall be initiated based on registration of a hall call at an elevator landing. Control system will automatically enter a car call for the opposite terminal landing to the landing where the hall call is registered when the infrared light ray screen door edge protector detects passage of a patron through the door. Registration of the automatic car



call shall be reflected on the car call station but illumination of the indicator lamp as done for normal car call entries. System shall be programmable to have the automatic dispatch feature on or off and shall be controllable remotely through the PLC interface to a network.

- E. Controller shall be provided with starting switches of adequate size, together with all relays and switches to accomplish the type of elevator operation indicated herein. Switches that operate power circuits shall be designed to prevent sticking due to fusing. Overload relay shall be of the manual reset type of suitable size for the motor furnished.
- F. All controller components shall be neatly mounted and wired in a vented NEMA 4X stainless steel enclosure. All terminals and wires shall have identification markings. When venting of NEMA 4X cabinet cannot be achieved, all controller cabinets shall be supplied with a NEMA 4X compact cabinet cooler sized in accordance with manufacturers anticipated controller heat dissipation as approved by the MBTA. For wall mounted enclosures, these types of controllers are to be affixed to walls utilizing unistrut of sufficient strength and size capable of sustaining overall controller enclosure with components weight. For controller enclosures that are floor mounted and freestanding, these types of enclosures are to be supplied with a 6" high base to prevent potential water infiltration.
- G. Emergency Battery Lowering: Provide a separate battery powered unit that senses loss of power. Two (2) Batteries shall be 12 volt minimum, sealed nickel cadmium or gel cell construction. When loss of power occurs, elevator shall descend to nearest 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 button shall operate under battery power. Reduced speed for evacuation on battery operation is permitted.
- H. The PLC controller shall communicate with the existing Hub Monitoring Control System (HMCS) via the station's GE 90/30 PLC so that remote monitoring of the elevator can be accessed within the six (6) Hub Centers and the Operations Control Center (OCC).
- I. The diagnostic system shall be an integral part of the controller and provide user-friendly interaction between the service person and the controller system. Documentation to be provided in the O&M Manuals.
- J. A BNC connector (stud/pass thru) shall be mounted in the controller and shall be used for the CCTV coaxial cable. Terminal blocks for CCTV power cables shall also be mounted in the controller. These connections shall be kept away from high voltage. Additional noise suppression devices may be required to filter video signal. BNC connector (stud/pass thru) will act as a junction for the video coax cable. Additional coax cable will be needed for the connection between the OMK and controller. Refer to drawings for indicated distances and proper cables to use.
- K. Car Stall Protective Circuit: Provide a protective circuit which shall stop the motor and return the car to its first floor landing in the event that the car, while traveling up, does not reach its designated landing within a predetermined time interval. This circuit shall permit a normal exit from the car but prevent further operation of the elevator until the problem has been corrected.

- L. PLC will be used for future remote monitoring capabilities. The installer's engineering department will be responsible for programming the PLC. The PLC should be compatible with GE Simplicity.
- M. The PLC rack shall provide space for the following Signal List and for two (2) future single slot modules.

Signal Description	Data Registers	Comments
Signal Power Supply Good	1	24-volt supply for inputs is on
Safety Circuit Good	2	
Top Final Limit Tripped	3	
Bottom Final Limit Tripped	4	
Inspection Operation On	5	
Independent Service On	6	
Fire Service Phase 1 On	7	
Fire Service Phase 2 On	8	
Smoke Sensor @ Main On	9	
Smoke Sensor @ Others On	10	
Override On	11	
Car is running UP	12	
Car is running DN	13	
Car is in Door Zone	14	
Interlocks are made	15	
Front Door Gate Switch Made	16	
Rear Door Gate Switch Made	17	no signal wire if no rear door
Front Door Fully Closed	18	
Front Door Fully Open	19	
Front Door Reversal Activated	20	
Rear Door Fully Closed	21	no signal wire if no rear door
Rear Door Fully Closed	22	no signal wire if no rear door
Rear Door Reversal Activated	23	no signal wire if no rear door
Brake Lifted	24	
Drive Ready / Fault	25	no signal wire if no drive
Car Position 1 (Bit 1)	26	If more than 7 stops, provide binary position
Car Position 2 (Bit 2)	27	
Car Position 3 (Bit 4)	28	
Car Position 4 (Bit 8)	29	
Car Position 5 (Bit 16)	30	
Loss of DVR signal	31	
Telephone line voltage	32	Voltage deviates (+-) 10 % nominal voltage level
Pressure Switch ON	33	
Stop Switch ON	34	
PLC Backplane communication fault	35	

Signal Description	Data Registers	Comments
Processor reset	36	
Low Oil	37	
Power Off	38	
Electrical Protective Devices	39	
Emergency Alarm Bell On	40	
Travel Time	41	
Emergency Power On	42	
Sump Liquid Level	43	If Applicable
Door Protective Devices	44	
Availability for Service	45	

- N. The PLC shall store the last 99 faults, accessible via laptop connection, panel view and remote communications.
- O. OEM's may not supply their standard elevator controller for this project.
- P. An alpha numeric fault indicator shall be provided in the service cabinet.
- Q. In cases where the programming is done by the supplier, the supplier shall provide a copy of all working programs in electronic format as well as a printed program listing.
- R. Each I/O shall be fuse protected or utilize optical isolation.
- S. Provide UPS for PLC memory.
- T. The ability to monitor the status of any processor remotely via the network.
- U. The ability to communicate with all other models of programmable controller manufactured by said manufacturer.
- V. The Programmable Controller shall have one dedicated serial port which supports RS-232-C signals. It shall be accessible in ladder logic and provide support for Point to Point and Slave communication protocol systems. Alternatively, it must be usable for programming purposes or for access to remote programmers via modems.
- W. The Programmable Controller shall have one dedicated serial port which supports RS-485 signals. It shall be accessible in ladder logic and provide support for DH485 protocol systems. It must be usable for programming purposes.
- X. Bi-directional communication between the programmable controllers and the communication network via a standard modem interface. The protocols shall meet EIA RS-232-C electrical standards and ANSI standard communication protocols.
- Y. The processor shall have built-in diagnostics and self-test, such that each time power is cycled, the processor does a complete CPU and RAM memory test. Additionally the power-up test will momentarily light up all diagnostic LED's to be sure they are working. A power up test will not be performed if the internal flag (bit) for Fireman's Service Phase I is latched. The processor shall be capable of reporting major and minor fault

codes and processor status information back to the polling master, provided the fault is not a catastrophic hardware failure where the processor is unable to power up.

- Z. The processor shall have a built-in watchdog timer to ensure that all processor program scans occur within the time limit set by the watchdog timer. The watchdog timer cycle shall be adjustable from 20 msec to 2.5 seconds in 10 msec increments.
  
- AA. The processor shall have individual LED indicators that are clearly visible and labeled for easy identification. At a minimum the following indicators must be provided:
  - 1. CPU is in RUN mode.
  - 2. CPU is FAULTED.
  - 3. CPU battery is LOW.
  - 4. I/O points are FORCED and are not under program control.
  - 5. COMMUNICATION channels are active.
  
- BB. Input/Output Modules
  - 1. The Input/Output Modules shall be slot type and compatible with the PLC processor I/O structure. Each module shall be provided with a wiring arm to connect panel wiring to the module.
  - 2. Discrete Input Modules: 24 VDC, 16 point input module suitable for use with input devices. Provide Allen-Bradley Model 1746-IB16 or approved equal.
  - 3. Discrete Output Modules: 24 VDC, 16 point output module for use with 24 VDC output relays. Provide Allen-Bradley Model 1746-OB16 or approved equal.
  - 4. Analog Input Modules: Converts 8 differential analog signals to proportional twelve-bit binary values. The module shall accept 4 – 20 Ma signals. Provide Allen-Bradley Module 1746-NI8 or approved equal.
  - 5. Analog Output Modules: Converts 12-bit binary values to four analog output signals. The module shall output a 4 – 20 ma DC signal. Provide Allen-Bradley 1746-NI8 or approved equal.
  - 6. DeviceNet network card. The PLC shall have a DeviceNet network card Allen-Bradley part number 1747-SDN or approved equal.
  
- CC. I/O Chassis and Power Supply:
  - 1. The I/O Chassis shall be a minimum 7-slot chassis. The chassis shall accept PLC slot type modules to provide backplane connections. The first slot shall accept the processor. Provide Allen-Bradley 1746-A7 or approved equal.
  - 2. Power supplies shall provide power to the PLC processors, I/O rack and I/O modules. The power supply shall be suitable for operation of 120 VAC, single phase power. Power supply capacity shall be a minimum of 150% of the connected load. Provide Allen-Bradley 1746-P2 or 1746-P4 or approved equal as required by the application.
  
- DD. The controller shall be designed to operate automatically on standby power.
  
- EE. Dielectric Matting: Dielectric rubber matting to be supplied on floor in front of controller to prevent accidental shock.
  
- FF. Controller Room Intercom/Two Way Communication Device: Provide within each controller/machine room a two way communication/ intercom that will interface with any type of ADA compliant telephone. Intercom shall be mounted directly on or within hands distance proximity to the elevator controller. Intercom shall be manufactured by

Electronic Micro Systems Inc. (www.electronicmicrosystems.com) Model # SHWMRI-2 and or approved equal Intercom. System shall be provided with the following:

1. NEMA 4X Enclosure.
2. Handset.
3. Two (2) Phone Line capability.

GG. Controller cabinets are to be equipped with integral air conditioning units or cooling fan as needed. Air conditioning units or cooling fan are to be sized based on the control room arrangements and the heat load generated by the control equipment.

## 2.9 HOISTWAY ENTRANCES

### A. General:

1. Hoistway entrances shall be of the horizontal sliding type, with operation and number of panels as indicated on the Contract Drawings.
2. All materials and finished surfaces exposed to public view shall be stainless steel with embossed finish and glass panels as indicated on Contract drawings. Glass panels to be completely flush with door assembly.

### B. Hoistway Frames and Doors:

1. Entrance frames shall be of welded and mitered construction for complete one-piece unit assembly. All frames shall be sound deadened and securely fastened to fixing angles mounted in the hoistway and shall be Rimex #6- OM of Type 316L stainless steel. The landing sills shall be extruded stainless steel with a mill finish.
2. Entrance frames shall be provided with an extended sill floor plate the full width and depth of each entrance frame assembly. The extended sill floor plates shall be extruded stainless steel with a mill finish.
3. Hoistway entrances shall be of the horizontal sliding type, with operation and number of panels as indicated on the Contract Drawings.
4. Hoistway doors are to be Rimex Pattern No. 6-0M stainless steel reinforced and provided with keyways as required for operating mechanisms and door hangers. Provide glass panels that are completely flush with door, as indicated. Each door panel shall have Z style/shaped stainless steel bottom guides that run in landing sill slots. Guides are to be replaceable without removing door panels.
5. Provide stud mounted die cast jamb markings (2 per entrance) mounted at 5'-0".
6. Hoistway door hangers and door operator shall be as specified herein.

C. Struts and Closer Support Angles: Hoistway entrances adjacent to non-load bearing walls (gypsum dry wall, gypsum block, etc.) shall have hanger housing and door closers supported by steel angles of adequate size. Angles shall be continuous between sill and building beams above and shall be bolted to the hanger support. For load bearing walls (masonry, concrete block), submit for Engineer's approval Shop Drawings of the method to be used to support hanger housing and door closers on the wall. Door closers to be water resistant.

- D. Landing Sills: Landing sills shall conform to Section 2.11 of the Code and shall be extruded stainless steel with a mill finish supplied with grooves and trash slots for door guides and machine planed for minimum clearance. Mount sills on combination of concrete/grout and steel supports anchored to floor construction.
- E. Hanger Supports and Cover Plates: Hanger supports shall be Type ASTM 316L 3/16 inch thick stainless steel bolted to strut angles and closer support angles. Hanger cover plates shall be of Type 316L nominal 0.078 inch thick stainless minimum and shall extend, as indicated in the contact drawings. Covers shall be made in sections for convenient access when servicing hangers. Hanger sections above door openings shall be removable from within elevator car.
- F. Hoistway Fascia: Fascia to be Type 316L nominal 0.078 thick stainless steel with a number 4 finish unless otherwise shown on contract drawings. Shall be full width of hoistway in compliance with code requirements.
- G. Dust Cover: Dust cover shall be Type 316L nominal 0.078 thick stainless steel with a number 4 finish, reinforced as necessary to ensure a flat even surface throughout. Dust cover shall extend at least the full width of door opening on each side and fastened to hanger housings. Dust cover shall extend above entrance opening as indicated on Contract drawings.
- H. Interlocks and Contacts:
  - 1. The doors at each hoistway entrance shall be equipped with approved water resistant hoistway door interlocks of the hoistway unit system type tested as required by the Code.
  - 2. Interlock shall prevent operation of the car away from a landing until doors are locked in the closed position. Interlock shall prevent doors from opening at any landing from the corridor side unless car is at rest at that landing, or is in the leveling zone and stopping at that landing.
  - 3. Hoistway door unlocking devices shall conform to the requirements of the Code and shall be provided to permit authorized persons to gain access to hoistway when car is away from landing. Stainless steel ferrules to be supplied for all hoistway unlocking device keyholes to protect elevator hoistway doors.
- I. Sight Guards: Type 316L stainless steel with Rimex Pattern No. 6-OM to match hoistway entrance finish.
- J. Hoistway Sill and Extended Sill Floor Plate Heat Trace/ Heaters: Provide heat trace/heaters at each hoistway entrance to prevent the accumulation of snow, ice and water at each hoistway entrance. Heaters shall be provided with the following:
  - 1. Commercial grade PVC coated polyester tarpaulin.
  - 2. Thermostatic Control. Control to be mounted next to adjacent wall closest to hoistway and in proximity to elevator controller.
  - 3. Moisture sensor.
  - 4. Electrical box for direct wiring to 115VAC, 20 Amp separate circuit or as required.

2.10 CAB ENCLOSURE COMPONENTS:

- A. Elevator Car:

1. General:
  - a. Elevator car and car components shall meet the applicable requirements of the Code. Car control station and position indicator shall be as specified herein.
  - b. Entire car assembly, including car frame and platform, shall be free from warps, buckles, and squeaks and rattles. Joints shall be lightproof.
2. Car Frame and Platform:
  - a. Car frame and platform shall be welded galvanized steel units designed and fabricated in accordance with applicable requirements herein and Section 2.14 of the Code.
  - b. Protect car platform with fire retardant material. The platform shall be recessed as required to accept floor finish.
3. Elevator sub-flooring:
  - a. Slip-resistant metal fabrication.
  - b. To be installed in a single piece without joints inside elevator cabs as finished floor surface. Provide fabrication in shapes and sizes unique to each elevator cab as indicated on Drawings. Coordinate with elevator manufacturer and installer regarding scheduling installation.
  - c. Type: Anti-slip floor plate of ASTM alloy 316L Certified Passivated stainless steel.
    - 1) Thickness: 3/8"
    - 2) Surface Texture:
      - a. Coefficient of Friction, Anti-Slip Surface: OSHA and ADA Compliant. Minimum 0.80 for Wet and Dry Surfaces.
      - b. Resilient flooring systems shall be self-extinguishing, have 200 Deg. F. heat resistance, 11,700 PSI compressive strength, 2,200 PSI tensile strength, and 5,000 PSI flexural strength.
  - d. All perimeter edges of anti-slip floor plate shall be ground smooth and deburred for acceptance of cab base wall mullion structures. Coordinate with elevator cab manufacturer and elevator platform manufacturer for specific securing and bracing requirements to elevator platform and anti-slip floor plate.
  - e. Wood or similar materials that have the potential to absorb moisture shall not be used as sub-floor material.
4. Elevator Finished Flooring:
  - a. Poured epoxy finished floor installed by manufacturer approved installer per MBTA Elevator Design Standards.
5. Elevator Car Guides: Car guides shall be of the roller type; each guide shall consist of a set of three (3) large diameter polyurethane rollers equipped with

sealed preloaded ball bearings. Each roller shall be supported by a pivoted rocker arm that shall automatically adjust itself to guide rail misalignment and prevent excessive lateral car movement.

6. Car Enclosures:

- a. Car Top: Car top shall be of stretcher leveled, cabinet grade, and nominal 0.109 thick furniture sheet steel, reinforced to support 300 pounds on any one square foot area. An emergency exit shall be installed in the car top in conformance with the Code. Interior surface of car top shall be painted reflective white. Exterior surface of car top shall be painted black.
- b. Size and detail to withstand design stresses and provide for attachment and support of cladding, housing, ceiling, glass panels, and appurtenances. Paint all members after fabrication. Exterior of car glazing shall be easily accessible for cleaning.
- c. Suspended Ceiling:
  - 1)  $\frac{3}{4}$ " nominal overall thickness. Ceiling to be constructed by bending and forming individual ceiling sections which are to be bolted together. Additional ribbing material on non-exposed side, allowed to be added for reinforcement to panel sections and for the compensation for heavy vandal resistant type light fixtures. Material to be nominal 0.125 thick stainless steel Type 316L. Finish to be Rimex Pattern No. 6-OM and or approved equal. All edges are to be deburred and ground smooth to prevent bodily injury.
  - 2) Lighting: Car lighting shall provide a minimum of 15-foot candles measured at any point on the cab floor and shall of the type shown on the Contract Drawings. Car lighting shall be provided with emergency battery backup upon failure or interruption of normal car lighting. Emergency lighting unit shall provide required lighting for a minimum of four (4) hours. Battery charger shall be capable of restoring battery to full charge within sixteen (16) hours after resumption of normal power. Provide an external means for testing battery, lamps, and alarm bell. Lighting is to be Benfield Electric Luminaire Model RVP26PLEL (NYC Housing Authority Grade) total quantity of fixtures as per Contract drawings. Fixture to be supplied with stainless steel face plate and stainless steel backer box. Gasketing/weatherstripping to be supplied on interior portion of hinged portion of flange to prevent water and dust accumulation when in the closed position. Outer mounting flange to be supplied with welded nuts for vandal resistant spanner head screw mounting.
  - 3) Elevator Cab Digitized Floor Annunciator: Verbal Floor Annunciation shall be provided with a verbal announcement of the arrival to each floor to the passengers. Each floor announcement will coincide with the floor designation listed on



the car in print and Braille. The elevator cab digitized floor annunciator shall be tamper resistant and enclosed in a NEMA 4X enclosure and inconspicuously mounted within a self-contained unit mounted above the suspended ceiling. Faceplate to be Type 316L #4 finish stainless steel. Annunciator shall have the following features:

- a. custom vocabulary.
  - b. up to 1 Min. of Speech.
  - c. 63 Messages programmability.
  - d. Up to 3 Output control lines.
  - e. Human voice programmability via .WAV file types or approved equal.
  - f. Male and Female Voices.
  - g. 6-150VAC/DC Inputs.
  - h. Sealed Mid-Range Speaker.
  - i. Device shall be connected to the PLC and shall be remotely programmable over the PLC WAN connection.
- d. Interior Walls: Interior walls shall be as shown on the Contract Drawings and in accordance with the following:
- 1) Finish shall be Type 316L Stainless with rigidized textured surface. Finish to be Rimex Pattern No. 6-0M and or approved equal.
  - 2) Glazing per Section 2.2.
  - 3) Pad hooks shall be stainless steel.
  - 4) Cab protective pads – sides only.
- e. Stationary returns, transom and entrance column are to be provided in Type 316L stainless steel. Exposed surfaces are to be finished with Rimex Pattern No. 6-0M and or approved equal.
- f. Car Doors: Car doors to be supplied with glazed panels as indicated on Contract drawings. Glazed panels are to be completely flush with door frames. Doors shall be of the horizontal sliding type with operator, number of door panels. Exposed surfaces are to be finished with Rimex Pattern No. 6-0M and or approved equal. Doors shall protect the full width and height of car entrance opening when in the fully closed position. Car doorframe shall be integral with front wall of cab.
- g. No exposed company logos shall be allowed.
7. Car Door Equipment:
- a. Door Hangers: Door hangers for car and hoistway doors shall be of the two point suspension sheave type equipped with grease packed heavy

duty precision ball bearings, eccentric up-thrust rollers, and oiler/cleaners. Track shall be of formed cold rolled steel or cold drawn steel with rounded track surface to receive sheaves. Track shall be mounted on an eccentric stud to provide for adjustment.

- b. Car/Hoistway Door Operator: Car and hoistway doors at each landing shall be opened and closed quietly and smoothly by a direct current electric operator.
- c. Door Protection: Electronic Entrance Detector Screen: Provide TriTronics electronic door detector device, which projects an infrared curtain of light guarding the door opening. Arrange to reopen doors if one beam of the curtain is penetrated. Unit shall have Transmitters and Receivers spaced at a minimum distance to provide the maximum amount of protection within the height of the doorway. Systems, which have the availability to turn Off or On individual zones within the curtain, will not be allowed.

8. Appurtenances:

- a. Handrails: Tubular Type 316L stainless steel with #4 satin finish. Tube steel to be 1 1/2" diameter (exact measurement) with rolled and tapered ends and supplied with stainless steel spacers. Provide as shown on the Contract Drawings.
- b. Exhaust Fan: Exhaust fan, mounted on the car top, shall be a two speed, squirrel cage, centrifugal blower type capable of exhausting at least 350/700 CFM and shall conform to the requirements of the Code. Provide sixty (60) minute backup battery power for fan.
- c. Car top safety rail: Provide car top safety rail as shown on contract drawings.

2.11 SIGNAL DEVICES AND FIXTURES:

- A. General: Provide signal fixtures and control devices for each elevator. Buttons and signals shall be tamper resistant of the illuminated type that light-up when activated and remain lit until call or other function has been fulfilled. All signal fixture and control device faceplates shall be of Type 316L, nominal 0.135 inch thick stainless steel with No. 4 finish, unless otherwise shown on the Contract Drawings.
- B. Car Operating Station:
  - 1. Provide one (1) main station in the front and one (1) auxiliary station at the rear return of the elevator.
  - 2. Car operating stations shall contain Braille plates adjacent to each call button. Contractor to coordinate proper landing call outs based on maximum characters as indicated on Contract drawings. Buttons for DOOR-OPEN, DOOR-CLOSE, ALARM, EMERGENCY PHONE call functions are to be supplied. Buttons are to be vandal resistant and of the positive stop type. Buttons to be Monitor Control Model #HPS1300 with rounded edges and 1 3/8" in diameter.

3. Station shall also have in a locked service cabinet, keyed switches for car light, inspection, independent operation, as indicated on the Contract drawings.
  4. Station faceplate shall be Type 316L stainless steel with #4 finish as indicated on the Contract drawings.
  5. Engrave the car operating panel with the following:
    - a. No Smoking. Minimum 1 inch high lettering.
    - b. In Case of Fire Do Not Use Elevator, as per 524 CMR regulations.
    - c. Elevator Capacity: Minimum 3/8 inch high lettering.
    - d. Firefighters Operating Instructions.
    - e. No Smoking Symbol.
    - f. MBTA Elevator Number.
  6. Provide die cast raised markings for the car buttons and car controls in compliance with MA 521 CMR, ADAAG 2004, (minimum or current guideline as applicable) and the "Handicapped Requirements" of ANSI/ASME A17.1. Die cast plates are to be flush with faceplate surface, as indicated on Contract drawings.
  7. Provide die cast raised markings for the elevator and station identification in compliance with MA 521 CMR, ADAAG 2004, (minimum or current guideline as applicable) and the "Handicapped Requirements" of ANSI/ASME A17.1. Die cast plates are to be flush with faceplate surface, as indicated on Contract drawings.
  8. Emergency Communication: "Hands-free" ADA compliant telephone/intercom, VPP model T-1250E.
- C. Top of Car Operating Device: Provide a top-of-car operating device in compliance with the requirements of Section 2.26 of the Code. The device shall have control switches for UP, DOWN, OPERATE/INSPECT and EMERGENCY STOP. The device shall also have an 110v ac outlet for extension cord and provided with a light and protective guard as required by code.
- D. Hall Stations: Hall stations of the push-button, call acknowledging, stainless steel, tamper resistant type shall be recess mounted into the wall and or returns at all elevator landings, as indicated on Contract drawings.
1. Buttons are to be vandal resistant and of the positive stop type Buttons to be Monitor Control Model #HPS1300 with rounded edges and 1 3/8" in diameter with red jewel.
  2. Highest landing shall have a single DOWN button. Lowest landing shall have a single UP button. Intermediate landings shall have UP and DOWN buttons with the Up button on top.
  3. Phase I Fire Service illuminating fire hat to be supplied.
  4. Provide die cast raised markings for the hall buttons in compliance with MA 521 CMR, ADAAG 2004, (minimum or current guideline as applicable) and the "Handicapped Requirements" of ANSI/ASME A17.1. Die cast plates are to be flush with faceplate surface, as indicated on Contract drawings.

5. Provide die cast raised markings for the elevator and station identification in compliance with MA 521 CMR, ADAAG 2004, (minimum or current guideline as applicable) and the "Handicapped Requirements" of ANSI/ASME A17.1. Die cast plates are to be flush with faceplate surface, as indicated on Contract drawings.
  6. Engrave the hall station with the following:
    - a. In Case of Fire Do Not Use Elevator, as per 524 CMR regulations.
    - b. Firefighters Operating Instructions, as indicated on Contract drawings.
  7. Additional switches for Hoistway access, Phase I Firefighters Operation and Parking feature are to be supplied. Keyswitch requirements for Phase I Firefighters Services to be in accordance with national and local code requirements. Keyswitch requirements for Hoistway access and Parking feature per Owner's current standard lock requirements and or Engineer approval.
  8. Faceplate finish shall be Type 316L stainless steel #4 finish.
- E. Hall Lanterns:
1. Tamper resistant hall lanterns shall be equipped with illuminated UP and DOWN signal arrows, but provide single arrow where only one direction is possible. Provided units projecting from faceplate for ease of angular viewing. Match materials, finishes and mounting method with hall stations.
  2. In conjunction with each hall lantern, provide an adjustable electronic chime signal to indicate that a car is arriving in response to a hall call and to indicate direction of car travel. Signal shall sound one for up direction of travel and twice for down direction.
- F. Bell Alarm System: Bell alarm system for each elevator shall be properly located within building and audible outside hoistway when activated by the EMERGENCY STOP switch or the ALARM call button on each car control station.
- G. Firefighters' Service System: Firefighters' service system shall be provided in compliance with national and local code requirements and also tied into the MBTA's Fire Panels in the station. Any changes to the existing Master Fire Panel will have to be addressed by the contractor.
- H. Closed Circuit Television (CCTV) Security Cameras:
1. Coordination of CCTV camera: CCTV Inside each car the cab ceiling shall be designed to accept a Network camera outdoor-ready, day/night fixed dome with HDTV 1080P or approved equivalent shall be properly located and installed in car by others.
  2. Coordinate location of camera in accordance with the Elevator Contract drawings.
  3. Camera housing and lens cover exposed to public view shall be made of vandal resistant housing.
  4. Camera to be a wide angle, ceiling mounted CCTV cameras shall be mounted within the cab ceiling to provide full view of the elevator cab interior.

5. Connections shall be made through the elevator traveling cable to a connector located outside the elevator controller for connection to the Authority's system by others.
6. Ceiling cutout for security camera provisions to be coordinated with elevator manufacturer and installer. Security Camera to be physically installed by others.

## 2.12 PIPING AND APPUTENANCES

- A. Pipe and Fittings: Provide piping sizes recommended by OEM, and provide isolation couplings to prevent sound/vibration transmissions from power unit. Hydraulic oil piping shall be ASTM A53, standard weight Schedule 80 pipe with extra heavy malleable iron, 600 WSP fittings. Victaulic fittings are not permitted.
- B. Muffler: Provide a blow-out-proof muffler in the oil line between the hydraulic power unit and jack assembly. Muffler shall reduce pulsation and noise originating from power unit. Muffler shall be easily accessible for inspection of interior parts without removing the housing from the oil line.
- C. Provide a 60-100-mesh strainer in the suction line between the tank and pump. Strainer shall be sufficiently sized for low-pressure drop.
- D. All piping that requires welding shall be performed by a certified welder and inspected prior to being buried and or covered below grade.
- E. All piping that requires to be buried and or covered below grade shall be covered in minimum one (1) inch insulation and encased in a minimum Schedule 40 PVC sleeve and or liner preventing the piping from coming in direct contact with the earth. Quantity and Size of pipe sleeve and or liner shall be in accordance and coordinated with OEM's hydraulic oil line size.
- F. Hydraulic Oil Line Supports: All piping that requires to be run along ceilings, walls or other structural members, shall be mounted on approved supporting devices of sufficient size, strength and length to support piping with hydraulic oil. Quantity and size shall be in accordance and coordinated with OEM's hydraulic oil line size and recommended procedures for installation. Piping shall be exposed and shall be supported by approved and substantial straps, hangers or clamps to the structural steel, reinforced concrete, or other approved supports All applicable approved supports and connections shall be run as close as possible to ceilings, walls or structural members as to avoid any infringement to clear headroom and egress clearance requirements. Hydraulic oil line(s) shall not be welded and shall be inspectable per the local AHJ's inspection requirements.
- G. All piping within pump/machinery spaces with extended pipe lengths shall be supported with approved pipe supports of adequate size to support pipe with hydraulic oil. Quantity and size shall be in accordance and coordinated with OEM's hydraulic oil line size and recommended procedures for installation.
- H. Installer and OEM shall supply hydraulic piping diagram with all applicable connection points and mounting locations. Diagram shall be in accordance with Section 1.6.

## 2.13 WIRING AND ELECTRICAL INSTALLATION:

- A. Electrical installation shall be in accordance with Division 16.
- B. Conduit and Wiring:
1. Unless otherwise specified, all electrical conductors in the pits and hoistways, except traveling cable connections to the car shall be provided in rigid zinc-coated 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. Terminal boxes and other similar items shall be of approved construction, thoroughly reinforced, and in no case less than number 12 USSG. All electrical boxes exceeding 150 cubic inches shall be supported independently of the conduits. The rigid conduit shall conform to the specifications here in before specified. All raceway shall be threaded rigid steel conduit. Flexible heavy-duty service cord, may be used between fixed car wiring and switches on car doors for door reversal devices. Low Smoke Zero Halogen (LS0H) covered Liquidite Flexible Metal Conduit shall be utilized. No PVC conduits or PVC coated flexible liquidite metal conduit shall be allowed.
  2. 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. 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.
  3. Conduit fittings and connections using set screws or indentations as a means of attachment are not permitted.
  4. Connect motors and other components subject to movement or vibration, to the conduit systems with flexible conduit.
  5. The Contractor shall furnish all materials and completely wire all parts of the electrical equipment of the elevators including electrical devices on hatch doors.
  6. All solid state and electrical components located on top of the car enclosure or in the hoistway shall be installed within NEMA 4X enclosures.
  7. The conduits shall be of such size that the wires or cables can be readily installed and replaced, if necessary. No conduit or raceway shall be less than 3/4 inch trade size, except that for small devices such as door switches, interlocks, etc., 1/2 inch conduit may be used. 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.
  8. Conduits shall be neatly and systematically run. All exposed conduit and boxes shall be supported by approved and substantial straps, hangers or clamps to the structural steel, reinforced concrete, or other approved supports. Riser conduits in hoistway shall be supported at each floor level.
  9. All interlock, hall button and limit switch branch wiring shall be enclosed in flexible steel conduit with covering of Low Smoke Zero Halogen (LS0H) covered Liquidite Flexible Metal Conduit type.

10. All screws used for terminal connections of all wiring (control room, machine area, hoistway and pit) shall be provided with "star washers" of proper size and type.
- C. Conductors:
1. 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.
  2. 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.
  3. Provide all necessary conduit and wiring between all remote control rooms, machine areas and hoistway.
- D. Traveling Electrical Cable
1. Shall be Type ETT, rated for a maximum of 300 volts, and shall comply with the requirements of UL Standard #62 and Articles 400 and 620 of ANSI/NFPA No.
  2. Travel cables shall include separate coaxial cable shielded for the communications system.
  3. Provide 10 percent spares, but not less than 6 spare conductors in each traveling cable.
  4. Provide two (2) spare CCTV wires and two (2) twisted shielded pair. Cable shall be provided with Optical Fiber as supplied by Draka Elevator Products and or Approved equal. Training of personnel on installation of optical fiber and its interface shall be at cost to the Installer and a letter of training and/or experience of contractor shall be submitted for review.
  5. Provide separate traveling cables for car lighting and fan control circuits.
  6. Provide traveling cable for telephone in the elevator car. Cable shall extend from junction box in hoistway to telephone box in car.
  7. Provide traveling cable for car work lights.
  8. All insulated wiring, control wiring and wiring in traveling cables shall be tag coded at their terminals in the motor room or controller location and hoistway junction box, elevator cab junction box, and push-button stations within the cab, and shall agree with the approved wiring diagrams.
- E. Car and hall operating signal circuits shall not exceed 48 volts.
- F. 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.

## 2.14 OPERATION:

- A. General: Operation shall be simplex collective.
1. Simplex Collective Operation:

- a. Operation shall be automatic by means of the car and landing buttons. Stops registered by the momentary actuation of the car or landing buttons shall be made in the order in which the landings are reached in each direction of travel after the buttons have been actuated. All stops shall be subject to the respective car or landing button being actuated sufficiently in advance of the arrival of the car at that landing to enable the stop to be made. The first car or landing button actuated shall establish the direction of travel for an idle car.
  - b. "UP" landing calls shall be answered while the car is traveling in the up direction and "DOWN" landing calls shall be answered while the car is traveling down. The car shall reverse after the uppermost or lowermost car or landing calls has been answered, and proceed to answer car calls and landing calls registered in the opposite direction of travel.
  - c. If the car without registered car calls arrives at a floor where both up and down hall calls are registered, it shall initially respond to the hall call in the direction that the car was traveling. If no car call or hall call is registered for further travel in that direction, the car shall close its doors and immediately reopen them in response to the hall call in the opposite direction. Direction lanterns, if provided, shall indicate the changed direction when the doors reopen.
- B. Independent Service: Provide a key switch in the car operating panel which, when actuated, shall cancel previously registered car calls, disconnect the elevator from the hall buttons and allow operation from the car buttons only.
- C. Non-Contact Door Reopening Device operation shall be as follows:
1. The doors shall be prevented from closing from their full open position if any obstruction comes within the zone of detection. The detection zone shall move with the doors and if a person or object enters the zone as the doors are closing, the doors shall reverse and reopen. The doors shall re-close after a minimal time interval. A passenger entering or leaving the car shall not cause the doors to stop and reverse unless the doors reach a predetermined proximity to the passenger.
  2. After a stop is made, the doors shall remain open for a time interval to permit passenger transfer, after which the doors shall close automatically. This interval shall be less for a car call stop than for a hall call stop or a coincident car/hall call stop.
- D. Car Stall Protective Circuit: Provide a protective circuit which shall stop the motor and return the car to its first floor landing in the event that the car, while traveling up, does not reach its designated landing within a predetermined time interval. This circuit shall permit a normal exit from the car but prevent further operation of the elevator until the problem has been corrected.
- E. Door Operation:
1. Door close shall be arranged to start after a minimum time, consistent with MA 521 CMR, ADAAG 2004 requirements (minimum or current guideline as applicable) from notification that a car is answering a hall call.
  2. Doors shall be arranged to remain open for a time period sufficient to meet MA 521 CMR, ADAAG 2004 requirements (minimum or current guideline as applicable).



3. The time interval for which the elevator doors remain open when a car stops at a landing shall be independently adjustable for response to car calls and response to hall calls.
  4. An approved positive interlock shall be provided for each hoistway entrance, which shall prevent operation of the elevator unless all doors for that elevator are closed and shall maintain the doors in their closed position while the elevator is away from the landing. Emergency access to the hoistway as required by governing codes shall be provided.
- F. Standby Power Transfer: Upon the loss of normal power provide controls to automatically send the elevator(s) nonstop to the landing designated by the Fire Department. When arriving at the designated landing, the elevator doors shall open automatically and remain open.
- G. Automatic Leveling: Hydraulic motor and pump design shall be coordinated with the control so that car shall slow down and stop automatically at the floor (within 1/4 inch) after transition from contract speed. Car level shall be maintained automatically within one-quarter inch of the landing by an anti-creep leveling device regardless of any deviation that maybe caused by the loading or unloading of the car. Landing zone detection shall indicate to the control system the position with respect to the floor level.
- H. Top-of-Car Operating Device: Operation of elevator from top-of-car device shall also be subject to applicable electrical protective devices required in Section 2.26 of the Code.
- I. Low Oil Protective Device: A low oil protective control circuit shall be provided to automatically stop the car should oil level become insufficient to permit car respond to an upper floor call. System shall automatically bring car down to lowest landing, open doors, and then shut down elevator.
- J. Elevator Control Room:
1. A metal cabinet of not more than twenty (20) cubic feet in volume shall be provided and located in the elevator machine room. Cabinet to be rated to hold flammable materials.
  2. Cabinet shall have lockable doors and be mounted on legs or pedestals, minimum of four (4) inches off the floor.
  3. Cabinet shall be painted and marked for elevator purposes, as directed by the Owner, and Contractor shall store small parts, supplies, tools, and other materials within.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Prior to commencing with the installation of elevator equipment, examine the following and verify that no irregularities exist that would affect the quality of execution of work as specified.
1. Hoistway size and plumbness.
  2. Anchor brackets.
  3. Sill support.
  4. Pit depth.

5. Overhead clearance.

3.2 INSTALLATION:

- A. Install elevator in accordance with the OEM's installation procedures and approved Shop Drawings.
- B. Verify that electrical wiring installation is in accordance with the OEM's submittal and in accordance with the installation requirements of other Sections of the Specifications.
- C. Erect all items square, plumb, straight and accurately fitted with tight joints and intersections.
- D. Coordinate all trades to ensure that the installation of the elevators is not in conflict with the work performed of other trades.
- E. Isolate non-compatible, dissimilar materials from each other by providing vibration isolation, gaskets or insulating compounds.
- F. Provide protective coverings for finished surfaces.
- G. Upon completion, touch up and restore damaged or defaced factory finished surfaces. Touch up any marred finishes and replace as directed by the Authority.
- H. Remove protective coverings and clean exposed surfaces after completion.
- I. Welding shall comply with AWS D1.1. Identify field welds with welder's identification stamp.

3.3 FIELD TESTING

- A. Acceptance Testing:
  - 1. General: After installation and before date approved for start of interim maintenance, inspect and test the elevator and related equipment to the MBTA Engineer's, MBTA Engineering and Maintenance Department and Department of Public Safety Inspector's satisfaction that operation of every part of equipment complies with applicable requirements of ASME/ANSI A17.1, MA 524 CMR including sound level criteria specified in paragraph 1.4E herein. Elevator shall be inspected in accordance with procedures outlined ANSI/ASME A17.2, MA 524 CMR Including the 72 hour test.
    - a. Provide test instruments, materials, other necessary facilities, and all labor required for acceptance tests specified.
  - 2. Notification Requirements:
    - a. Notify the Project Manager and the Engineer a minimum of five (5) working days prior to each scheduled test.

3.4 72 HOUR PERFORMANCE PERIOD PROCEDURE

- A. Performance Period: The purpose of the performance period is to provide the Authority with a high level of assurance that the elevator system has been installed in the prescribed manner, and operate within the guidelines set in the Design Standard. The performance period is intended to enhance the quality of system start-up and aid in the orderly transfer of elevators for use by the Authority.

1. The performance period shall be for 72 hours starting after the contractor has received state acceptance. Run elevator continuously a minimum of seventy two (72) hours with full specified rated load, during which time car shall be stopped at top and bottom landings with a minimum standing period of 10 seconds at each landing.
2. Contractor shall operate the elevator at full load under normal modes of operation. Workmanship and equipment compliance with Contract Documents, Contract speed, capacity, floor-to-floor, and door performance comply with Contract Documents.
3. Elevator shall start at five minute intervals.
4. All faults recorded during performance period will be turned over to the Authority for review. Such as, but not limited to:
  - a. Door lock or car gate switch malfunction.
  - b. Pump motor and valve protection timer.
  - c. Time out of service timer.
  - d. Emergency stop switches and safety circuit malfunction.
  - e. Door protection timer.
  - f. Motor overload circuits.
  - g. Stuck button protection features.
  - h. Low oil and oil pressure devices.
  - i. Test emergency telephone in car.
5. Any deficiencies found during the performance period will be repaired by the contractor at no charge to the Authority. If deficiencies are found a new 72 hour test will be performed. The MBTA shall be notified of any testing or re-testing to be performed.
6. Speed Test: Make tests before and after full load tests. Using a tachometer on guide rail, determine actual speed of car in both directions of travel, both with full-specified rated load and no load in car. Tolerances for determining if car speeds meet the specified requirements are as follows:
  - a. Ascending Car Speed: Not more than 10 percent above or more than 10 percent below required speed.
  - b. Descending Car Speed: Not more than 10 percent above or more than 10 percent below required speed.
7. Car Leveling Test: Determine accuracy of floor landing tests both before and after full load run tests. Minimum of 1/4 inch leveling must be maintained. Test accuracy of landing at all floors with full load and no load in car, in both directions of travel.
8. Electrical Tests: Ensure elevator wiring system is free of short circuits and accidental grounds. Test ground resistance of elevator structure, equipment, and raceways for continuity. Using megohm-meter, determine that insulation resistance of each circuit is more than one (1) megohm or higher as required by

the cable manufacturer. Insulation resistance for motors shall be determined under actual conditions after installation.

9. Test Reports: Within 24 hours after completion of a test, submit a test report stating type of test, test requirements, failures, or problems, and name of certifying Engineer and Title. Safety device failure or defective equipment shall be identified, with description of cause and corrective action taken.
  10. Failures for any reasons shall be identified with cause(s) and corrective action taken.
  11. Retest Notification Requirements:
    - a. The Project Manager and Engineer shall be notified ten (10) days prior to the scheduled retest.
    - b. If any equipment is found to be damaged or defective, or if the performance of the elevator does not conform to 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.
  12. The certificate of inspection for operational use will be issued to the Owner by the enforcing inspection agency. The certificate shall be posted in the elevator control room and in the car operating station.
- B. Any deficiencies and defects discovered during the field-testing shall be corrected, repaired, replaced and a new 72 hour tested performed to the satisfaction of the MBTA's Engineer and MBTA Engineering and Maintenance Department.
- C. Acceptance: Elevator acceptance will be based upon elevators meeting requirements of Contract Documents and upon evidence of passing specified acceptance tests and inspections.

### 3.5 FINAL TURN-OVER TESTING UPON COMPLETION OF THE WARRANTY PERIOD

- A. 30 days prior to the completion of the warranty period a 24 hour turn-over test shall occur. The purpose of the turn-over test is to provide the Authority with a high level of assurance that the elevator system has been maintained in the prescribed manner, and operates within the guidelines set in the Design Standard. The turn-over test is intended to enhance the quality of the system turn-over and aid in the orderly transfer of elevators for use by the Authority.
1. The turn-over test shall be for 24 hours. Run elevator continuously a minimum of twenty four (24) hours with full specified rated load, during which time car shall be stopped at top and bottom landings with a minimum standing period of 10 seconds at each landing.
  2. Contractor shall operate the elevator at full load under normal modes of operation. Workmanship and equipment compliance with Contract Documents, Contract speed, capacity, floor-to-floor, and door performance comply with Contract Documents.

3. Elevator shall start at five minute intervals.
4. All faults recorded during turn-over test will be turned over to the Authority for review. Such as, but not limited to:
  - a. Door lock or car gate switch malfunction.
  - b. Pump motor and valve protection timer.
  - c. Time out of service timer.
  - d. Emergency stop switches and safety circuit malfunction.
  - e. Door protection timer.
  - f. Motor overload circuits
  - g. Stuck button protection features.
  - h. Low oil and oil pressure devices.
  - i. Test emergency telephone in car
5. Any deficiencies found during the turn-over test will be repaired by the contractor at no charge to the Authority. If deficiencies are found a new 24 hour test will be performed. The MBTA shall be notified of any testing or re-testing to be performed
6. Speed Test: Make tests before and after full load tests. Using a tachometer on guide rail, determine actual speed of car in both directions of travel, both with full-specified rated load and no load in car. Tolerances for determining if car speeds meet the specified requirements are as follows:
  - a. Ascending Car Speed: Not more than 10 percent above or more than 10 percent below required speed.
  - b. Descending Car Speed: Not more than 10 percent above or more than 10 percent below required speed.
7. Car Leveling Test: Determine accuracy of floor landing tests both before and after full load run tests. Minimum of 1/4 inch leveling must be maintained. Test accuracy of landing at all floors with full load and no load in car, in both directions of travel.
8. Electrical Tests: Ensure elevator wiring system is free of short circuits and accidental grounds. Test ground resistance of elevator structure, equipment, and raceways for continuity. Using megohm-meter, determine that insulation resistance of each circuit is more than one (1) megohm or higher as required by the cable manufacturer. Insulation resistance for motors shall be determined under actual conditions after installation.
9. Test Reports: Within 24 hours after completion of a test, submit a test report stating type of test, test requirements, failures, or problems, and name of certifying Engineer and Title. Safety device failure or defective equipment shall be identified, with description of cause and corrective action taken.
10. Failures for any reasons shall be identified with cause(s) and corrective action taken.
11. Notification Requirements:

- a. The Project Manager and Engineer shall be notified ten (10) days prior to the scheduled retest.
- b. If any equipment is found to be damaged or defective, or if the performance of the elevator does not conform to the requirements of the contract specifications or the Safety Code, no turn-over or acceptance of elevators shall be allowed 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.
- 12. Any deficiencies and defects discovered during the turn-over testing shall be corrected, repaired, replaced and a new 24 hour test performed to the satisfaction of the MBTA's Engineer and MBTA Engineering and Maintenance Department.
- 13. Turn-over Acceptance: Elevator acceptance will be based upon elevators meeting requirements of Contract Documents and upon evidence of passing specified acceptance tests and inspections and including the following:
  - a. Complete installation including completion of all punch list items.
  - b. Complete function and acceptance test performed.
  - c. All test reports turned over to MBTA.
  - d. Completed maintenance agreement to meet MBTA current requirements.
  - e. Unit numbers matched to MBTA inventory.
  - f. All keys and cylinders matched to MBTA units.
  - g. DPS certificate of acceptance.
  - h. Spare parts inventoried and delivered.
  - i. All as builts and drawings turned over to MBTA.
  - j. All maintenance manuals turned over to MBTA.
  - k. All maintenance software turned over to MBTA.
  - l. Any maintenance and test equipment turned over to MBTA.
  - m. Unit and machine room are completely cleaned and inspected prior to first use.

### 3.6 ADJUSTING AND CLEANING:

- A. Immediately upon the completion of the elevators, thoroughly clean each elevator including car and hoistway doors and install 3/4 inch fire retardant plywood on wood studs (2 feet –0 inches on centers) to protect all hoistway doors, frames and sills. This protection shall be maintained until the Owner orders its removal, just prior to acceptance. At that time the Installer shall perform a complete re-cleaning including doors and cabs.
- B. Remove all debris not necessary for the elevator's operation that could cause safety problems.
- C. Keep areas orderly and free from debris during the progress of the Project.
- D. Remove all loose materials and filings resulting from this work from hoistway surfaces, pits and control room spaces.
- E. Clean control room floor of dirt, oil and grease.

### 3.7 OWNER COORDINATION:

- A. Engage OEM authorized service representative to train Owner's maintenance personnel to operate elevators. Refer to Section 01820 "Demonstration and Training."
- B. Check operation of elevators with Owner's personnel present and before date of Substantial Completion. Determine that operation systems and devices are functioning properly.
- C. Check operation of elevators with Owner's personnel present not more than 60 days before end of warranty period. Determine that operation systems and devices are functioning in accordance with the contract documents.

**PART 4 - MEASUREMENT AND PAYMENT**

4.1 MEASUREMENT

- A. Elevator systems will be measured as per each complete in place, including all preparation, fixtures, accessories and incidentals.

4.2 PAYMENT

- A. Payment for Elevator systems will be made at the Contract lump sum price for the quantities as specified above.

4.3 PAYMENT ITEMS

ITEM NO.	DESCRIPTION	UNIT
1419.970	HYDRAULIC ELEVATOR	LS

**END OF SECTION**