DIVISION 14 - CONVEYING SYSTEMS

END OF SECTION

SECTION 14200

IN- GROUND HYDRAULIC ELEVATORS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications, apply to this Section.

1.02 SUMMARY

A. This section specifies work pertaining to heavy-duty hydraulic passenger elevator systems including elevator cars, hoistway equipment, hydraulic piping, valves, cylinders, machinery, control systems, indicators, signs, elevator pit ladders and finish work in the vicinity of the hoistway doors. Work under this section also includes drilling of casing holes, furnishing and installation of 3/8-inch thick steel well hole casings, and concrete in the bottom of the well hole.

B. The following sections include related requirements and are performed by other trades:

1. Section 02205 – Removal and Restoration of Existing Facilities
2. Section 02220 – Demolition
3. Section 05500 – Metal Fabrication
4. Section 08800 – Glass and Glazing
5. Section 09920 – Field Painting
6. Section 07170 – Bentonite Waterproofing
7. Section 13110 - Cathodic Protection
8. See Division 15 for heating, ventilation, air conditioning and/or fire suppression requirements for elevator machine room.
9. See Division 16 for operation and maintenance of electrical service to elevator equipment, fire alarm systems and communications systems.

C. Definitions: All terms in this specification have the meaning as defined in the ASME code.

1. Heavy duty elevator: An elevator designed specifically for the harsh environment and duty load cycles common to transportation system usage.
2. 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
3. Elevator, passenger: An elevator used primarily to carry persons other than the operator and persons necessary for loading and unloading.
4. Elevator, hydraulic: Power elevator in which the energy applied, by means of a liquid under pressure, in a hydraulic jack.
5. OEM: Original Equipment Manufacturer.
6. Dwell time: The period of time the elevator is at a landing while the doors open, passengers transfer and doors close.

7. Elevator 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.
8. Elevator Final Acceptance: The point at which the owner accepts the project as being complete including all submittal requirements. This may be a different point in time than substantial completion.
9. Interim Maintenance: Maintenance from the point of substantial completion, but prior to Revenue Service.
10. Beneficial Use: When the elevator is placed into service, may be prior to the site being ready for public use.
11. Revenue Service: The station or facility opening date.
12. Override Switch: A switch located in a kiosk panel, which disables the Hall Call Buttons.
13. MSDS: Material Safety Data Sheet
14. BOM: Bill of Material
15. SMNT: WMATA Office of Systems Maintenance
16. Elevator MCP: Maintenance Control Program as defined in the ASME A17.1 Code.
17. ICC: International Code Council
18. NIST: National Institute of Standards and Technology
19. NESC: National Electrical Safety Code
20. NEII: National Elevator Industry, Inc.
21. SPI: Society of the Plastics Industry
22. NAAMM: National Association of Architectural Metal Manufacturers

1.03 REFERENCES

A. Codes, Regulations, Reference Standards and Specifications.

1. Comply with codes and regulations of the Authority Having Jurisdiction.
2. ASME A17.1 - Safety Code for Elevators and Escalators Includes Requirements for Elevators, Dumbwaiters, Moving Walks, Material Lifts, and Dumbwaiters With Automatic Transfer Devices
3. ASME A17.2 - Guide for Inspection of Elevators, Escalators and Moving Walks Includes Inspection Procedures for Electric Traction and Winding Drum Elevators, Hydraulic Elevators, Inclined Elevators, Limited-Use/Limited-Application Elevators, Private Residence Elevators, and Escalators and Moving Walks
4. ASTM A36/A36M – Standard Specification for Carbon Structural Steel
5. ASTM A123/A123M – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
6. ASTM A153/A153M – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

7. ASTM A240/A240M REV B – Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
8. ASTM A264 – Standard Specification for Stainless Chromium-Nickel Steel-Clad Plate
9. ASTM A276/A276M – Standard Specification for Stainless Steel Bars and Shapes
10. ASTM A500/A500M – Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
11. ASTM A653/A653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
12. ASTM B3 – Standard Specification for Soft or Annealed Copper Wire
13. ASTM B8 – Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
14. ASTM D471 – Standard Test Method for Rubber Property-Effect of Liquids
15. AWS D1.1/D1.1M ERTA – Structural Welding Code - Steel
16. ICC A117.1 – Accessible and Usable Buildings and Facilities
17. IEEE 1202 CORR 1 – Flame-Propagation Testing of Wire and Cable Corrigendum 1
18. NEMA C80.1 – Electrical Rigid Steel Conduit
19. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum)
20. NEMA KS 1 – Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum)
21. NEMA MG 1 – Motors and Generators
22. NEMA PB 1 - Panelboards
23. NEMA WC 70 – Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy
24. NFPA 13 – Standard for the Installation of Sprinkler Systems
25. NFPA 70 – National Electrical Code
26. NFPA 72 – National Fire Alarm and Signaling Code
27. NFPA 130 – Standard for Fixed Guideway Transit and Passenger Rail Systems
28. UL 6 – Electrical Rigid Metal Conduit - Steel
29. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations
30. UL 62 - Flexible Cords and Cables
31. UL 98 - Enclosed and Dead-Front Switches
32. UL 360 - Standard for Safety Liquid-Tight Flexible Metal Conduit
33. UL 486A-486B - Wire Connectors
34. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures
35. UL 514A - Metallic Outlet Boxes
36. WMATA Design Criteria requirements indicated in Section VI-Mechanical.

1.04 QUALITY ASSURANCE

A. Elevator Manufacturer and/or Installer's Qualification:

1. Manufacturer Qualification: : Shall provide documents stating that their firm has successfully produced elevators for transit system applications for a minimum of ten (10) years and regularly engaged for the past five (5) 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.
2. Installer's Qualifications: Shall be the original manufacturer of elevator equipment or manufacturer's authorized agent who is trained and approved for installation of units required for this Project.
3. The Contractor shall obtain and pay for all permits and licenses and perform all required inspections.

B. Elevator Contractor:

1. The elevator contractor shall guarantee the materials and workmanship of the apparatus furnished under these specifications and will correct any defects not due to ordinary wear and tear within two (2) years from date of completion of each elevator, inclusive of labor and traveling expenses. Defective work shall be repaired or replaced at no additional cost to the Authority.
2. 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.
3. Labeling Requirements: Every elevator shall be clearly marked with rated load and speed, manufacture serial number and the designated Authority identification.
   a. All elevators shall be permanently numbered with number designations corresponding to the indications on the kiosk annunciator panel. A station sketch showing the elevator numbers shall be submitted for WMATA ELES Engineering. The elevators shall be numbered in sequence, starting at the north entrance left to right facing to the elevator at each station and proceeding clockwise around the station. The numbering shall proceed into the station toward the end of the platform. Corresponding numerical identification shall be affixed to the equipment in the machine rooms. The elevator numbering shall be approved by the ELES Engineer.

C. Work by Other Trades

a. Hoistway conforming to code and specified requirements, plumb to within ¼ inch, including machine beams, pit, and pit ladders.
b. Intermediate rail bracket supports.
c. Grouting around hoistway entrances and sills.
d. Temporary and Permanent Electrical Power Services:
e. Contractor shall provide and coordinate the following:
f. For the elevator drive systems: 480V (460V), 3 phase, 3 wires, 60 Hz terminating in a disconnect switch within sight of the controller. The disconnect shall be free of any obstruction for a total of 36" from any part of the disconnect.
g. For lighting and GFCI receptacles: 120V, 1 phase, 3 wires, 60 Hz terminating at the elevator controller location.

h. Separate disconnect for cab lighting and wiring to cab. This disconnect shall be located close to the mainline disconnect.
i. Separate service for sill heaters where required.
j. Cutouts in hoistway walls for fixtures.
k. Smoke and/or heat sensors in machine room, in car and above each hoistway entrance.
l. Closed circuit television camera (CCTV) in elevator car.
m. Intrusion detectors on machine room doors.
n. Space in kiosk for elevator annunciator panels.
o. All embedded electrical conduit between elevator hoistway, machine room and kiosk.
p. Pit Drainage means to prevent water from accumulating in the pit for outdoor and indoor elevators. If pumps are used, they shall have a backup power source. The pit floor shall be sloped toward the pit drainage/ sump pump.
q. Lock and Key Requirements: Contractor shall coordinate with WMATA. The keys for all elevators except of Code requirements shall be keyed the same. Each station shall have a key and a master key shall be furnished which will operate all elevator locks in the Metro System, including previously installed elevators.
r. Contractor shall coordinate any alterations required to accommodate elevators with the Authority.
s. Contractor shall attend appropriate safety training programs provided by WMATA at no extra cost.
t. 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.

1.05 SUBMITTALS

Submit the following for approval in accordance with the Contract Documents and with the additional requirements as specified.

A. Product Data

1. The summation of product information shall be submitted, in tabular form, of all parts incorporated in the entire group of elevators supplied under this Contract. Hard copies and electronic copies on the Flash Drive/Compact Discs (CDs) shall be submitted.

   a. Manufacturer's design data, material specifications, drawings, installation and maintenance instructions including preventive, predictive and general maintenance, and other data pertinent to the components used in the elevator systems, including, but not limited to, detailed repair data for all components, including disassembly, inspection/gauging/torque requirements, reassembly, testing and other related information. Submittals shall cover all mechanical components, operating panels and indicators and electronic equipment to control and monitor elevator control functions. Exploded view drawings shall be included to facilitate repair and maintenance functions.

   b. Lubricants, sealers, paints and any other potentially hazardous substances are subject to review and approval by the Authority. The Contractor shall submit the necessary Material Safety Data Sheets.

2. The following information shall be provided:

   a. Nomenclature of part.

   b. Elevator Contractor's part number

c. Nomenclature of next higher assembly in which used.

d. Manufacturer and part number.

e. Model number(s) of elevator(s) on which used.

f. Total quantity in entire group of elevators.

g. Current unit price to the Authority.

h. Recommended spare parts list showing parts with prices for each part. The parts listing shall be provided on or before 90 days prior to scheduled completion

3. Loads on supporting members, reaction points, and deflections under varying loads.

a. Loads imposed on the structure shall be coordinated with the Authority and not exceed agreed limits. This requirement shall be verified, documented, and stamped by a registered Professional Engineer Supporting calculations shall be provided for record file.

B. Shop Drawings

The contractor to provide detailed drawings that shows the dimensions and tolerance, specification that may include the material specification, hardness or electrical rating for each component that is being used. In regards to assemblies they must provide a top level drawing with BOM and quantities with detailed material specifications and drawings with dimensional tolerances. The contractor also to provide as-built CAD models of all elevator components.

The name of the manufacturer and type or style designation shall be listed on the each page of the equipment shop drawings. Drawings submitted shall include, but not be limited to, the following.

a. Fully dimensioned layout in plan and elevation, showing the arrangement of equipment and all pertinent details of each specified elevator unit, including as appropriate

1. All equipment located in machine rooms.

2. Location of circuit breaker, switchboard panel or disconnect switch, light switch, and feeder extension points in machine room. These electrical components shall not be blocked by anything.

3. Location in hoistway of outlets for connection of traveling cables for car light, fire detectors, communication, and control system.

4. Car, hydraulic cylinder and plunger, supporting beams, guide rails, buffers, and other components located in the hoistways.

5. Maximum guide rail bracket spacing. Guide rail brackets shall be provided at every horizontal structural member and shall be of sufficient strength to meet the ASME Code.

6. Reactions at points of supports.

7. Weight of principal parts.

8. Top and bottom clearance and over-travel of car.

9. Complete wiring diagram of the elevator system and subsystems. Complete data regarding electrical characteristics and connection requirements.

10. Refuge space on top of car and pit.

11. Cab design, dimensions and layout.
12. Color/material schedule and selection chart for cab and entrance features.
13. Hoistway Ventilation - Thermostatically Controlled, positive mechanical ventilation system.
14. Hydraulic Jack Details
15. Machine/Pump Room area, pit and hoistway layout.
16. Hydraulic piping layout indicating layout, type, size, and schedule of piping from machine room to elevator pit(s) indicating orientation of valve(s), and location of shut-off valve(s), and shall include calculations of working pressures.

b. Drawings of the hoistway entrances and doors showing their method of operation, details of construction, and fastenings to the structural members of the station structure.

c. Drawings of the car for each design specified, showing dimensions, details of construction, fastenings to platform, car-lighting, ventilation, air conditioning (if applicable), communication, and location of equipment.

d. Cuts or drawings showing details of all signal and operating devices, identifying graphics, and detailed design with diagram and schematic of kiosk annunciator panel.

e. Hydraulic drive:

1. Cylinders and plunger.
2. Power unit, including volume, rate of flow, working pressure, rpm of pump, and horsepower, voltage, frequency, service factor and rpm of the motor.
3. Piping, fittings, and couplings.
4. Valves.
5. Storage tank.
6. Muffler.
7. Hydraulic Jack Details Drawings
8. Fluid flow diagram showing all valves, operating devices, and controls.
9. Complete assembly detail of machine/pump, hydraulic tank mounting, with all load calculations.

f. Elevator controller, including manufacturer's technical data and catalog cuts, and interface hardware and software requirements.

g. Power door operator.

h. Door interlocks and electrical contacts including test reports showing that hoistway door interlocks, car door contacts, and car top emergency contacts meet the requirements of the ASME Code and certification by the NIST or other approved laboratory.

i. Car ventilation fan.

j. Car Air Conditioning (if applicable)

k. Car lighting.

l. Cabling.

m. Buffer, including stroke and certified maximum striking speed for car.

n. Communication and intrusion system design details covering electrical, mechanical, and architectural aspects.

o. Design and architectural details, including light ray unit locations, of the electrical protective device for car doors.

p. Where the use of adjoining dissimilar metals is required, descriptions of protective measures to be employed to avoid corrosive damage.

q. Certification from independent testing laboratory that glazing gaskets meet the specified requirements.

r. Hall and car fixtures at each landing including the car operating panel (COP).

s. Interface wiring diagrams with other systems showing terminal board location and identification.

t. Expected heat dissipation of elevator equipment in machine room and control areas (i.e. BTU's/hr.) based on 240 round cycles per hour.

u. Complete wiring diagram of the elevator system and subsystems. Complete data regarding electrical characteristics and connection requirements.

v. Complete assembly detail of machine/pump, hydraulic tank mounting, with all load calculations.

w. Lubricants, sealers, paints and any other potentially hazardous substances are subject to review and approval by the Authority. The Elevator Contractor shall submit the necessary Material Safety Data Sheets.

C. Samples

1. Three of each of the following samples shall be submitted for approval:

a. Steel cladding: Baked-enamel finish, six inches square. The sample shall show the rust-proofed surface of the base metal on one side and the prime and finish coats (stepped) of enamel on the other side, although both sides of actual panels are to be enameled as specified.

b. Sheet metal: Six inches square of thickness and finish specified.

c. Stainless steel cladding: 12 inches square of thickness and finish specified.

d. Glass: 12 inches square.

e. Floor covering: 12 inches square in the color and finish to be supplied.

f. Neoprene gasket: Each type.

g. Landing selector button mounted in cover plate with identity marking alongside button.

h. Signs: One of each type.

i. Ceiling material.

D. Certification:

1. Certificates of inspection and acceptance issued by Jurisdictional Authority.

2. The Acceptance Inspection (Specifications and Code) by the Office of the Elevator and Escalator (ELES) shall take place prior to the Final Acceptance Inspection by the Jurisdictional Authority, and the elevators and associated equipment shall be free of defective material, imperfect work and faulty operation.

3. All defective work identified by ELES representatives shall be repaired or replaced at no additional cost to the Authority prior to the Final Acceptance Inspection by the Jurisdictional Authority.

E. Operation & Maintenance Manuals.

1. Six sets and electronic copy of the approved manuals, elevator installation, operation instuctions, troubleshooting techniues and related equipment drawings and software (all publication must be in English) – two copies of which to be delivered to the WMATA/ELES Engineer representing of the Authority at least 60 days prior to the fina1

acceptance.. Each binder shall has the Binder Cover and Spine Insert which contain the Station Name and Unit ID.

2. Submit an electronic copy of the Manual for the review and approval, after installation and at least 90 days prior to the final acceptance. The information shall be saved/presented as follows:

a. Graphic images in ".dwg" AutoCad and ".pdf" formats. All revisions shall be made by using computer software. Hand written changes are not acceptable.
b. Text in Microsoft Word .doc, ".pdf" or approved equal format

F. The manuals shall include the following:

1. Complete operation and maintance Instructions of the elevator equipment included complete illustrated, exploded views of all assemblies and a complete illustrated, exploded view for identification all system parts.

2. 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.

3. Furnish a summation, in tabular form, of all parts incorporated in the elevators supplied under the Contract. Include but not be limited to the following:

a. Nomenclature of part.

b. Contractor's part number.

c. Nomenclature of next higher assembly in which used.

d. Manufacturer and part number.

e. Model number of elevator on which used.

f. Total quantité.

g. Current unit price to the Authority.

h. Serial numbers of all serialized assemblies, subassemblies, motors, and other major components supplied and installed.

4. Control and schematic electrical wiring diagrams of controller including wiring of safety devices.

   a. Wiring Diagrams shall be full size (11x17), ladder type, complete "as-built" wiring and single line diagrams showing the electrical connections, functions and sequence of operation of apparatus connected with each elevator, using standard symbols or proprietary symbols defined on the diagram, both in the machine room and in the hoistway, shall be furnished in duplicate for each elevator.

   b. Wiring diagrams shall incorporate the wiring identification labeling to identify the controller and field wiring used for each circuit. Wiring diagrams shall have sheets numbered with an indication of the total number of sheets in the diagram set. Each page should include unit number where the diagram belongs to.

   c. After approval, a copy of each print (11x17) shall be laminated and mounted with non-metallic holder in each elevator machine room. A hard copy set of wiring diagrams for each elevator shall be delivered to ELES Engineering Office.

   d. Coded diagrams are not acceptable.

5. Complete detailed drawings and wiring diagram of elevator system.

6. Lubricants, sealers, paints and any other potentially hazardous substances are subject to review and approval by the Authority.

   a. Provide MSDS for all the lubricants/chemicals.

   b. Provide manufacturer part number.

   c. Provide name of the manufacturer.

7. Detailed lubrication and cleaning schedule.

8. Procedures for adjusting all elevator components.

9. Complete set of contract software including operating control software.

10. Detailed, record and as-built layout drawings.

11. The entire manual, all software upgrades and service tools for elevators shall be provided in an electronic format on Flash Drive/CD-ROM that is acceptable to the WMATA Engineering and Maintenance Department.

12. All hard copy publications shall be in loose-leaf form, on 30-pound paper and with punch holes reinforced with plastic, cloth or metallic material.

   a. The O&M manual shall only contain information related to equipment installed under this contract. Generic information that does not pertain to the equipment installed shall not be included. Scanned documents are not allowed. The fonts should be standard format.

   b. All covers shall be resistant to oil, moisture, and wear commensurate with their intended use. Diagrams and illustrations shall not be loose or in pockets. All printed material shall be capable of being reproduced on dry copying machines.

13. Each elevator shall be treated as a whole and not as a grouping of disassociated parts. The material in the Wiring Diagram Manual shall be organized and indexed by the elevator classifications included in this Specification. All manual sections shall be sub-divided, to the extent required by the subject matter, and shall include, but not necessarily limited to the following topics:

    a. General system or sub-system description and operation.

    b. Sequence of operation.

    c. Replacement and step by step adjustment procedure for all components and systems.

    d. Block diagrams.

    e. Functional schematics.

    f. Functional as-built wiring diagram.

    g. Lubrication and cleaning, including frequency, methods, and trade identifications of recommended materials.

    h. Component location and description.

    i. Inspection and maintenance standards including wear limits, settings, and tolerances.

    j. Installation and removal sequence.

    k. Test and evaluation procedures.

    l. Spare parts lists and special tools.

14. The contractor shall provide all information: manuals, drawings, design changes, modifications, techniques, procedures and any other documents related to maintenance, safety, operations which relate to any part, component, system, subsystem or material and applicable to the elevator equipment. All operating, programming, control software and licensing keys (if applicable) to the PLC control system for the installation.

15. 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. During a ten (10) years period, In case of any items are obsolete or no longer available from the manufacturer the Elevator Contractor shall provide the alternative products.

G. Maintenance Control Program (MCP).

1. Provide a separate Maintenance Control Program (MCP) for each unit as required by A17.1 Code.
    a. Submit an electronic copy of the MCP to ELES Engineering for the review and approval.

    b. Provide one copy of the the approved MCP at each elevator machine room.

    b. Three (3) sets of hard copies and electronic version of the approved MCP shall be submitted to the WMATA/ELES Engineer representative.

2. The MCP shall include, but not be limited to, the Code required maintenance tasks, maintenance procedures, examination and tests.

3. The MCP shall specify examinations, tests, cleaning, lubrication, and adjustments to applicable components at regular intervals.
4. The MCP shall only contain information related to equipment installed under this contract. Generic information that does not pertain to the equipment installed shall not be included. Scanned documents are not allowed.
5. The instructions shall be permanently legible with characters a minimum of 0.125 in. (3 mm) in height.
6. All covers shall be resistant to oil, moisture, and wear commensurate with their intended use. Diagrams and illustrations shall not be loose or in pockets. All printed material shall be capable of being reproduced on dry copying machines.
7. Each unit shall be treated as a whole and not as a grouping of disassociated parts. The material in the MCP shall be organized and indexed by the elevator classifications. Each binder shall has the Binder Cover and Spine Insert which contain the Station Name and Unit ID.

1.06 SYSTEM DESCRIPTION AND PERFORMANCE REQUIREMENTS

A. Design Requirements:

1. General:

a. Elevators furnished under this Contract shall be of the heavy duty automatic, hydraulic-type with direct-acting plunger.

b. All parts shall be built to standard dimensions, tolerances, and clearances so that similar machines and devices supplied under contract are completely interchangeable. Elevators shall be designed with provision for thermal expansion and contraction of complete elevator assemblies and for any movement of the facility.

c. Fasteners: Fasteners shall be compatible with materials being fastened. Fasteners shall be furnished with self-locking nuts or retaining rings (spring washers, toothed disks). Fasteners shall be equal to or of greater corrosion resistance than the most corrosion resistant metals being fastened. The mechanical fastening used throughout the equipment on parts subject to wear and requiring replacement shall be key and seat, nut, screw, or other removable and replaceable type not requiring physical deformation or field positioning. The use of rivets or similar devices will not be acceptable as mechanical fastenings for such parts.

d. Doors of elevators shall be of the horizontal sliding type, single speed, and center-opening. The doors shall be arranged for low-speed electric power operation.

2. Capacity, Speed, Travel, Platform Size

a. All parts of the elevator equipment shall be of such design, size, and material as to satisfactorily function under all conditions of loading and operation within its rated load and speed, all with a proper factor of safety, maximum mechanical and electrical efficiency, and a minimum wear on parts.

b. Hydraulic elevators shall have sufficient capacity to lift the rated load at 150 feet per minute, with a tolerance of plus or minus 8.0 percent.

c. The rated load shall be exclusive of the weight of the complete car and shall be determined in accordance with ASME Code requirements for passenger-elevators required to carry freight, Class C3 (ASME A17.1 Section 2.16) or 4500 lbs, whichever is greater.

d. The travel, location, terminal floors, number of stops and openings, and the overall car platform size shall be as shown on the Contract Drawings.

e. The anticipated freight load (cart) will be approximately 4 feet-1 inch by 2 feet in plan, supported on four 8-inch wheels with 2-inch wide treads spaced approximately 2 feet-4 inches center-to-center longitudinally and one foot five inches center-to-center transversely. The loaded cart will weigh approximately 1,260 pounds.

f. The entrance of the cart into the elevator car will produce eccentric forces which, acting through the guide rails, will result in additional deflections and deformation on the hoistway. These deflections and deformations shall not exceed 1/16 inch and shall not be permanent.

g. The top enclosure shall be reinforced to support two men and capable of sustaining, without damage or permanent deformation, a load of 300 hundred pounds on any area one foot square and 100 pounds applied at any point. An emergency exit shall be installed in the car top in conformance with the Code.

h. In-ground (Holed) hydraulic elevator travel shall not exceed 36 feet.

B. Performance Requirements

1. The elevators shall be designed for continuous operation seven days per week, 24 hours per day.

2. Elevators shall be designed to be capable of operating with full specified performance capability while exposed to the climatic and environmental conditions described in the following paragraphs. In addition, during installation and until the beginning of scheduled maintenance service, the elevators will be subject to more extreme environmental conditions. The elevator shall be furnished the amount of protection necessary to prevent any damage to or deterioration of the elevators during this period.

a. Elevators shall be designed to operate in dry bulb temperature range of -10^0F to 140^0F and operate while exposed to the natural elements of weather, including sunlight, rain, snow, slush, salt; all condition of relative humidity, de-icing chemicals, debris, airborne dust, and corrosive elements.

b. The elevators shall have a special winter operation. The elevators shall be designed to operate in the event the outside temperature falls below a pre-established minimum value. The elevator contractor shall furnish and install the necessary timers and thermostat to accommodate the desired function.

3. Sound Level: No elevator car or elevator power unit shall generate noise in excess of NC45 sound level. Measurement of noise shall be made at a point 3 feet from the hoistway, machine room entrances, and ventilation openings, either free running or under load. For multiple elevator installation, 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.

4. Hoistway Movement:

Elevators shall be designed to sustain the load and operate with the following lateral movements of the hoistway structures:

a. In any individual glazed area: 1/4 inch.

b. In total height of hoistway structure:

1. Aerial and surface structures: 5/8 inch

2. Underground structures: ½ inch

5. The elevator assembly shall be designed in a manner to avoid corrosion and galvanic action due to physical contact between dissimilar metals or due to other causes.

6. Reliability:

1. Each elevator shall be capable of operating at full load under any of the normal modes of operation at a level of availability of not less than 98 percent over a period of 365 days.

2. Availability (*A*) is defined as the portion of normal operational time during which the equipment is available for use. Or

$$A = \frac{MTBF}{MTBF + MTTR}$$

Where:

MTBF = Mean time between failure in days

= Operating time, *t* (in days) /Number of failures in time *t*

MTTR = The average time in days required to restore an elevator to operation after a report of a failure.

B. Seismic Loads

1. In accordance with Building Code, all structures shall be designed to resist the effects of earthquake motions.

2. The elevator shall be designed to comply with the seismic zone 2 requirements of ASME A17.1.

C. Make provision for and provide a closed circuit television camera (CCTV), in the elevator car(s) with the ability to monitor the CCTV from the Kiosk annunciator panel. Submit drawings for approval before fabrication.

a. Provide electrical connections, through shielded traveling cables, between camera and the communications terminal block in machine room or pit.

D. Painting: Pit walls and machine room floor shall be painted. All machine room equipment shall be given two coats of approved machinery paint. All new iron work shall be given one coat of rust- inhibiting paint.

E. Workmanship:

1. Joints shall be welded their full length and dressed smooth and flush on exposed surfaces. Spot welding shall be used where practicable in preference to screw or rivet fasteners.

2. Sheet metal materials shall be accurately rolled and leveled, and have smooth finish and uniform color. Joints shall be formed to a tight fit, with abutting edges flush, and shall be securely welded or riveted together in such a manner as to give strength equivalent to the solid sheet. Riveted construction shall have heavy reinforcement on the back, and no rivets shall show on exposed surfaces, Welds shall be solid and dressed flush, and holes for screws or bolts shall be drilled and countersunk.
3. Wrought work shall have joints milled to a tight even fit and, where possible, shall be made without screws. Square turns and comers shall be sharp, Curves and loops shall be true and without visible joints. Abutting members shall be welded, riveted or both. Similar bars shall be halved at intersections and wide bars shall be punched for the small bars to pass through.
4. The finished work shall be strong, rigid and neat, painted in appearance. Plane surfaces shall be smooth and free from warp or buckle. Molded members shall be clean cut, straight, and true. Miters shall be well formed and in true alignment. Fastenings shall be concealed from face side of the material.

F. Corrosion Protection:
1. The contractor shall design the elevator assembly in such a manner to avoid corrosion and galvanic action due to physical contact between dissimilar metals or due to other causes.

1.07 PROJECT SITE CONDITIONS

A. The project site premises shall be visited by the Contractor to thoroughly familiarize with all details of work and working conditions. All dimensions shall be verified in the field and by comparison with the station structural and finish (information) drawings and the Authority shall be informed of any discrepancy before ordering equipment or performing work. Coordination and proper relation of this work to the structure and to the work of all trades shall be performed.

B. The elevator installer shall install all elevator wiring in the embedded conduit provided by other trades including that to the kiosk. Other trades will bring wiring for their services to either the elevator machine room or the elevator pit, terminated on a terminal block. The elevator installer shall extend wires from the terminal blocks to the appropriate location or device within the elevator enclosure or hoistway. Some of these circuits shall require shielded wires or separate isolated circuits.

1.08 WARRANTY

A. Warranty: Two (2) year warranty of construction shall start at Final Contract completion.

B. The OEM shall warrant in writing that all equipment manufactured and installed under this specification, for a period of twenty four (24) months from the date of Final Acceptance by the Authority, be free of defects in design, materials, and workmanship, under normal use and service. Defective work shall be repaired or replaced at no additional cost to the Owner.

C. The warranty shall include materials and labor necessary to correct defects.

D. The warranty does not begin until all of the following requirements have been met.

1. The Operations and Maintenance Manuals are accepted by WMATA.

2. The required training has been completed to the satisfaction of WMATA.
3. All field tests have been successfully completed.
4. The acceptance testing has been successfully completed.
5. The elevators are in service for passenger/public use.
6. The State and local jurisdictions have inspected the elevators and issued the respective certificates of Operation.
7. All spare parts have been delivered and received by WMATA.
8. Any discrepancy identified by the ELES representative shall be repaired or replaced by the Contractor at no additional cost to the Authority.

1.09 OPERATION AND MAINTENANCE TRAINING

A. Training: The Contractor shall develop and provide operation, troubleshooting and maintenance training in accordance with the General Requirements

The following training requirements shall be met:

1. Three days of classroom plus two days hands on training on the field shall be provided for 10 students per class. Six training session for a total of 60 students is required.
2. Time and place of training will be determined by the Authority, but must be completed no later than 30 days prior to the Final Completion.
3. Training shall be organized to make optimum use of the required maintenance and operation manuals including training for replacement of all parts contained in the Parts Inventory list.
4. At the completion of the first training session, a narrated and properly edited training video shall be submitted for the Authority on DVD or flash drive. The video shall be taken by the professional camera operator with quality image and sound track and will be used for the future trainings. The video shall cover operation of the elevator, function of the devices, maintenance, adjustment procedures and troubleshooting. The following items shall be included as minimum requirements:

    1) Step by step adjustment procedure on the followings:
        1.1 Door operators, DCL, DOL, full door opening, and so on…
        1.2 Valve adjustment
        1.3 Car Leveling and adjustment of leveling sensors and vans
        1.4 Door: door interlock, proper pressure, restrictors ...
        1.5 Pump motor: belt tension and alignment
    2) General overview of major items:
        2.1 Packing:
        2.2 Piston:
        2.3 shut of valve
        2.4 Controller:
        2.5 Controller display:
        2.6 Hydraulic pump
        2.7 Hydraulic tank
        2.8 Door sills
        2.9 Guide rails
    3) Daily operation and sequence of operation
    4) Replacement and Installation of components:
        4.1 hydraulic packing
        4.2 door photo eye

4.3 Hydraulic valve
4.4 Door clutch
4.5 Door pickup rollers

5) Proper guide roller adjustment
6) Verification of safety circuit
7) Maintenance procedure and Frequency of maintenance
8) Proper access of pit and top of car for inspection
9) Proper test of fire service operation
10) Proper lubrication of components
11) Troubleshooting techniques
12) How to use proper communication device, machine room, car top, and kiosk

5. Provide one additional copy of all required submittals to the ELES Engineer for Authority use.

6. Provide two copies in DVD format of training materials along with visuals and handouts to the Engineer for the Authority use.
   a. Video shall be narrative.
   b. Video shall be separated by major components Sections
   c. Equipment Identification shall be as a part of the section title.

7. Separate training manual shall be submitted for approval prior the scheduling of the training. The O&M manual shall not be used as a training manual.

B. Scope of Work

1. All training, as described below, shall take place prior to Final Acceptance of equipment or materials by the Authority. Operations and maintenance training may take place as a combined class by agreement of the Office of Elevators and Escalators (ELES). The minimum number of ELES employees to be trained will be no fewer than 60 total with a maximum of 10 per class. Those persons will be identified by WMATA. The contractor shall video tape all training sessions and provide WMATA/ELES with edited copy of the recording as stated above.

2. Operations training shall be tailored specifically to the furnished and installed equipment, and designed to teach the day-to-day operation of all equipment. The training shall be sufficient to bring personnel to a level of operating proficiency such that routine vendor support is not needed.

3. Maintenance Training shall be tailored specifically to the furnished and installed equipment, and designed to develop the knowledge and skills required to maintain all item(s) delivered.

4. Maintenance training shall be subdivided into two major levels as follows:

   a. System Level Maintenance Training, covering:

      1. Theory of operation of the system and its major components.

      2. System configuration.

      3. Preventative maintenance, consisting of written procedures and schedules for the periodic maintenance of all equipment.

      4. Written and validated inspection procedures and a system-level trouble-shooting guide (to the lowest field-replaceable unit).

   b. Shop Level Maintenance Training, covering

1. Detailed theory of operation to module, board, and/or device level.
2. Component level troubleshooting and component replacement and adjustment.
3. Testing and alignment procedures of repaired units.

C. Deliverables

1. The following course materials shall be delivered by the Contractor, according to the following specifications:

a. An Instructor's Guide containing all the information and direction necessary for the instructor to make an effective presentation. It shall include adequate guidelines to conduct a comprehensive training program. Individual lessons within the course shall be organized as separable blocks (or modules) which may be taught as a unit. The Instructor's Guide shall contain, as a minimum:

1. Discussion of student prerequisites (if any).
2. Program overview.
3. A statement of overall program goals.
4. Lesson plans (a session-by-session outline containing the following):

a. Student learning objectives, stated in measurable term
b. Overview of each lesson.

b. A Student Manual including all materials for the student to interact in the learning situation. It shall contain, as a minimum:

1. Program overview and introduction.
2. Statement of overall program goals.
3. Learning objectives, stated in measurable terms that specifically describe desired behaviors or knowledge to be gained.
4. A fully developed prose treatment (not outline format) of content presentation, developed in the same modular format as the Instructor's Guide.
5. Illustrations, charts, photos and other graphics of actual system components as needed to enhance content presentation.
6. The training manuals shall be prepared and submitted for approval to WMATA/ELES prior to training. The training manuals shall include procedures for adjustment and replacement of all electrical and mechanical components, and a troubleshooting guide.

c. Audio-visual Aids consisting of a narrated video of not less than 90 minutes duration to include, but not limited to, the following:

1. General overview of major features.
2. Daily operations.
3. Maintenance procedures such as lubrication, adjustments, critical measurements, etc.

4. Frequency of maintenance procedures.
5. Parts replacement such as safety devices, lighting, etc.
6. Verification of safety circuits, methods of accessing and preserving computerized functional data if required.
7. Step by step adjustment procedures and installation of components.
8. Handouts, transparencies and/or slides as necessary to ensure clear and comprehensive presentations.
9. The training video shall be taken from actual equipment installed under this contract by the professional camera operator

D. Supplemental Materials consisting of a functional mock-up or a functional representation is required of any equipment that requires theoretical discussion. This may be in the form of an animated schematic, a model of the equipment, an actual device, an interactive video training device, or an Authority approved substitute. All mock-ups shall become the property of the Authority for eventual turn over to WMATA/ELES.

E. The final copies shall be delivered to the Authority as follows:

1. One complete set of training materials that is completely camera-ready. Camera-ready copy is defined as typewritten or typeset originals or high-quality copies such that further copies can be made from them with no noticeable decrease in copy quality.
2. Five copies of all student and instructor materials, to be used for archival purposes, in the WMATA ELES Technical Library.
3. A set of complete student materials including training manuals for each participant enrolled in training classes. The O&M manual, training manuals and special tools shall be approved by the Engineer and delivered to the Authority for eventual turn over to WMATA ELES.
4. The contractor shall video record all training sessions and provide WMATA/ELES with edited DVD copy of the recording to be used as training guide for other WMATA ELES employees.

F. The following specifications shall be met in instructional delivery:

1. Instructor Qualifications. A description of instructor qualifications, a resume, curriculum vitae, or other description of instruction qualifications must be submitted at least 60 days prior to the presentation of training. The description shall document a thorough knowledge of the equipment being taught, an understanding of the adult learning process, and demonstrated experience in vocational instructional. The ELES Engineering Office will review and approve the Instructor candidacy.
2. Course length - The length of the course shall be 5 working days with 3 days in the classroom and 2 days hands-on training.
3. Student qualifications - For the purposes of course development and presentation, vendors shall assume all WMATA students are high school graduates (or equivalent), and that maintenance personnel will possess the ability to use basic hand tools and electronic test equipment.

4. Testing. Instructors must give written and/or practical tests as a measuring device to determine knowledge transference. Tests shall use a multiple-choice or short answer format, and have been validated in a pilot course or by some other means agreed to by the Authority and Contractor. Whenever possible, a practical hands-on test shall be developed to demonstrate the transference of operational/ mechanical skills.

1.10 SPARE PARTS AND SERVICE FACILITY

A. Spare Parts

At the expiration of the warranty requirements of the General Provisions, the Contractor is responsible to provide a source for spare parts and service facility in the United States which can be obtained for an additional five years. If product source is another vendor, Contractor shall include name and address of other vendor.

1. The Contractor shall propose and provide a spare parts inventory to be approved by the Engineer and provided to the Authority not less than 90 days prior to scheduled completion, equal in value to seven percent of the cost of each elevator.

2. This provision requires the furnishing of a Recommended Spare Parts and Special Tools List based on manufacturer's recommendations, defines criteria to be used by the Contractor in developing spare parts recommendations; defines the manner of identifying spare parts on the list and the labeling and identification of spare parts upon delivery; and the timing of delivery of spare parts.

3. Elevator parts list, grouped by system and subsystem for stocking identification and the list shall contain the following information for each item listed:

   a. Component name and Part number(s)

   b. Manufacturer's name

   c. Model number(s)

   d. A blank column for WMATA's part number

   e. Manufacturer's recommended quantity (see Section 1.03F4 below)

   f. Anticipated annual usage

   g. Unit price

   h. Special storage and handling requirements

4. The manufacturer's recommended quantities shall be based upon the following reliability, usage and lead time considerations:

   a. Wear: Components which may be expected to require replacement under normal maintenance schedule and operations, such as mechanical parts subject to continuous operation within projected mean time between failure levels.

   b. Consumables or Expendables: Components which are consumed, used up, destroyed, or upon failure, are otherwise made usable for their intended purpose and are economically unrecoverable except for inherent scrap value.

   c. Recoverable or Repairable: Components which, upon failure, are capable of being repaired or remanufactured to a serviceable, operational condition and maintained available for use within their initial intended purpose.

d. Long Lead: Components that is not available from commercial distributors or within 48 hours from the manufacturers such as specifically made or selected components.

5. Cross referencing: Where replacement components are common to more than one system or subsystem, include a cross reference and indexing system in the replacement components list:

6. Non-Unique parts: In all components lists, items that are not unique to the system and have been manufactured by others shall be identified by the manufacturer's name and part number.

7. WMATA will provide the Elevator Contractor with shipping instructions, with WMATA part numbers for each item the Elevator Contractor is required to furnish.

8. The parts shall be shipped to the locations as directed by the Authority. Shipping documents shall identify the Contract number, manufacturer's part number, quantity, unit price and WMATA part number.

9. Spare parts shall be properly packaged or crated so as to prevent damage during shipment and long-term storage. An individual packing slip shall be included inside the package or crate.

10. Spare parts shall be the same in all respects as their counterparts furnished as a part of the assembled equipment to be delivered.

11. Parts furnished in accordance with this provision are WMATA spares, separate and distinct from any Contractor obligation to replace parts, components or assemblies under any warranty provision.

12. Parts lists contained in Operations and Maintenance Manuals provided under the Contract shall include assigned WMATA part numbers.

13. A Manufacturer’s Recommended Spare Parts List shall be provided. Parts to be provided shall be based on the criteria described herein and require Authority approval and shall be provided prior to Final Acceptance.

14. Any Special Tool(s) used including, but not limited to, troubleshooting, maintaining the elevator, software and/or hardware shall be provided as part of the spare parts to the Authority. Any tools provided shall be the same as those issued to the Adjuster and equivalent members of the subcontractor’s staff.

G. The finished elevator installations shall be completely barricaded and enclosed to preclude their use without permission of the Contractor until Final Acceptance and release by the Contractor for general use. The enclosure shall be fabricated to allow easy access for maintenance, testing and adjustment.

H. The Contractor shall be responsible for the security of the contents of each machine room. The Contractor shall control access to that room, and ensure that it shall remain secure at all times until the completion of the Contractor’s interim maintenance obligation.

1.11 SPECIAL TOOLS

A. A complete set of special tools and instruments necessary for troubleshooting, maintenance, repair and making all adjustments on every part of the elevator installation, including software and hardware shall be furnished for each elevator and delivered to the Engineer as part of the spare parts inventory. Tools that are designed specifically for tasks associated with elevator inspection, maintenance and repair or that are required for these tasks, and are not readily available through normal purchasing channels are defined as special tools.

B. Any “Special Tool/ equipment” that is required to troubleshoot, maintain, adjust, and test the system; the tool/equipment shall remain operational for the life of the equipment.

a. Provide all special tools and equipment necessary for making all system adjustments to the signal and speed controller and door equipment. A programming unit, approved by equipment manufacturer (OEM) such as a new laptop with minimum 4GB memory, 15-inch display and DVD drive, with all software packages required to setup and program all equipment in the elevator system shall be provided, one per station or location. Software shall be provided for the display unit, Device Net, hoist motor drive, if applicable, and any other programmable devices, as well as for the controller PLC. Any hardware or software required for configuring, programming and or communicating to controller or any parts of the elevator shall be submitted to ELES engineering. Using the provided laptop, the contractor shall demonstrate loading, downloading (programming) any and all software that is required for the elevator for all operating needs. This includes display, PLC and any I/O controls. All special tools shall be new and to be provide with casing. No special tools with decaying circuits or clocks are permitted. All application programs included in this escalator shall be the property of WMATA and shall not be considered proprietary to OEM.

C. Keys: Provide ten (10) sets of keys per elevator to operate all keyed switches and locks prior to completion of the first unit.

1.12 AUTHORITY COORDINATION:

A. The elevators shall not be in service for passenger/public use until all of the following requirements have been met.

1. The Operations and Maintenance Manuals have been approved and received by WMATA.
2. The Training and Student Manuals as well as video record of all training sessions have been approved and received by WMATA
3. The required training has been completed in accordance with this specification.
4. All field tests have been successfully completed.
5. The acceptance testing has been successfully completed.
6. All spare parts have been delivered and received by WMATA.
7. All Special Tools/Equipment and Software have been delivered and received by WMATA.
8. All discrepancies identified by the WMATA’s CEI (Certified Elevator Inspector) representative shall be completed.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. The major elevator components shall be the products of one of the three manufacturers of established reputation, except they may be the products, either wholly or in part, of another manufacturer of established reputation provided such items are capably

engineered and produced under coordinated specifications to ensure a high grade, safe, and smooth operating system. Also, the major components to be furnished for this project shall be of a make or makes that have performed satisfactorily together under conditions of normal use for not less than one year in at least two other elevator installations of equal or greater capacity and speed.

2.02 MATERIALS

A. Stainless Steel

1. Shapes and Bars:

a. ASTM A276, Type 304 or 301 for non-exposed components, and Type 316, all finish panels and exposed components.

2. Plate, Sheet, and Strip

a. Over 1/8 inch, ASTM A264 with ASTM A240, Type 316 on ASTM A36 base;

b. Under 1/8 inch, ASTM A167, Type 304, Type 316, for all finish panels and exposed components.

3. Stainless steel finish shall be NAAMM NO.4 with vertical grain.

4. Stainless steel screws, bolts and nuts shall be used for fastening and shall be AISI Alloy 303.

B. Steel Sheet and Steel Fabrications

1. Steel sheet for top enclosure shall be minimum 12-gauge.

2. Steel sheet for hoistway door frame shall be minimum 12-gauge.

3. Steel sheet for corrugated floor decking shall be minimum 10-gauge.

4. Steel sheet for subfloor shall be minimum 3/8-inch thick.

5. Galvanized steel material shall comply with ASTM A123, ASTM A153, and ASTM A653 (G90 Coating) as applicable. All steel sheet and steel fabrications, except lubricated machinery parts, which are not shown or specified to have other applied finishes, shall be galvanized.

C. Steel Finishes

1. Where visible to the public, steel surfaces shall have a baked enamel finish unless otherwise shown.

a. Color shall meet the requirements as shown in the finish schedule on the contract drawings.

b. Baked enamel finish shall consist of a thorough hot chemical cleaning process, a six-step zinc-phosphate process, two prime coats, and one finish coat of sprayed acrylic enamel (1.25 mils thickness minimum), baked at 350ºF for a minimum of 30 minutes.

2. Fasteners

Fasteners securing removable sheet metal materials shall be operable with the aid of simple tools and concealed wherever possible. When the framework to which the metal is fastened is less than 1/4-inch thick, steel backup plate's 1/4-inch thick shall be added with tapped holes and clearance holes where necessary. Exposed fasteners shall match the color and finish of the material being fastened, and shall be tamperproof flat-head machine screws of a captive screw fastener design.

a. Fasteners shall be compatible with materials being fastened.

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

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

2.03 EQUIPMENT AND COMPONENTS

A. The hydraulic elevator drive shall be of the oil-electric type with direct-acting plunger, power unit, oil storage tank, and control equipment. The power unit, storage tank, and associated control equipment shall be mounted in the machine room.

1. Cylinder and Plunger:

a. The cylinder and plunger unit shall be designed and constructed in accordance with the applicable requirements of the ASME Code and other applicable codes. It shall be of sufficient size to lift the gross load to the height specified and shall be factory-tested at a pressure of 400 psi. Gray cast iron or other brittle materials shall not be used in the construction of the cylinder and plunger unit. The cylinder shall be coated on the outside to prevent rust and corrosion. The bottom of the cylinder shall be closed and the top provided with an internal guide bearing and a cylinder head. The cylinder head shall be equipped with an adjustable packing gland designed to effectively prevent leakage of oil. A scavenger pump shall be provided to return oil to the system. It shall be located so as not to obstruct the path between the pit entrance and the cylinder.

b. The packing gland shall be constructed to permit easy repacking.

c. The cylinder shall be provided with a means to release air or other gas and shall have a drip ring below the packing gland to collect all oil leakage.

d. The cylinder shall be secured to a support, provided by the Contractor, which will transfer and distribute the load to the floor of the hoistway pit.

e. Plunger of built-up construction shall be secured to the car platform by means of a suitable platen.

f. Plunger shall be designed to prevent its leaving the cylinder.

g. The cylinder shall be isolated from soil, ground water, pit channel, building structure and other sources of possible corrosive or galvanic damage by being installed in a PVC casing with the area between the cylinder and the casing left empty and free of water and oil.

h. The cylinder shall be coated with corrosion-rust resistant primer and painted with a dark gray industrial epoxy or other approved paint.

i. The top of the cylinder shall be jointed to the PVC liner by a Victaulic coupling forming a sealed unit.

2. Well Hole and Casing

a. Well Hole and Well Hole Casing

1. The well hole shall be plumb enough to provide a plumb installation of the PVC inner casing and pressure cylinder.

2. The well hole outer casing shall be installed to retain the well hole for installation of the PVC casing and pressure cylinder.

3. The well hole casing shall be 3/8” thick welded steel pipe.

b. PVC Casing:

1. The PVC casing inside the well casing shall be ½-inch thick minimum, water tight and free of any liquid or debris after being installed plumb in the well hole.

2. Exterior surface of casing shall be cleaned prior to application of solvent welding material to ensure watertight connections.

3. The PVC casing shall be capped with PVC to prevent liquid and debris from getting in the area between the PVC casing and the cylinder.

4. The PVC casing shall be capped at the bottom.

5. Provide top of PVC with a PVC pipe coupling connecting with cylinder Victaulic coupling.

6. A PVC pipe shall be installed in the PVC casing to allow installing hydraulic piping to the cylinder. The PVC casing shall be secured at its base relative to the outer casing. Gaps between the PVC and outer casing may be filled using clean, dry backfill or other approved material.

7. An electronic monitoring device shall be installed to detect the presence of oil or water in the PVC casing. A “Liquid in Casing” alarm signal shall be provided to the elevator controller for display on the fault display and transmitting to the remote monitoring system.

8. An evacuation tube with an evacuation port shall be provided between the PVC liner and the cylinder.

3. Cathodic Protection

a. The cathodic protection shall be provided for cylinders and piping and shall be provided by dielectrically isolating the cylinder and piston from the car platen, pit support structure, and pressure piping.

b. Gaskets and pads for dielectric insulation shall be neoprene or approved alternative. Insulating sleeves, washers, and oil line coupling shall be provided where specified or shown.

4. Power Unit

a. The power unit shall consist of a screw-type or gear-type oil pump driven by an electric induction motor with oil control valves, combined in a self-contained unit fabricated of structural steel. Power unit drive motor is specified under Electrical Work (See Section. Submersible units will not be accepted.

b. The oil pump shall be especially designed and manufactured for hydraulic elevator service. It shall be designed for a steady discharge with minimum pulsation to give smooth and quiet operation. The pump shall be of proper size and shall deliver oil into the cylinder in sufficient quantity and pressure to lift the elevator car with specified load at specified speed. During downward trip of elevator, the oil shall be returned to the tank by gravity.

c. Geared pumps, when used, shall be provided with accurately cut herringbone or helical gears. The gears shall operate under flooded suction in an accurately machined case with close clearances to assure maximum efficiency. An effective strainer shall be provided in the suction line to the pump. The power unit shall be equipped with a vibration isolation device suitable for use with and approved by the power unit manufacturer. The vibration isolation shall effectively prevent the transmission of power unit vibration to the machine room structure.

5. Piping, Fittings, and Couplings

a. Piping, fittings, and couplings shall be furnished and installed between the storage tank, pump, muffler, valves, and cylinder complete with necessary supports.

b. All connections between the discharge side of the pump check valve, muffler, cylinder, and lowering valves shall be of rigid steel with screw, flanged, welded, or approved mechanical couplings.

c. Pipe supports shall be provided within 12-inches of every change of direction in piping.

1. Supports shall not be more than 10-feet apart.

2. Secure vertical runs properly with iron clamps at sufficiently close intervals to carry weight of pipe and contents and provide supports under pipe to floor.

3. Furnish and install all piping from remote machine room to hoist way, including necessary supports and/or hangers.

d. Size of pipe and couplings between cylinder and pumping unit shall be such that fluid pressure loss is limited to 10 pounds.

e. Mechanical couplings, when used, shall be of a self-centering type that provide for some degree of deflection, contraction, and expansion.

1. Couplings that provide for partial or full separation of the two sections of piping being connected are acceptable, provided all other specified requirements are met.

2. Couplings shall be rated for a pressure at least three times the working pressure of the elevator and shall be so designed that failure of the flexible sealing element or gasket shall not permit the separation of the parts connected.

3. Flexible sealing elements or gaskets shall be of a type and material suitable for use with the hydraulic fluid furnished.

f. Where piping, fittings, and couplings supplied by the Contractor are contained within sleeves, conduit, trenches, troughs, or other passage means provided by others to allow for the connection of the power unit with the cylinder and plunger, the Contractor shall provide appropriate devices which shall effectively prevent the transmission of vibration to the surrounding structure.

g. The Contractor shall install all piping, fittings, and couplings used to connect the power drive to the cylinder and plunger in such a way that these may be removed and replaced at a future date. When Victaulic is used, there shall be access for inspection and maintenance. Destruction of portions of these items in the process of removal is acceptable but efforts shall be made in the designs to minimize the necessity to destroy items.

6. Valves

   a. Valves shall be of the unitized manifold type with no more than four solenoids and arranged so that all adjustments are individually adjustable without the need for sequential readjustment. Valve shall be designed to ensure that oil flow will be controlled in a positive and gradual manner, thereby ensuring smooth starts, operation, and stops of the elevator car.

   b. Valves shall be designed for quiet operation and shall be mounted above the storage tank in a manner that allows leakage to drain back to the tank.

   c. A safety check valve shall be provided which will function to hold the elevator car with rated load at any point when the pump stops or the maintained pressure drops below the minimum operating pressure required holding the car in place.

   d. A manually operated lowering valve shall be provided, which shall permit the manual lowering of the elevator car in the event of power failure. The location of the lowering valve and access to it shall be described in white stenciled lettering on the front panel of the pump unit. The lowering valve operating means shall be easily and readily accessible and unobstructed by the valve wiring, conduits or other equipment. A tank shut-off valve shall be provided to permit isolating the oil in the tank during maintenance operations. The location and orientation of the valve shall allow for safe operation of the handle throughout its range of travel.

   e. All additional pump relief valves and other auxiliary valves required by the ASME Code or necessary to provide smooth, safe and satisfactory operation of the elevator shall be furnished and installed.

   f. Any relief valves having exposed pressure adjustment shall have their adjustment sealed after being set to the correct pressure.

   g. Manual shut-off valves shall be provided in the hydraulic oil line in the elevator pit and in the elevator machine room. In any portion of its travel, the machine room shutoff valve handle shall not intrude in the walk space or work space or obstruct access to other equipment.

7. Storage Tank

   a. The storage tank shall be constructed of steel and shall be provided with a steel cover, protected vent opening, overflow connection and a valve drain connection. Tank shall act as a storage tank only. Suitable gauge glasses shall be provided if the top of the tank is over 4 feet above the floor. An initial supply of oil sufficient for proper operation of the elevator shall be provided. The tank shall have a capacity equal to the volume of oil required to lift the elevator to the top terminal plus a reserve of not less than 10 gallons.

   b. The oil storage tank cover shall be arranged for easy unobstructed access. Clearance of 24 inches vertical and 18 inches horizontal from tank cover shall be maintained for ease of service.

   c. The permissible minimum liquid level shall be clearly indicated. The manufacturer's recommendation of type of oil to be used shall be included in the written instruction for the care, adjustment, and maintenance of the equipment. The flash point of oil used shall be not less than 400 degrees F.

   d. Provide an oil filtering system that removes contaminants that can clog valves and settle in the bottom of the tank.

8. Blowout-proof foil-hydraulic muffler of an approved make shall be furnished and installed in the oil line near the power unit to reduce noise to a minimum.

9. Oil Temperature Control/Tank Heater: Hydraulic oil viscosity/temperature control shall be provided by the application of an internally mounted, thermostatically controlled, tank heater. The oil temperature shall be maintained at a maximum 110 degrees Fahrenheit with the use of a 120 VAC powered tank heater. Unit shall be permanently mounted, integral with oil reservoir, and with a lighted switch/indicator to visually confirm unit is powered. Tank heater shall include the switch for disconnection of power during maintenance/repair operations. Unit shall be hard wired to electrical source per ASME A17.1.

10. Elevator Car Buffers: Heavy-duty spring buffers shall be provided, mounted on the supporting channel or block on the pit floor. The buffers shall comply with the requirements of the ASME Code. Buffer anchorage at pit floor shall be arranged to avoid damaging the waterproofing.

11. Car guides consist of a guide rail and guide-rollers. Guide rails for the elevator cars shall be of planed steel standard T-section. Guide rails shall be erected plumb and parallel with a maximum deviation of 1/8 inch and shall be securely fastened to the bracket or other supports by approved heavy rail clamps.

12. Car Roller Guides:

    a. The elevator car shall be provided with roller guides.

    b. Roller guides shall be spring-loaded and allow rail-to-rail and front-back adjustment of the rollers.

    c. Three or more rollers per guide and shall have 4-inch minimum sound-deadening wheels.

B. Operation:

1. Operation shall be automatic. Automatic operation by means of car and landing buttons. Stops registered by momentary actuation of car buttons to be made irrespective of number of buttons actuated or of sequence in which buttons are actuated.

2. Operating station in car containing bank of buttons numbered to correspond to landing served position indicators. EMERGENCY CALL button, keyed EMERGENCY STOP button, DOOR OPEN/DOOR CLOSE buttons, independent maintenance key switch, and key-operated light and fan switches, with legends as specified. Identification as specified for emergency telephone. Emergency call button connected to bell that serves as emergency signal. Panel finish: Stainless Steel.

3. Landing: Single push-button fixture at each terminal landing. Button fixture having push buttons with UP and DOWN legends at intermediate landing. Button identification as specified for Person with disabilities per latest ADA regulation (ADA rule 4.10.3).

4. Momentary pressure on car button or landing button illuminates that button, which remains illuminated until call is answered. Illuminated buttons serve as visual indication that call has been registered and that car will stop at that landing. The Push Buttons shall be round, have a Metalized Halo and center jewel. The metalized halo shall be from differrent color and approved by ELES Engineer.

5. Stops, registered by momentary actuation of landing buttons. All stops subject to respective car or landing button being actuated sufficiently in advance of arrival of car at that landing to enable stop to be made. Direction of travel for idle car established by first car or landing button actuated.

6. UP landing calls answered while car is traveling in up direction and DOWN landing calls answered while car is traveling down, car reversing after uppermost or lowermost car or landing call has been answered and proceed to answer car calls and landing calls registered in opposite direction of travel.

7. Elevators to park at the secure landing level selected by the Engineer.

8. Push-button units to be PB-46 NEMA-4 Series or approved equal with button identification as specified by latest ADA regulation.

9. Emergency-stop shall be key operated rather than push-pull arrangement with key removal only in off position.

10. All elevator car control panel operating devices shall be designated by Braille and by raised standard alphabet characters for letters, Arabic characters for numerals, and standard symbols as required by the Code and ADAAG.

11. Lettering shall have a highly visible coloring, such as white, that is permanently affixed.

12. 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. Car door shall remain open unless closed fully by the door close button.

13. Two-Stop Collective Simplex Automatic Operation:
The two-stop collective simplex automatic operation shall be used and checked for the following:

    a. System shall be designed so that when the car is standing at either terminal landing, pressure on car button for the other terminal shall automatically dispatch car to that landing. Pressure of landing button at either terminal landing shall call car automatically to that landing. If a landing call is registered while the car is making its trip that call shall remain registered until the car responds to that call. If no car calls are registered car shall start automatically and respond to hall calls. Provide time limit relay arranged to hold car at landing at which it has stopped for predetermined time after car stops. After all car landing calls have been answered, car shall remain parked at landing where last used with car and hoistway doors closed until another call is registered. Pressing the landing button at floor at which car is parked shall automatically open car and hoistway doors. In all normal operations, the starting of the car shall be contingent upon establishment of hoistway door interlock and car door circuits.

    b. Automatic dispatching operation: all two stop elevators shall include “Step-in-and-Go” feature. Calls for the opposite landing will be automatically set when the elevator opens its doors for a hall call. This feature shall be provided for all elevators that have public access for two stops (i.e., any elevators with key operated service landings will be included).

C Position Indicators:

1. Car indicator: In accordance with ADA requirements. Mounted in vertical row in car-operating panel to show position of car in hoistway by illumination of indicators corresponding to landing at which the car is stopped or passing. Finish for exposed-to-view metal components: Stainless Steel.

2. Landing indicator: In accordance with ADA requirements. Two-element direction-of-travel indicator mounted above call station or hoistway entrance as shown, including one red and one white indicator. Direction of car's operation shown by illumination of red indicator for DOWN and white indicator for UP.

3. In-car signals: Audible signal indicating car's direction of travel, signal sounding once for UP direction and twice for DOWN direction.

4. Landing signals: Audible signal at each hoistway entrance indicating car's direction of travel, signal sounding once for UP direction and twice for DOWN direction.

D. Lighting:

1. Machine Room Emergency Lighting: Emergency lighting shall be provided in each elevator machine room.

a. There shall be a minimum of light lighting fixture.

2. Car interior: LED fixture, 120-volt operation, with clear prismatic glass diffuser, flush mounted in ceiling, cool white bulbs. Illumination level shall be 15-foot candles minimum at car operating panel.

3. Car top and underside of car floor: Medium-base porcelain lamp receptacles, with wire lamp guards.

4. Car Emergency Lighting:

a. Fixture: Recess mounted, with stainless steel frame, location as shown.
b. Diffuser: Prismatic poiycarbonate plastic.
c. Lamps: Two, size 16-51
d. Remote power supply:

1) Power pack: Sealed gel cell battery with integral regulating charger and an alarm bell.

2) Capable of operating bell for one-hour minimum and light at car-operating panel at 0.2 low candles minimum for four hours minimum.

3) Location: in top of car or COP with easy access provided.

E. Inspection Operation: Key switch in car to nullify car and landing buttons permitting operation of elevator from top of car for inspection purposes:

1. Top of Car Inspection Station: The Inspection Station contains continuous pressure UP and DOWN buttons, emergency stop button and toggle switch to activate inspection devices. The device shall also have an 110v ac outlet for extension cord and provided with a light and guard.

F. Leveling: Automatic leveling device to stop car within 1/8 inch of landing level regardless of load or direction of travel. Landing level maintained within leveling zone irrespective of hoistway doors being open or closed.

G. Emergency Service:

1. Controls to return elevator to designated floor by means of key-operated switch outside street or ground floor hoistway entrance in compliance with ANSI/ASME A17.1.

2. In-car control during emergency operation by means of key switch in compliance with ANSI/ASME A17.1.

3. Terminals on elevators controllers for connection of circuit from heat and smoke sensing devices, with wiring from sensing devices to elevator controller.

H. Telephone Facilities:

1. Provide all audio/visual communication, signaling, and monitoring in accordance with ADA and ANSI. “Hands-free” phone integral with control panel, mounted in accordance with ADA requirements; having inscription EMERGENCY TELEPHONE as specified for Person with disabilities; finish exposed-to-view components to match stainless steel control panel; color of letters to contrast with panel.

   a. Provide emergency communicators in accordance with ADA requirements to include auxiliary push button to summon help and visual feedback indicating that the call has been responded to.

2. Provide wiring and jacks for a portable self-contained battery-powered maintenance telephone system. Jacks shall be located on car top, inside car, and in machine room. Furnish three telephone instruments for use of maintenance personnel.

I. Electrical Equipment:

1. Electric equipment for elevator shall be designed, selected, and fabricated in accordance with NEC, NEMA, IEEE, ANSI Standards, applicable jurisdictional codes, and additional specified requirements. All equipment including motors, controllers, service cabinets, circuit breakers, switches, panelboards, indicators, lighting, wiring, conduit, boxes and other appurtenances for proper installation and operation of the elevator shall be furnished and installed by the Contractor.

2. Cable and wire for external circuits between the various items of elevator equipment, exclusive of the traveling cable, shall comply with the requirements specified below. The talk pair of the voice communications intercom system shall be shielded with 0.008-inch, minimum, copper shield.

   a. General Requirements for Single-Conductor and Multiple-Conductor Cable:

      1. Type and size: As shown or as required by code.

      2. Rated voltage: 600 volts.

      3. Conductors:

         a. ASTM B3 or ASTM B8 annealed copper

         b. Size 10 AWG and smaller: Solid or Class B or Class C stranded.

         c. Size 8 AWG and larger: Class B stranded.

         d. Other constructions as specified.

      4. Standards: Except as modified, wires and cable complying with the following:

         a. Cross-linked polyethylene (XLPE) insulated cable: NEMA WC 70.

         b. Other cable: NEMA WC 70.

      5. Nonmetallic jacket for single-conductor cable and individual conductors of multiple-conductor cable and as overall covering on multiple-conductor cable:

a. Chlorosulfanated polyethylene or cross-linked polyolefin.

b. Cross-linked polyolefin complying with the following physical requirements.

6. Properties tested in accordance with NEMA WC 70 if ethylene-propylene-rubber (EPR) insulation is used or with NEMA WC 70 if cross-linked polyethylene insulation is used. Jacket material free of PVC and PVC-based compounds.

a. Tensile strength, minimum pounds per square inch: 1,800.

b. Elongation at rupture, minimum percent: 150.

c. Aging requirement: After 168 hours in air oven test at 100EC, plus or minus one degree C:

a) Tensile strength, minimum percentage of unaged value: 100.

b) Elongation at rupture, minimum percentage of unaged value: 80.

d. Oil immersion: 18 hours at 121EC, plus or minus one degree C, ASTM D471, Table 1, No. 2 oil:

a) Tensile strength, minimum percentage of unaged value: 80.

b) Elongation at rupture, minimum percentage of unaged value: 80.

c) Jacket materials other than cross-linked polyolefin complying with NEMA WC 70. Jacket material free of PVC and PVC-based compounds.

e. Flame retardancy: Single-conductor and multiple-conductor cable demonstrating flame retardancy in accordance with the following:

a) Single-conductor cable and individual conductors of multiple-conductor cable passing vertical flame test in accordance with UL 1591 or NEMA WC 70. Cable size for testing: 14 AWG.

b) Single-conductor and individual conductors of multiple-conductor cable passing vertical tray flame test using ribbon gas burner in accordance with IEEE 1202.

c) Multiple-conductor cable passing vertical tray flame test, using ribbon gas burner in accordance with IEEE 1202.

f. Applied voltage testing:

a) Single-conductor cable and individual conductors of multiple-conductor cable to be given applied ac voltage dielectric strength test, i.e., six-hour water-immersion test.

b) For single conductors of multiple-conductor cable, conduct tests prior to assembly as multiple-conductor cable.

c) Test procedures:

(a) Polyethylene insulated conductors: In accordance with NEMA WC 70

(b) Other conductors: In accordance with NEMA WC 70.

b. Single-Conductor Cable:

1. Insulated with ethylene-propylene-rubber with non-metallic jacket or unjacketed filled cross-linked polyethylene. UL-labeled Type RHW or XHHW.

2. Color coding: In accordance with paragraphs 200-6, 200-7 and 210-5 of the NEC.

c. Multiple-Conductor Cable:

1. Individual conductors:

a. Number of conductors: As shown or as required by code.

b. Construction: Complying with one of the following:

a) Insulated with ethylene-propylene-rubber, with or without nonmetallic jacket as specified.

b) Insulated with composite compound of ethylene-propylene-rubber and polyethylene, UL Class EPCV, without outer jacket.

c) Insulated with filled cross-linked polyethylene without jacket.

c. Phase and neutral conductors: Individually insulated.

d. Neutral conductors: Same size as phase conductors.

e. Bare ground conductors: Sized in accordance with the NEC, unless otherwise shown.

f. UL-listed as Type RHW or XHHW.

2. Conductors assembled with non-wicking, flame-retardant filler to form cable of circular cross section.

3. Metallic-sheath: Provide one of the following

a. Continuous smooth aluminum sheath in accordance with NEMA WC 70.

b. Continuous corrugated aluminum sheath in accordance with NEMA WC 70.

c. Interlocked aluminum tape armor.

d. Multiple-conductor cable provided with overall nonmetallic jacket as specified.

e. Cable UL-listed as follows: Metallic-sheathed cable: Type MC, suitable for wet and dry locations.

4. Color coding:

a. Power cables: In accordance with paragraphs 200-6, 200-7 and 210-5 of the NEC.

b. Control cables: In accordance with NEMA WC 70

d. Fixture Wire: UL 62, with the following additional requirements:

1. Type: Suit temperature rating of lighting fixture, minimum 194EF.

2. Conductor: Stranded copper conductor 16 AWG or larger as shown.

e. Bare Conductor: ASTM B3 or B8, annealed copper conductor; 8 AWG and larger, class B stranded.

3. Traveling Cable

a. The elevator car traveling cable shall be type ETT conforming to the requirements of the NEC with minimum conductor sizes as specified in the NEC. Individual conductors in the cable shall have a distinctive color code for identification. Each traveling cable shall have one two-conductor stranded 18 AWG, twisted shielded pair for elevator intercom and a minimum of ten spare conductors. Traveling cable exceeding 100 feet in length shall have steel supporting fillers. Traveling cable 100 feet or less in length shall have steel or non-metallic fillers.

b. For surface elevators only, the traveling cable shall be provided in addition to the above requirements, with one RG-6u coaxial cable, and one two-conductor, twisted shielded pair, stranded 18 AWG power cable for CCTV camera.

4. Connector, Terminal Lugs and Fittings

a. In accordance with UL 486.

b. For 10 AWG and smaller conductor cable: Tin-plated copper pressure connectors with nonflammable, self-extinguishing insulation grip with temperature rating equal to that of conductor insulation.

c. For 8 AWG to 4/0 AWG conductor cable: Tin-plated copper compression connectors and terminal lugs with insulating sleeve or heat shrinkable insulator for insulation grip.

d. For multiple-conductor cable: Watertight aluminum fittings with stainless steel pressure ring and set screws or compression cone for grounding of aluminum sheath of Type MC Cable.

e. Terminal lugs used for bonding connections to metallic structures shall be installed on bare/uncoated metallic surfaces to assure minimum contact resistance.

f. All wires shall run inside conduits. Wires and cables shall not be spliced inside or outside of conduit. Wire and cable shall only be connected at terminal strips or devices inside boxes, controller or approved enclosures.

5. Self-extinguishing nylon bundling straps having a temperature range of minus 65EF to plus 250EF shall be used for bundling or cabling of conductors where required. Strap shall have a hub complete with stainless steel locking barb on one end and a taper on the other.

6. Conduits and Fittings:

   a. Rigid conduit and fittings shall be UL-Listed rigid galvanized steel conforming to the requirements of UL 6 and ANSI C80.1. The minimum diameter shall be 3/4 inch for power circuits, one inch for fire and intrusion circuits, and two inches for audio and control circuits.

   b. Liquid-tight flexible conduit shall conform to the requirements of UL 360 and consist of a flexible galvanized steel core containing a copper bonding conductor spiral-wound between convolutions and a neoprene or PVC jacket overall. Fittings for liquid-tight flexible conduit shall be watertight and shall conform to the requirements of UL 514.

   c. All conduits (rigid steel and liquid tight flexible) should be permanently secured with metallic clamps. Zip ties are not acceptable to use as permanent use.

7. Auxiliary gutters, wireways, and raceways shall be constructed of galvanized sheet steel conforming to the requirements of the NEC and shall be UL-listed. Raceway, conduit and wireways within the hoistway exposed to public view shall be concealed within steel cladding.

8. Electrical Boxes:

   a. Outlet, junction and pull boxes shall be galvanized sheet steel or galvanized malleable iron, cast iron or ductile iron conforming to the requirements of UL 50, UL 514 and NEC paragraph 370-C. Pull boxes shall have screw cover with a liquid-tight gasket.

   b. Junction boxes on car bottom and hoistway connecting the traveling cable shall contain approved terminal blocks for connection of traveling cable conductors. Terminal blocks shall have indelible identification numbers for each terminal connection.

   c. All wire connection terminal blocks shall have the same identification number as labeled on the associated electrical wiring. All electrical wires shall use a labeling tube and heat shrink and match the terminal numbers.

   d. During field installation of junction boxes or control boxes, the contractor/subcontractor shall not drill or cut into the top sides of the box for wiring.

   e. All boxes shall be accessible without removal of other components.

   f. All boxes in machine room or pit shall be mounted on strut channels in order to prevent future corrosion and water damage. The strut channels shall be mounted on the wall and has a minimum of 1-1/2 inches thickness and 18 inches above the floor.

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

9. Disconnect Switches for Car Lights and Mainline Power

a. Disconnect switches shall be the following: UL 98, NEMA KS 1, heavy-duty, quick-make/quick-break switching mechanism with operating handle external to enclosure, with positions labeled ON and OFF, defeat able interlock to prevent opening of enclosure door when switch is ON. Enclosures shall be NEMA 250 Type 4 xs. Label disconnects switches in accordance with the NEC.

b. Mainline power disconnect switch shall be located in close proximity to the machine room entrance and shall be easily identifiable from other disconnect.

10. Circuit Breakers and Panelboards

a. Circuit breakers shall be the following: NEMA AB 1, UL 489, molded-case, bolt-on quick-make/quick-break, mechanically trip-free switching mechanism, with thermal trip for inverse time delay overcurrent protection and magnetic trip for instantaneous short-circuit protection. Designed to carry continuous rating in ambient temperature of 40ºC.

b. Panelboards shall be the following: UL 50, NEMA PB 1, latch and handle in accordance with UL 50, minimum side gutter size of four inches, bus bar of 98-percent-conductivity copper with contact surfaces silver-plated or tin-plated, rating of neutral and ground buses equal to phase bus rating, neutral bus mounted on insulated block, neutral and ground buses equipped with integral mechanical connectors, one-inch high engraved plastic nameplate with 2-inch high letters on black and attached with stainless steel fasteners. Enclosures shall be NEMA 250 Type 12.

11. Pit Receptacles and Lights

a. Electrical power receptacles shall be furnished and installed in the elevator hoistway, pit, and top of car as shown or required by code. Each receptacle shall be duplex, ground fault interrupter type, resettable at the receptacle; waterproof; grounded; rated for 120 volts at 20 amperes.

b. Maintenance lighting shall be furnished and installed in the elevator hoistway as shown or required by code. Lighting shall be vapor-tight service lights with quick start type PL compact fluorescent lamp. Furnish and install light switches; waterproof; grounded. The light switches shall be so located as to be accessible from the pit access door.

12. Drive Unit Motor

a. Motor shall be designed specifically for elevator service. The drive motor shall be of the alternating current, intermittent duty, 120 starts per hour, 1.15 service factors, squirrel cage induction type design adapted to the severe requirements of elevator service. Elevator drive motor shall be single-speed. The motor shall be suitable for operation on a 480-volt, three-phase, and 60-Hertz supply and capable of developing the required starting torque.

b. The motor shall be rated in accordance with NEMA Standard MG 1 for 60-minute rating motors and shall have sufficient capacity to operate the elevator with specified rated load at specified rated speed without overheating. The insulation and the starting and running torque of the motor shall be capable of permitting operation in accordance with NEMA MG 1. Standard factory motor test data and motor dimensions shall be submitted to the Contractor for approval. Each motor nameplate shall include the motor hp rating, voltage, full-load amperes, locked rotor amperes, full-load speed, design temperature rise, and NEMA design rating of the motor. Each motor shall be provided with ring or other suitable lifting means. The motor frame shall be tapped and drilled for a copper cable grounding connection.

c. Insulation of windings shall be NEMA Class B, fully impregnated and baked to prevent the absorption of moisture and oil. The insulation resistance between motor frame and windings shall be greater than one megohm.

d. Motor bearings shall be of the ball or roller type arranged for grease lubrication and fitted with grease gun connections and drains plugs or fitted with sealed-for-life bearings. The bearings shall incorporate dust-tight lubricant seals.

e. Motor shall be provided with an electronic soft start feature and thermal overload protection for each phase.

f. Connect motor and pump with multiple V-belt.

1. Belts and sheaves shall be sized for duty involved and designed to prevent any metallic contact between motor and pump shaft.

2. Furnish and install isolation units of rubber in shear to prevent transmission of pump and motor vibration to building.

3. Furnish and install expanded metal sheave guard that can be easily removed for servicing and inspection.

13. Elevator Controller:

1. An Allen Bradley (or ELES Engineering approved equal) PLC-based Controller shall be provided, governing starting and stopping as well as preventing damage to the motor from overload or excessive current. It shall automatically cut off the motor current and bring the car to rest in the event any of the safety devices are activated.

a. System shall coordinate the functioning of elevator drive unit relative to actual location and status of elevator. It shall interface with door control and all required safety circuits, switches and devices. The controller shall be mounted in a NEMA 4X stainless steel air-conditioned cabinet within the controller room.

b. The diagnostic system shall be an integral part of the controller and provide user-friendly interaction between the service person and the controller system.

c. The supervisory logic shall be performed by a main controller or coordinated between the elevator controllers which will interface directly into the Allen Bradley DH485 (or ELES Engineering approved equal) protocol Remote Monitoring network, transmitting data from the elevator controller through a data concentrator to the Authority's AEMS

RTU computer control and data system. The supervisory logic will coordinate dispatching assignments, interfacing operational demand data accumulated from car and corridor operating fixtures, selector and door control functions.

d. Controller shall be capable of operating with an operating temperature range of 32^0 F to 140^0 F with non-drip environment and no more than 90 percent relative humidity. However the air conditioner on controller cabinet shall maintain the operating temperature in range of 50^0 F to 80^0 F.

2. An Allen Bradley Compact Logix 1769-L32E (or ELES Engineering approved equal) based PLC control system shall be provided. (Take to #1)

1) The exclusive Allen Bradley DH485 protocol data port will transmit data from the elevator controller to the station or facility data concentrator. The contractor shall provide a controller data interface to a DH 485 network. Contractor shall provide Data cables to connect from the PLC controller to data concentrator in the station and available for connection to the controller DH485 interface. The contractor shall pull Belden 9842, or ELES Engineering approved equal, cables to connect the controller into the monitoring DH485 network. The DH 485 controller interface shall be programmable for date rates up to 115 Kbps. The interface shall allow other nodes such as other elevators and escalators to be readily incorporated into the DH 485 network.

2) A data concentrator PLC shall be installed using an Allen Bradley CompactLogix 1769 L32E or SLC5/05 PLC per station to function as data concentrated or to consolidate data from all controllers in the station. The software for the data concentrator shall receive controller data over the local monitoring DH 485 network and provide formatted data to the AEMS RTU through an RS232 link. The data concentrator shall provide an Ethernet port for interfacing with the WMATA wide area network. A data concentrator connection to the WMATA wide area network shall be provided.

3. The PLC shall accommodate the following Signal List, as Applicable, and provide data to the data concentrator as specified in specification.

4. The PLC CPU module shall store the last 99 faults, accessible via laptop connection, controller fault/status display and remote communications. The Contractor shall provide WMATA with a programming and monitoring unit, such as a laptop computer with the newest version of Allen Bradley RS-Logix and any other software required to setup and program all electronic items in the control system, for each elevator, for the purpose of troubleshooting and remote monitoring modifications. The laptop should allow uploading, editing, and downloading any software that is being used on this elevator for any operation.

5. An Allen Bradley Panel View Plus 6, Automation or ELES Engineering Approved Equal, fault/status display/interface shall be provided in the Controller cabinet. Control system timers and other setup criteria shall be programmable through this unit. All fault, status and setup data shall be stored in the controller CPU module.

6. In cases where the programming is done by the supplier, the supplier shall

provide a copy of all working programs, including labels for all inputs and outputs, data tables and internal logic points, on Flash Drives/CD-R disks as well as a printed program listing. The programs and setup data shall require a password for access and modification. The password shall be provided to ELES Engineering as part of the Submittal.

7. The main control of an elevator shall contain at least the following devices or electronic sensing: phase failure line voltage monitor, motor current and ground fault monitor.

8. The controller cabinet shall contain a permanently mounted fault indicator panel with LED indicator lights. Tripped safety devices, door position, door reversal, car running status, and control system status shall be indicated.

9. All terminals shall have identification markings and all wires, including field wires, shall be provided with permanent heat shrink sleeve cable markers. These wiring identifications shall be provided in the wiring diagram at each end of the circuit connections.

10. The controller shall be equipped with the AC vector drive installed in-line before the motor contactor and the motor.

11. The AC vector drive shall be capable of accelerating and decelerating the motor smoothly and gradually.

12. Adjustable settings for acceleration and deceleration ramps shall be provided.

13. The controller shall have, at least, one dedicated serial port for interface to the DH485 monitoring network and programming access without disconnecting any other port.

14. The Programmable Controller shall have, at least, one dedicated port to support the controller fault/status display.

15. The controller PLC shall provide the following Remote Monitoring and diagnostic network support:

    a) All applicable faults, statuses and data listed in Table 1 shall be provided
    b) Fault indications shall remain until reset in the controller.
    c) Status and analog data shall be provided for the duration of the condition.
    d) Software in the controller PLC shall format monitoring data responses to data concentrator polling as specified in the specification.
    e) The monitoring data port in the controller shall be setup for DH485 protocol with the port network identification number programmed for the particular elevator identification. For instance, identification number 11 applies to elevator 1, 12 to elevator 2, etc.
    f) All faults, statuses and data shall be held by the controller CPU and sent from the CPU when polled by the data concentrator.

16. Provide sufficient non-volatile CPU memory, for non-volatile retention of program memory, system status and operating parameters.

17. Diagnostics

    a) 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 LEDs 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 data concentrator, provided the fault is not a catastrophic hardware failure where the processor is unable to power up.

b) 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.

c) 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

COMMUNICATION channels are active.

18. Input/Output Modules

a) The Input/Output modules shall be compatible with the PLC processor I/O structure. Each module shall be provided with a detachable terminal strip to connect wiring to the module. Each wire on the terminals shall be identified by the module terminal.

b) Discrete Input Modules: Suitable for the input voltage and compatible with the Allen Bradley system

c) Discrete Output Modules: Suitable for the voltage and load and compatible with the Allen Bradley system.

d) Analog Input Modules: Converts analog signals to proportional twelve-bit binary values. The module shall accept 4 to 20 mA signals. Provide modules compatible with the Allen-Bradley system.

19. I/O Chassis and Power Supply

a) The controller chassis shall have an additional three spare modules.

b) Power supplies shall provide power to the PLC processors, I/O and other function 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.

20. Air Conditioning
Provide an independent air conditioning unit for each controller to maintain manufacturers' recommended operating temperatures. Condensate from the air conditioning unit must be piped to a suitable drain.

21. Selective Collective Operating: As defined by ASME A17.1 and shall be the pressure upon one or more car buttons to correspond to 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

a. Momentary pressure on car button or landing button illuminates that button, which remains illuminated until call is answered. Illuminated buttons serve as visual indication that call has been registered and that car will stop at that landing.

b. 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.

c. UP landing calls answered while car is traveling in up direction and DOWN landing calls answered while car is traveling down, car reversing after uppermost or lowermost car or landing call has been answered and proceed to answer car calls and landing calls registered in opposite direction of travel.

d. Should both an up and a down call be registered at an intermediate landing, only the call responding to the direction in which the car is traveling shall be canceled upon the stopping of the car at the landing.

22. Supervisory Control: A processor based system to coordinate dispatching assignments, interfacing operational demand data accumulated from car and corridor operating fixtures and other special feature commands issuing from computer processing, selector and door control functions. Incorporate in the system specific operational features as herein described.

a. Allocate service to demand, make decisions to prevent crowding, save energy, and provide efficient coverage throughout the building. Respond in real time to prevailing traffic conditions as well at historical traffic patterns.

b. Constantly compare passenger demand, car load, anticipated demand, car motion status, machine status and other prevailing conditions and evaluate this information in the context of the following dispatching approaches:

1) Give priority to contiguous calls, assigning calls on adjacent floor to the same car if other criteria is satisfied.

2) Give priority to coincident calls, having the same car let a riding passenger off and a waiting passenger on at the same floor.

3) Anticipate demand based on hall calls and car calls already registered and floors with a high possibility of demand.

4) Evaluate relative system response time for each car in the group, weighing all of the above factors.

5) Allocate calls and position cars to minimize waiting time, response time and travel time. The other elevator shall respond for hall calls without any delay after the first elevator leaved the door zone.

6) When there is a hall call registered and an elevator left the landing, the other elevator shall run toward opposite landing.

c. Provide the capability to make both car to call or call to car assignments.

d. During light traffic conditions, assign cars without demand to specific parking areas until requested for a hall call. Continuously evaluate dispatching assignment and immediately release a car from its assigned area to meet heavy demand elsewhere in the building.

e. In determining relative system response time for a car to answer a hall call, factor in round-trip calculations for each car as well as other system parameters before deciding which car shall respond to a hall call.

23. Other Features:

a. Independent Operation: Provide TWO-position keyed switch (ChicagoLock 7500) marked Independent Service, OFF and ON in the lower portion of the car operating panel of all cars. The switch shall be spring loaded type. When placed in ON position, car will be removed from the automatic operating system and will not respond to demands registered at the hall push buttons. It will respond only to floor with doors open until another demand is registered in the car. Demands registered at the landing will remain registered until answered by another elevator. The car only responds to car calls and that the doors remain open after a stop until closed by continuous pressure on the door close button.

b. The controller shall be designed to operate automatically on standby power.

24. Control Room Two Way Communication Device: Provide within each controller/machine room a two way communication device that will interface with any type of ADA compliant telephone. The device shall be mounted directly on or within hands distance proximity to the elevator controller.

25. Any junction boxes installed in the machine room or hoistway shall be accessible for Maintenance.
a. Drilling or opening top end of enclosure is not acceptable
b. Wire nuts or splicing without terminal strips is prohibited.
c. All openings shall be properly sized for the conduits.

J. Emergency Lowering

1. Provide a separate battery powered unit that senses loss of power and which shall operate as follows:

a. Elevator automatically descends to bottom landing.

b. Doors open automatically when car arrives at bottom landing and remain open until power is restored.

c. Elevator shall remain inoperative until normal power is restored.

2. The system shall differentiate between actual power failure and manual operation of disconnect switch.

3. Failure protection (operational/power) battery shall be a 12 volt minimum, sealed, lead-acid, or approved alternative. The separate box shall be used for battery and not stored within the main controller.

a. Unit shall be connected to a power source

b. Unit shall automatically maintain the battery at its proper charge.

4. Provide a manual lowering valve to allow the car to return to the lowest landing. The manual lowering shall be easily accessible and reachable.

5. Provide all wiring, sensors and associated connections to the main line power and disconnect.

K. Elevator Hoistway Entrances and Doors

1. Doors of elevators shall be of the horizontal sliding type, single-speed, center-opening. All elevator door openings shall be a minimum of 42-inches wide per the Americans with Disabilities Act.

2. Entrance frames shall be of welded or bolted construction for complete one-piece unit assembly. All frames shall be securely fastened to fixing angles mounted in the hoistway and shall be type 316 stainless steel. Provide an additional type 316 stainless steel sill angle support. The landing sills shall be extruded stainless steel with a mill finish.

3. All materials and finished surfaces exposed to public view shall be stainless steel with embossed finish and/or glass panels as indicated on Contract drawings. Glass panels (if provided) to be completely flush with door assembly. In a glass hoistway the struts or any brackets should not be visible to public.

4. Fascia and Dust Cover in the hoistway shall be galvanized or type 316 stainless steel and extend at least the full width of door opening on each side. Toe guard shall be fastened to the sill at the lowest landing.

5. Hoistway doors are to be stainless steel and provided with keyways as required for operating mechanisms and door hangers. Provide glass panels that are completely flush with door, as indicated in A17.1. Each door panel shall have stainless steel bottom guides that run in landing sill slots. Guides shall be replaceable without removing door panels. All doors shall have fixed fire gibes.

6. Interlocks and Contacts:
   a. The doors at each hoistway entrance shall be equipped with approved hoistway door interlocks of the hoistway unit system type tested as required by the Code. 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.

   b. Provide key-operated hoistway door unlocking devices. A device shall conform to the requirements of the Code and shall permit authorized persons to open the hoistway doors from the landing when car is away from landing. The key for emergency use shall be mounted in a receptacle with a breakable transparent cover clearly marked in letter at least 1/8 inch high ELEVATOR DOOR KEY FOR FIRE DEPARTMENT AND EMERGENCY USE ONLY. The location of the receptacle shall be as directed by the Engineer.

7. Provide raised floor/level designations in characters and Braille on each jamb at 60 inches from floor to centerline. Characters shall be two inches high and in accordance with ADA requirements.

   a. Sills shall be stainless steel and shall be supported on and attached to galvanized steel anchors securely fastened to the sill plate support. The sill and its assembly shall be capable of supporting 1260-pound service load for the transfer cart used by WMATA. Grooves for the door guides shall be machined with minimum clearance for the guides. The Contractor shall provide sill plates. Sill plates and all other sill support structure including shims and jack bolts shall be hot-dipped galvanized.

   b. Struts and closer angles shall be hot-dipped galvanized structural steel angles of sufficient size to accommodate and support the hoistway door header plate. Angles shall be continuous and securely bolted to the sills and building beams or structure above.

8. Hanger supports shall be 1/8-inch minimum thickness formed sections securely bolted to the strut angles.

9. Fascia Plates: Galvanized Steel cladding reinforced to ensure a flat, even surface throughout, and shall be securely fastened to hanger supports and sills above.

10. Dust Covers: Galvanized or Stainless Steel cladding which shall extend over the hanger support the width of the jamb opening plus the jamb flanges, at the top landing for which fascia plates are not supplied.

11. Hanger cover plate sections above the door openings shall be arranged for opening or removal from within the car.

12. Sill guards: Sill guards (galvanized steel cladding) shall be supplied for the lowest landing. On glass hoistway, they shall extend the full width of the hoistway and to bottom of pit.

13. Door hangers and tracks shall be provided for each hoistway, sliding door sheave type, two-point suspension hangers and tracks, complete. Sheaves shall not be less than 2-1/4 inch diameter with ball bearings properly sealed to retain grease lubrication and shall be mounted on stands arranged for attaching to the doors by two cap screws. Hangers shall be equipped with adjustable ball bearing rollers to take the up--thrust of the doors.

14. The tracks shall be high-carbon steel or formed steel with nylon inserts, shaped to permit free movement of the sheaves.

15. All inside surfaces of doors shall have baked-enamel finish as shown on the finish schedule.

L. Elevator Components

1. The elevator car and car components shall conform to the requirements of the Code, and shall operate without squeaks or metallic sounds.

Entire car assembly, including car frame and platform, shall be free from warps, buckles, and squeaks and rattles. Joints shall be lightproof.

2. Frame and Platform

a. The car frame shall be constructed of structural steel members. The platform shall consist of a steel frame with necessary steel stringers all welded together. The frame and platform shall be braced and reinforced to prevent the transmission of strain to the elevator car. Steel framing shall conform to the requirements of ASTM A500, Grade B, modified to minimum yield strength if required. The variation in straightness of individual members and the frame as a whole shall not exceed 1/8 inch. Secondary straightening may be performed if necessary. The car enclosure shall be securely fastened to the car platform and so supported that it cannot loosen or become displaced during ordinary service, on the application of the car safety or on buffer engagement.

b. Platform shall be provided with a steel floor designed for specified loading and sealed watertight. The platform shall be isolated from the cylinder by suitable rubber pads or other equally effective platen isolation.

c. All structural steel in the frame and platform shall be hot-dipped galvanized.

3. Car enclosure walls shall be structural steel tubing with stainless steel cladding, in-filled with aluminum framed laminated fully tempered safety glass. Stainless steel cladding shall be #4 satin finishes.

4. Railings and Handrails: Car handrails shall be 1/2 inch by 6 inch stainless steel #4 satin finished tubes suitably mounted.

5. Car threshold shall be stainless steel with a non-slip surface.

6. Toe Guard Aprons:

a. The toe guard apron (cladding) at entrance side of elevator cab shall be not less than 16 U.S. Standard Gauge (USSG) galvanized steel or stainless steel, and shall extend at least three inches beyond entrance jambs at each side. Toe guard shall have a straight vertical face, extending below the level of finished car floor, of not less than the depth of leveling zone plus three inches. The bottom of guard shall extend three inches below vertical face and be beveled at a 15-degree angle from the vertical. The toe guard shall be secured to car platform construction and be reinforced and braced to withstand a constant force of 150 pounds on its face without permanent deformation or deflection exceeding 1/4 inch.

b. On glass elevators, the toe guard shall extend full width of cab.

7. Suspended Ceiling:

a. The suspended ceiling shall be faced and edged with solid stainless steel panels, 0.075-inch thick with a fully adhered ¾-inch thick core of noncombustible, sound-absorbent material and backed with galvanized sheet steel. ASTM A653M, G90 coating or better.

b. Mounting brackets and any necessary holes for the CCTV camera shall be provided on the top of the ceiling, as further specified in Section A. Coordinate bracket configuration and location with the CCTV subcontractor.

c. Mounting brackets and any necessary holes for the smoke and fire detection sensors shall be provided on the top of the ceiling, as further specified. Coordinate bracket configuration and location with the fire and intrusion system subcontractor

8. Glass shall be laminated fully tempered safety glass conforming to ANSI Z97.1 and the requirements of Specification Section 08_81_00.

a. Glass shall be laminated. Heat-strengthened, safety glass conforming to requirements of ASTM C 1048 and ANSI Standard Z97.I and shall consist of two pieces of ¼ inch thick glass and a 0.060 inch thick polyvinyl butyryl interlayer, laminated together.

b. Color: Tint by Globe-Amerada Co., used as a standard of quality, or comparable and approved equal.

c. Weatherproof tape for field installation of final edge seating shall be compatible with the interlayer.

9. Dry Pressure Glazing Materials:

a. The setting blocks, edge blocks, and face gaskets shall be ozone-resistant, virgin neoprene.

b. Setting blocks for installation at each quarter point of the sill shall be 90 Durometer, shore A hardness, approximately full channel width, four inches long, and high enough to afford correct cover and 3/8-inch edge clearance for the glass.

c. Edge blocks, for vertical installation at the bottom of each joint channel, shall be 50 durometer, shore. hardness approximately full channel width, three inches long, and provide 3/8-inch edge clearance for the glass.

d. Face gaskets shall be continuous, 50 durometer hardness, and provide 3/16-inch face clearance both inside and outside.

10. Sub floor material to be nominal ¼” stainless steel to prevent water infiltration between finished floor, cab and platform base.

Floor covering: Poured Acrylic Epoxy, polymer system or approved equal, color selection and samples to be submitted to the Authority for approval by the Engineer, with slip-resistant surface, ¼ inch thickness, covering elevator car floor area. Flooring shall be non-shrinking, manufactured of prime quality compound, free of calendaring and curing defects, resistant to grease, oil, chemicals, aging, and ozone. Flooring shall be poured incorporating a full membrane system for the entire cab floor width and depth.

11. Emergency exit: Car shall have a top emergency exit conforming to the requirement of the ASME Code, and the applicable jurisdictional requirements. The door shall open toward the top of elevator and shall have a latching mechanism to keep it in place.

12. Ventilation: A 350-cfm two-speed exhaust fan for continuous car ventilation shall be provided and located above the car ceiling or outside the enclosure.

    a. Ventilating fans shall be securely mounted in place.

    b. Ventilation openings shall comply with the ASME and local codes, and shall be suitably sized and distributed to provide uniform airflow within the car.

    c. Connect continuous ventilation fan to emergency power system. Provide battery backup for fan operation of at least 1 hour in the event of power loss.

    d. The exhaust fan shall be controlled from the car operating panel with EPCO-1 (similar to existing WMATA Elevators keys).

13. Cab air conditioning (if applicable), in addition to the exhaust fan, shall be installed as specified in the contract and shall be a self-contained, packaged design for easy mounting, maintenance, and replacement.

    a. Packaged air conditioners shall be installed on the top of the elevator car.

        1. If not installed in original scope, space provisions shall be made for future installation of packaged air conditioning units.

        2. Installation area shall be coordinated with electrical, structural, and other trades to ensure no interferences with current or future installation.

        3. Electrical power of the proper voltage and capacity shall be available for the air conditioning unit installation current or future.

14. Lighting Fixtures and Plug Receptacles:

    a. Car lighting shall provide a minimum of 15-foot candles measured at any point on the cab floor and shall of the LED type. 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.

    b. Exterior car lighting shall be as specified. On glass-enclosed elevators they shall be concealed under access panels flush with cab top or bottom surfaces, respectively. A duplex plug receptacle shall be provided in the pit and on top and bottom of each car. The lighting fixtures and receptacles on exterior of car shall be controlled by a switch adjacent to each fixture.

c. Provide 115 volt ac plug receptacle (GFCI) within 12 inches of CCTV camera location. Coordinate the installation of CCTV equipment within the design of the elevator cab as the elevator contractor is responsible for the installation of the camera and wiring to the control room.

15. Car Doors and Door Equipment:

a. Car doors and door frames shall be suitably reinforced and provided with a laminated stainless steel #4 finish on cab side and baked enamel finish on hoistway side. Doors shall protect the full width and height of car entrance opening when in the fully closed position. Car door frame shall be integral with front wall of cab.

b. Hanger cover plate sections above the door opening shall be removable from the hoistway. Doors shall be guided at the bottom by composition gibs engaging threshold grooves with minimum clearance.

c. 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.

d. Door operation automatic at each landing with door opening being initiated as car arrives at landing and closing taking place after expiration of specified time interval, with electric contact to prevent starting elevator away from landing unless car door is in its fully closed position.

1. Time door closing to start 5 seconds minimum from notification that car is answering landing call.
2. Time doors to remain open five seconds minimum.
3. Time shall be adjustable to 20 seconds.
4. The interval of time that the doors remain open at intermediate landings shall be less for a stop made in response to a landing call. Door open time at a dispatching terminal shall be longer than the time for a stop in response to an intermediate landing call.
5. All door timers shall be adjustable from the controller display panel.

16. Capacity Plate:

a. The car capacity plate shall be of plain stainless steel and, in addition to data required by the ASME Code, but shall not bear the name of elevator manufacturer.

17. Door Operator Equipment:

a. Provide a water resistant heavy-duty GAL MOVFR or ELES Engineering approved equal door operator with encoder less 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. Designed for interior and exterior applications.

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

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

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

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

M. Normal and final terminal stopping devices shall be provided for elevator conforming to the ASME Code requirements.

1. Final terminal stopping devices, located in hoistway or on the car and operated by cams, shall be fitted with rollers having a rubber or other approved composition tread to provide silent operation when actuated by the cam.
2. Normal terminal stopping device may be mounted in hoistway, on top of the car, or in the machine room.

N. Signal Devices and Fixtures:

1. Car Operating Station:

a. Provide one (1) main station in the front and one (1) auxiliary station. The COP shall be a vertical type.

b. 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.

c. 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.

d. Car Operating Station shall have a locked service cabinet for keyed switches of the car light; exhaust fan, independent operation, GFI duplex outlet as indicated on the Contract drawings. The service cabinet key shall be EPCO-1 security switch.

e. Provide Emergency Communication: “Hands-free” ADA compliant telephone/intercom.

1) Hall Station: Riser of hall stations of the push-button, call acknowledging, stainless steel, tamper resistant type shall be mounted at all elevator landings. Highest landing shall have a single DOWN button. Lowest landing shall have a single UP button. Incorporate ADA compliant telephone with each hall station. Braille Indicator Plate shall be provided. Faceplate finish shall be Type 316L stainless steel #4 finish. The Hall Station shall be flush to the surface and shall not be projected out.

2) Hall Lanterns:

a. Tamper resistant hall lanterns shall be equipped with illuminated (LED type) 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.

b. 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.

3) Bell Alarm System: Bell alarm system for each elevator shall be properly located within building and audible outside hoistway when activated by the EMERGENCY ALARM call button on each car control building/station. When emergency stop switch is activated inside fire service box, the bell alarm system should not be activated.

4) Firefighters' Service System: Firefighters' service system shall be provided in compliance with Code requirements.

O. Drip pans constructed of 26 USSG galvanized sheet steel shall be provided below all bearings to catch lubricant drippings, except for bearings that are fitted with effective approved grease seals.

P. Metal parts visible to the public shall be field painted.

Q. A metal cabinet of suitable size shall be provided in each machine room for the storage of special tools and necessary spare parts. The cabinet shall be mounted on legs or a pedestal, a minimum of 4 inches off the floor. A Mobile Tool Storage Cabinet with wheels is not allowed.

R. A complete set of special tools or wrenches that are designed specifically for tasks associated with elevator inspection, maintenance and repair shall be provided with a case or suitably mounted in the storage cabinet.

S. At the expiration of the warranty requirements, the Contractor shall provide a spare parts and service facility in the United States at no additional cost to the Authority from which all manufactured parts and components of the equipment furnished and installed can be obtained for an additional three years.

2.04 KIOSK SURVEILLANCE CONTROL AND COMMUNICATION

A. Surveillance Camera Provisions (Surface Elevators). All requirements for CCTV shall comply with the WMATA SMNT Department.

1. Space provisions and mounting holes shall be provided for closed-circuit television (CCTV) cameras to be furnished and install by CCTV subcontractor.

a. The Contractor shall coordinate with the CCTV subcontractor and install wiring from the CCTV location within the elevator cab to an interface terminal and video transmitter located on the elevator car. Final equipment selection has not been performed and is subject to change. Coordinate model, configuration, and location with the CCTV subcontractor.

1) Power will be required by the video transmitter and CCTV camera and shall be provided.

2) Equipment: Fiber Optic Video Transmitters (Elevator Cameras)

b. The Contractor shall work with the CCTV subcontractor to install CCTV subcontractor-provided fiber-optic cable and transmitter to a terminal location specified by the CCTV subcontractor. The Contractor shall tag the cables appropriately, indicating that they are for future use by others.

B. Supply the following status indication, control, and communication functions for each elevator car and landing at an annunciator panel in the kiosk: indication, control, and communication functions in each elevator and landing; and all interconnecting wiring required to provide a complete and operable system. Systems to be provided and installed include the following:

1. Kiosk annunciator panel: Panel shall be a single panel approximately 7-½ by 19 inches. Coordinate design to ensure that the panel is compatible with the mounting provisions, previous designs, and human factors. The panels shall contain:

a. Indicators:

1) Visual display of elevator car status, to include landing stopped at or being approached and direction of travel:

a) Designate elevator by functional name, e.g., Garage 1.

b) For garage elevators designate landing by garage floor level.

2) Out of service because of malfunction.

3) In-Car stop switch is actuated.

4) Continuous audible alarm activated when emergency alarm switch in car is anitiated.

5) Indicator lamps shall be LEDs, with life expectancy of 50,000 average rated hours.

b. Controls:

1) Out of service.

2) Override control.

3) Door open.

4) Landing selection.

5) Push button switches shall have limited over-travel to prevent damage due to abuse and shall be equipped with lift-up covers to avoid inadvertent operation, have mechanical and electrical life of 25,000 cycles, with integral or isolated illumination circuit and be normally open with momentary action or alternate action circuitry.

6) When the override control switch is OFF, the kiosk controls shall function in parallel with the car and landing controls, i.e., the selective/collective control system shall respond to a kiosk-initiated landing selection with the normal priority afforded the remaining system landing selection and call buttons.

7) When the override control switch is ON, the following actions shall take place:

a) If the car is stationary at a landing, it shall remain at the landing and the doors, if open, shall close and remain closed.
b) If the car is in motion, it shall stop at the first landing reached and the doors shall remain closed.
c) The elevator control system shall then respond only to the kiosk controls and car staton.
d) The car shall park at the designate landing.

8) When the OUT OF SERVICE switch is actuated, the elevator shall return to the lowest landing before shutting off.

2. Elevator fire detection sensor: Provide space and mounting holes for smoke and fire detection sensors to be furnished and installed as required by building, electrical, elevator and local codes. Install wiring from the sensor location in the car to interface terminal cabinet in the machine room, for connection from the sensors to the smoke and fire detection system. Coordinate with installers to allow installation of sensors and operational checkout of the system.

3. Passenger - Kiosk communications (VIOP) system:

a. Communications signal button in elevator car momentary contact to illuminate back-lighted signal button in car and latch on a continuous audible signal and illuminated indicator in the kiosk.

b. Communications buttons at landings, momentary contact, to illuminate back lighted signal button at the landing and latch on a continuous audible signal and illuminated indicator in the kiosk.

c. Push button in kiosk to activate intercom system and reset indicator lamps and audible alarm.

d. Each passenger operated device shall have identification markings as specified for car operating devices.

e. The voice communication intercom system shall function as a master remote network. The master station shall be located in the kiosk annunciator panel and shall include a speaker-microphone, audio amplifier, on-off indicator lamp, audible signal device control and push button lamp for the operations. A remote station shall include a speaker-microphone and a communications signal button shall light the signal button and cause a continuous audible signal at the master station and light indicator lamp corresponding to the calling remote station. Communications between master and remote station shall be established upon the actuation of the master station push-button control corresponding to the calling remote station with the master station push to talk control determining the direction of transmission.

f. If successive calls are received from other remote stations while communication is in progress with one remote station, the audible signal shall sound the indicator lamps corresponding to the calling remote stations shall light and both shall remain on the indicate waiting calls.

g. Means shall be provided to clear the indicating lamps independently. Communication initiated from the master station shall be established upon actuation of the push button control corresponding to the called remote station, with the master station push-to-talk control determining the direction of transmission.

h. The audio amplifier at the master station shall be all solid state in construction and shall control incoming and outgoing volumes for all of the remote stations. The volume levels shall be preset during installation and shall be adjustable to provide a maximum of five watts rms at the speaker-microphones.

i. The power supply shall supply all ac and dc voltages necessary for all circuitry associated with the voice communications intercom system, and shall operate from the 120-volt ac, 60 Hertz emergency power supply located in the elevator machine room.

j. The audio amplifier and the speaker-microphones shall have a frequency response of plus or minus three Db from 300 Hertz to 5,000 Hertz. Power consumption shall be 5 watts maximum in standby and 50 watts maximum under load.

k. The Contractor shall be responsible for shielding, grounding and other measures necessary to protect the voice communications intercom system from interference from other electrical systems.

l. Speaker grilles shall have a minimum of 35 percent open area over the entire surface of the speaker cone.

m. Switches and relays used with this system shall have an operating life exceeding 5,000,000 cycles. Documentation shall be provided by the Contractor to the Engineer, for his approval, to substantiate this life cycle level.

n. The system shall perform adequately, as approved by the Engineer, with both the remote and the master station test personnel speaking from three feet away from the speaker-microphones.

o. Communication in the car shall also rollover to a 24-hour manned site (Rail Operations Control Center) in the event that the kiosk does not respond to the call.

p. Each passenger-operated device shall be identified in accordance with ADA/ADAAG requirements.

1. ADA requirement for providing emergency two-way communications between an elevator and a point outside the hoist way (the Kiosk).

2. Device mounting heights shall comply with:

a. ADAAG requirements.

b. ASME A17.1-2007. The highest operable part of the two-way communication system shall be a maximum of 48 inches from the floor.

3. A Braille Instruction Plate shall be permanently affixed on each remote intercom unit.

a. ADA Standards: Raised symbol and lettering (Signage) located adjacent to the device.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Prior to beginning installation of elevator equipment, examine the following and verify that no irregularities exist that would affect quality or execution of work as specified.
1. Hoistway size and plumbness.
2. Sill pockets.
3. Anchor brackets
4. Sill supports.
5. Spreader/Divided beams.
6. Machine beams and any other supplied by others.
7. Pit Depth
8. Overhead clearance

B. Do not proceed with installation until previous work conforms to project requirements.

3.02 INSTALLATION

A. Electrical Installation:

1. The Contractor shall install all raceways and wiring necessary for the proper connection and operation of all equipment. The installation shall comply with the applicable requirements of the NEC and local codes.

2. Raceway:

a. Rigid conduit connecting the various items of elevator equipment and electrical boxes in the machine room and hoistway shall be run parallel to the ceilings and walls. Metal wireway and auxiliary gutters in the machine room shall run exposed in readily accessible locations and shall not protrude into the working space around equipment.

b. Liquid-tight flexible conduit shall be used for connections to motor, limit switch, interlock push-button box, door operator motor, and similar devices. A length of liquid-tight flexible conduit 18 to 24 inches long shall be used for connection to the elevator drive motor.

c. Raceway terminal fittings shall be free from burrs, shoulders, or other projections that will reduce internal passage area or cause abrasion of conductors.

d. Electrical boxes shall be installed in accordance with the requirements of NEC paragraph 370.

3. Wiring:

a. All wiring shall be run in conduit, metal wireway, or auxiliary gutter, with the following exceptions:

1. Flexible hard-service cord, type SO, used between fixed car wiring and switches on car doors.

2. The traveling cable connection to the elevator car.

b. Wire and cable shall be sized for their respective duty so that the maximum current carried shall not exceed limits prescribed by the NEC and local codes. The minimum sizes of conductor shall be 12 AWG for lighting and receptacle circuits and 16 AWG for operating, control and signal circuits, except for traveling cable, where 14 AWG shall be the minimum size for elevator lighting circuit conductors.

c. In glass hoistways, wiring shall be installed only in the locations shown with the requirement that wiring and conduit be hidden from public view.

d. The traveling cable shall run from a junction box on the bottom of car to a junction box approximately midway in the hoistway. The cable shall be anchored and suspended to minimize any strain on individual cable conductors. The cable shall be free from contact with the hoistway construction, car, or other equipment. The overall covering of cable shall remain intact between junction boxes. The Contractor shall ensure that the cable shall not bend to a radius less than 12 times the outer diameter at any position of elevator travel.

e. Traveling cable shall be suspended by the wire rope center or self-gripping devices where cable weight will not cause excessive crushing forces.

4. Splices and terminations of conductors shall be made only in outlet, junction. Splices in conduit or raceways will not be permitted. Splices and terminal connections shall be made only by means of solderless connectors and terminal lugs as specified. Splices shall be covered with electrical insulating tape to an insulation level equivalent to that of the conductors. Terminal lugs used for bonding connections to metallic structures shall be installed on bare/uncoated metallic surfaces to assure minimum contact resistance.

5. Grounding:

a. The Contractor shall be responsible for grounding and bonding all parts of the elevator metallic structure, equipment and raceway in accordance with the applicable requirements of the NEC and the codes and regulations of the jurisdictional authorities. An equipment grounding conductor will be furnished and installed by other trades in each feeder to the elevator machine room and terminated in a disconnect device or junction box.

b. The Contractor shall provide equipment grounding conductors from the disconnect devices or junction boxes for all feeders and branch circuits as shown and required. Electrical equipment shall be provided with a minimum of two ground paths. One path shall be a green insulated equipment grounding conductor. The second path shall be a connection to grounded metallic structure using metallic fasteners, metallic conduit and/or bonding jumper. In elevator car, bond exposed metallic structures, ac equipment enclosures and lighting fixtures to grounded elevator metallic structure with metallic fasteners as shown.

6. Each device, each terminal, and each wire on the controller panels shall be properly identified by name, letter, or standard symbol in an approved indelible manner, on the device, panel, or wire. The identification markings shall be identical to markings used on the wiring diagrams.

B. Machine Room Equipment: Machine room shall be 224 sq. ft. minimum for a single elevator.

1. Machine Room Emergency Lighting: Maintained Emergency lighting fittings shall be provided in each elevator machine room.
   a. There shall be a minimum of one maintained lighting fixture.
2. Clearance around equipment in each machine room shall comply with provisions of all applicable codes. Clear distance for the maintenance purposes shall be at least 18”. In no case shall this clearance supersede minimum Code requirements.
3. Equipment in elevator machine room shall be so arranged that replaceable items can be removed for repair or replacement either by overhead hoist and dolly, or other conventional means, without dismantling or removing other equipment components in the same machine room.
4. Machine rooms must be air conditioned and heated to maintain an ambient temperature of 50^0 F to 80^0 F degrees and a relative humidity between 35% and 50%. The Air Conditioner shall be Split System. The heating system for the machine room is also a built in system. A forced removal should be done by moving the air from the room to the outside of the building to another part of the building to keep an air exchange through the equipment room. Intake and exhaust vent should not be located close to each other.
5. Any component attached to the controller shall have a minimum clearance of 18 inches from the side(s) of the component requiring access for maintenance and free air circulation.
6. One set of approved electrical and hydraulic diagrams of elevator shall be mounted in an aluminum channel frame with Lucite cover and waterproof fiberglass backing and installed adjacent to the appropriate drive machine.
7. Provide Mats of insulating rubber or other suitable floor insulation in the front of the Controllers.
   a. The Resistance range shall be $1x10^4<1x10^6$ and shall meet ANSI/ESD requirements.
   b. The rubber mat shall be the width of the controller plus 12”.
   c. The length of rubber mat shall be a minimum of 24”.
   d. The rubber mat shall be a ¼” thickness and beveled at each end.

C. Hydraulic Elevator Cylinder

1. The Contractor shall set the hydraulic elevator cylinders true and plumb

a. Dielectric Insulation Installation

1. Each cylinder shall be electrically isolated from the building steel and other earth ground sources

2. The following are minimum requirements:

a. Install an insulating gasket between the platen plate and floor of the elevator cab. Use insulating sleeves and washers on the bolts.

b. Use insulating pads to insulate the cylinder support members (channels) from the guide rails and other structures at ground potential.

c. Use insulating sleeves and washers on the bolts that connect the cylinder to the support channels.

d. Install an insulating coupling on the oil supply line between the pump and cylinder, located as close to the cylinder as possible.

2. Insulating gaskets shall be installed in the same manner as a normal gasket.

a. .Sleeves shall not be forced through misaligned bolt holes. Where misalignment occurs, the holes shall be reamed true, and all metal, chips shall be carefully removed.

b. The sleeves shall extend into the plastic washer on both sides of the flange. Any sleeves or washer cracked during installation shall be replaced immediately.

c. After making up the flange, the resistance of each bolt to the flange shall be tested using a 500-volt megohmmeter. If the resistance of any bolt is less than 50 megohms, the sleeve and washer shall be checked and changed, if necessary, to provide the required resistance.

3.03 DEMONSTRATION

A. Acceptance Tests:

1. The Contractor shall submit an operational test plan to the Authority for approval. When each elevator, furnished, installed, and tested, is ready to be placed in interim service, the Contractor, at no additional cost to the Authority, shall perform operational tests described below. The Authority shall be notified at least 48 hours prior to each scheduled test so that arrangements can be made for the presence of appropriate personnel to witness the tests. Acceptance Tests and inspections will be based upon the elevator meeting the requirements of the Specification and as evidenced by the operational test shall be witnessed by WMATA representative.

B. Elevator Tests

1. When the elevator work is fully completed, the Contractor shall demonstrate to the satisfaction of the Authority and Authorities Having Jurisdiction that the proper operation of every part of the equipment complies with all applicable requirements including the ASME Code.

a. The inspection procedure outlined in the ASME A17.2 will form a part of the final inspection.

b. No shop test of elevator motor and no certified test sheets will be required.

c. The heating, insulation and resistance of the motors will be determined under actual conditions after installation.

2. The Elevator Contractor shall furnish all test instruments and materials, required at the time of final inspection, to determine compliance of the work with the Contract requirements. Materials and instruments furnished shall include standard 50-pound test weights, megohmmeter, voltmeter and ammeter, Centigrade calibrated thermometers, spirit level, and stop watch. At the time of final inspection, tests shall include, but not be limited to, the following:

a. After installation, each elevator shall be tested without load by the Contractor. The elevator shall be subjected to a test for a period of eight-hours continuous run. During the test run, the car shall be stopped at top and bottom levels, in both directions of travel with a standing period of 10 seconds at each landing.

b. Full-Load Run Test

1. The elevator shall be subjected to a test for a period of one-hours continuous run, with full specified rated load in the car. During the test run, the car shall be stopped at top and bottom levels, in both directions of travel with a standing period of 10 seconds at each landing.

c. Speed Test

1. The actual speed of the elevator car shall be determined in both directions of travel, with full specified rated load and with no load in the elevator car.

2. Speed tests shall be made before and after the full-load run test.

3. For hydraulic elevators, speed shall be determined with a temporarily mounted tachometer on the guide rail or stop.

4. Car speed when ascending shall be not more than 10 percent above not more than 10 percent below the specified car speed.

5. Car speed when descending shall be not more than 25 percent above not more than 10 percent below the specified car speed.

d. Temperature Rise Test

1. The temperature rise of the drive unit motor shall be determined during the full-load test run. Temperatures shall be measured as specified in NEMA and IEEE Standards. Under these conditions the temperature rise of the motor shall not exceed NEMA and IEEE specified temperature rise. Test shall be started only when all parts of equipment are within 9 degrees Fahrenheit of the ambient temperature at time of starting test.

e. Car Leveling Test

1. Elevator car leveling devices shall be tested for ¼-inch accuracy of landing at all floors with no load in car and with full load in car, in both directions of travel.

2. One re-level operation is permitted when full load is in the car.

3. Accuracy of floor leveling shall be determined both before and after the full-load run test.

f. Insulation Resistance Test

1. The complete wiring system of elevator shall be free from short circuits and accidental grounds. The insulation resistance of the system shall be more than one megohm when tested by using a 500-volt megohmmeter. The elevator structure, equipment, and raceway shall be tested for continuity to ground.

3.04 ELEVATOR PROTECTION

1. The finished elevator installations shall be completely barricaded and enclosed to preclude their use without permission of the Contractor until Final Acceptance and release by the Contractor for general use. The enclosure shall be fabricated to allow easy access for maintenance, testing and adjustment.

2. The Contractor shall be responsible for the security of the contents of each machine room. The Contractor shall control access to that room, and ensure that it shall remain secure at all times until the completion of the Contractor's interim maintenance obligation.

3. Protection: During installation and until all elevator systems are fully operational and accepted by WMATA, make all necessary provisions to protect all elevator components from damage, deterioration, and adverse environmental conditions. Do not use or allow the use of the elevator for construction purposes such as hauling materials or worker transport during construction.

4. Security Of Machine Rooms: The Contractor shall be responsible for the security of the contents of each machine room. The Contractor shall control access to that room and ensure it shall remain locked and secure at all times.

5. Field Painting:

A. The pit, pit walls and machine room floor shall be painted. All machine room equipment shall be given two coats of approved machinery paint. All new iron work shall be given one coat of rust- inhibiting paint.

B. Metal parts visible to the public shall be field painted where specifically shown or authorized by the Authority.

3.05 MAINTENANCE

1. .The Contractor shall perform full maintenance service for a period of two years on each elevator in accordance with the manufacturer's maintenance manual and WMATA ELES maintenance program prior to WMATA providing permanent maintenance. The period of maintenance shall begin after test(s) and Provisional Acceptance of each elevator and shall extend to the scheduled date of Final Acceptance for all units in the same facility plus a period of two years. In no case shall the interval between inspections and testing be greater than one month. The maintenance service during the warranty period shall be provided by fully trained elevator mechanics. The maintenance tasks shall include, but not be limited to, the following:

a. Inspection of completed installation and periodic testing tomaintain the elevators in completely operable condition.

b. Contractor shall provide support for periodic, accident and incident, PM compliance inspections.

c. Lubrication of parts, and the protection of the equipment.

d. Replacement of defective parts at no additional cost to the Authority.

e. Annual clean down of the elevator and hoistway enclosure is required. Make necessary arrangements with Authority in order to minimize any inconvenience.

f. Contractors performing maintenance are responsible for all service, repair work and emergency call. The contractors shall provide unlimited service during revenue hours and twenty-four (24) hour (including Holidays) emergency call back service at no additional cost.

1) Provide twenty (24) hour (including Holidays) emergency service during the maintenance period consisting of a prompt response (within 1 hour) to emergency request by telephone or otherwise from Authority or designated representative if an elevator is inoperable or in case of injury, entrapment, or potential injury to persons.

2) Unlimited service callbacks are included with a required response time of one (1) hour (including Holidays). .

g. Periodic maintenance (based on WMATA schedule) shall be performed off peak hours to minimize service interruption as long as the other elevator serving the same plateform is operational.

h. Reporting: Detailed monthly records of tasks performed including names of individuals performing the tasks, date and time performed, and other pertinent data. In addition, the reports are to be provided in an electronic format acceptable to WMATA's needs.

i. Contractor performed maintenance shall follow the WMATA Office of Elevator and Escalator Operations procedures, schedules and check charts.

2. Within three (3) months prior to the termination of this contract, the Authority or his designated representative(s) shall make a thorough maintenance inspection of all equipment covered under this contract. The contractor shall provide personnel to remove, test, and operate equipment as necessary. All deficiencies found as a result of this inspection shall be corrected by the Contractor as required in this agreement with no additional cost for the Authority.

3.06 REMOTE MONITORING SPECIFICATIONS:

A. Allen Bradley DF1 or ELES Engineering approved equal or industry standard Modbus protocol shall be provided to transmit data from the Elevator/Escalators controller to the Authority's AEMS RTU computer control and data system. The Design-Builder shall provide a controller data interface to a DH-485 network located in the Elevator /Escalator machine room. The DH-485 controller interface shall be programmable for data rates up to 115Kbps. The interface shall allow other nodes such as other Elevator or Escalators to be readily incorporated into the DH-485 network. The controller data interface shall include one Allen Bradley SLC PLC per station to function as a data concentrator to consolidate data from all the controllers in the station. The software for the data concentrator shall be as specified by the Authority. The data concentrator shall receive controller data over the DH-485 data network and provide formatted data to the AEMS RTU through a RS 232 link. This data transmission may be accomplished by a separate PLC controller integrated into the control system.

B. The Elevator /Escalator control system shall automatically initiate the transmittal of data when data is requested by the Authority's AEMS system and continue until all data is received by the AEMS RTU in the station AC switchboard room. The Authority will perform final integration of the data in the AEMS system.

C. The Contractor shall also provide the required hardware to download data from any fault finding annunciator panel to a supplied laptop PC being utilized at the Elevator/Escalator location. The provided software shall permit the downloading and storage of data on the supplied laptop PC from multiple fault finding annunciator panels.

D. The Contractor shall install an Allen Bradley network interface module, (model 1761-NET-AIC or approved alternative) beside the PLC in the controller and provide 24 VDC power to the module. The Allen Bradley PLC will be used for remote monitoring capabilities into WMATA established engineering monitoring network.

a) The Contractor shall provide all wiring and programming of the PLC to communicate with station data concentrators on the DH-485 network. Coordinate work with WMATA ELES Engineering.

b) The Contractor shall pull all remote monitoring cables to the interface in the elevator controller from the remote monitoring network going back to WMATA's Automated Energy Management System (AEMS) remote terminal unit (RTU).

c) Provide Ethernet communication between the elevator machine room and WMATA's communication room. The communication port shall be located less than 6' from the controller and shall have minimum of two ports for data communication.

E. Terms and Definitions

1. Boolean - A single bit data type.
2. DF1 - A Rockwell Automation Company proprietary communications protocol.
3. DH485 - An industrial communications network used by Allen Bradley programmable controllers.
4. Integer - A data type 16 bit signed (range -32768 to 32767).
5. PLC - Programmable Logic Controller.
6. QEI - QEI Inc. Springfield NJ

7. RTU - Remote Terminal Unit

F. Elevator Remote Monitoring Data Specification

1. Overview

The design of the WMATA escalator & elevator monitoring system shall include a data concentrator PLC to gather data from the elevator control PLC's over an Allen Bradley DH 485 network or ELES Engineering approved equal. The QEI RTU shall read data from the WMATA data concentrator PLC via an RS 232 serial connection to a 1746-BAST (or ELES Engineering approved equal) module using Allen Bradley DF1 (or ELES Engineering approved equal) protocol. See figure 1.1 for reference. This specification defines data to be presented by the WMATA data concentrator PLC to the QEI RTU. The WMATA data concentrator PLC station shall pole the escalator & elevator controller(s) periodically for data and format the data into blocks within the WMATA data concentrator. An Ethernet TCP/IP connection is available at the Data concentrator PLC. The data concentrator PLC has been designed to collect data from up to (10) escalators and/or elevators. The data concentrator PLC is to be mounted into the existing QEI RTU enclosures and powered by a 120 VAC source from within the RTU. For Metro stations where more than (10) escalators and elevators are present additional data concentrator PLC's will be required.

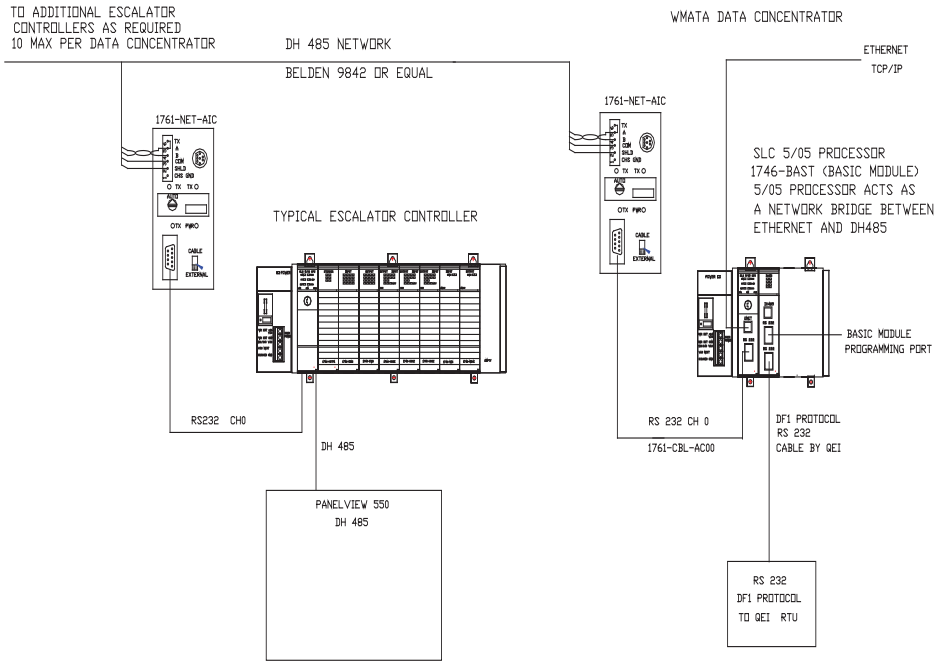


Figure 1.1

2. Data Concentrator PLC Data File Assignments.

`The WMATA data concentrator PLC shall store data for up to (10) escalators and/or elevators in any combination as defined in table 2.1.

Table 1

Escalator DH485 node #	Elevator H485 node #	Status bits File	Analog Data File	DC PLC MSG file#	DC PLC MSG buffer file#
1		N20	N21	N81	N101
2		N22	N23	N82	N102
3		N24	N25	N83	N103
4		N26	N27	N84	N104
5		N28	N29	N85	N105
6		N30	N31	N86	N106
7		N32	N33	N87	N107
8		N34	N35	N88	N108
9		N36	N37	N89	N109
10		N38	N39	N90	N110
	11	N40	N41	N121	N141
	12	N42	N43	N122	N142
	13	N44	N45	N123	N143
	14	N46	N47	N124	N144
	15	N48	N49	N125	N145
	16	N50	N51	N126	N146
17		N52	N53	N127	N147
18		N54	N55	N128	N148
19		N56	N57	N129	N149
20		N58	N59	N130	N150

oncentrator PLC (DC)	25	N80	N79		

Each data file shall begin with word 1 (example: escalator #1 status bits begin with N20:1 and end at N20:20)

The data concentrator PLC communication ports shall be configured as follows.

Channel 1

Driver: Ethernet

IP Address: TBD

Subnet Mask: TBD

Gateway Address: TBD

Channel 2

Driver: DH485

Baud Rate: 19.2K

Node Address: 25

1756-BAST basic module communication ports shall be configured as follows.

Port 1: Programming port

Settings -- 19,200 Baud, No parity, 8 bits, 1 stop bit, No handshaking

Port 2: DF1 port

Settings -- 19,200 Baud, No parity, 8 bits, 1 stop bit, No handshaking

DF1 – Op Code 19 (Full Duplex, NHS, ER, Enable DPD, CRC error checking,

Timeout = 50

Retries = 3

RTS on delay = 20 msec

RTS off delay = 20 msec

Module address = 10

DH485 Port – Not Available

3. Data Format

Data Concentrator status in File N80 per table 3.0

Table 3.0 Data Concentrator Status Bits

WORD	BIT	DATA TYPE	DESCRIPTION	"0" STATE	"1" STATE
1	0	BOOLEAN	Spare		
	1	BOOLEAN	Data Concentrator PLC Battery Status	FAULT	NORMAL

	2	BOOLEAN	Data Concentrator Basic Module Battery Status	FAULT	NORMAL
	3	BOOLEAN			
	4	BOOLEAN			
	5	BOOLEAN			
	6	BOOLEAN			
	7	BOOLEAN			
	8	BOOLEAN			
	9	BOOLEAN			
	10	BOOLEAN			
	11	BOOLEAN			
	12	BOOLEAN			
	13	BOOLEAN			
	14	BOOLEAN			
	15	BOOLEAN			

WORD	BIT	DATA TYPE	DESCRIPTION	“0” STATE	“1” STATE
2		BYTE	Data Concentrator checksum byte1		
3		BYTE	Data Concentrator checksum byte2		

Words 4 through 20 of the Data Concentrator status file (N80) are unused.

The Data Concentrator Analog data file (N79) is unused.

Elevator data:

Two 20 word (40 BYTE) blocks of data shall be developed for each elevator one block for status bits and one block for analog data. Table 3.3 defines the format of data for status bits. Table 3.4 defines the format for analog data.

Table 3.3 Elevator Status Bits

WORD	BIT	FAULT TYPE	DESCRIPTION	"0" STATE	"1" STATE
1	0	FAULT	24 VDC POWER SUPPLY	FAULT	NORMAL
	1	FAULT	SAFETY CIRCUIT GOOD	FAULT	NORMAL
	2	FAULT	TOP FINAL LIMIT TRIPPED	FAULT	NORMAL
	3	FAULT	BOTTOM FINAL LIMIT TRIPPED	FAULT	NORMAL
	4	FAULT	DRIVE FAULTED	FAULT	NORMAL
	5	FAULT	OVERLOAD TRIPPED	FAULT	NORMAL
	6	FAULT	STOP BUTTON ACTIVATED	FAULT	NORMAL
	7	STATUS	IN-CAR ALARM BUTTON PRESSED	ALARM	NORMAL
	8	FAULT	OUT OF SERVICE BY DELAY	FAULT	NORMAL
	9	FAULT	MOTOR LIMIT TIMER TRIPPED	FAULT	NORMAL
	10	FAULT	VALVE LIMIT TIMER TRIPPED	FAULT	NORMAL
	11	STATUS	INSPECTION OPERATION ON	ON	OFF
	12	STATUS	INDEDENDANT SERVICE ON	ON	OFF
	13	STATUS	VISCOSITY CONTROL ON	ON	OFF
	14	STATUS	CONTROLLER TEST SWITCH ON	ON	OFF
	15	STATUS	FIRE SERVICE PHASE 1 ON	ON	OFF

WORD	BIT	FAULT TYPE	DESCRIPTION	"0" STATE	"1" STATE
2	0	STATUS	FIRE SERVICE PHASE 2 ON	ON	OFF
	1	FAULT	SMOKE SENSOR @ MAIN ON	ON	OFF
	2	FAULT	SMOKE SENSOR @ OTHERS ON	ON	OFF
	3	STATUS	EMERGENCY POWER OPERATION	ON	OFF
	4	STATUS	OVERRIDE ON	ON	OFF
	5	STATUS	CAR IS RUNNING UP	NOT-RUN	RUNNING
	6	STATUS	CAR IS RUNNING DOWN	NOT-RUN	RUNNING

	7	STATUS	BRAKE LIFTED	LIFTED	NORMAL
	8	STATUS	CAR IS IN DOOR ZONE	IOT IN ZONE	IN ZONE
	9	STATUS	INTERLOCKS ARE MADE	OPEN	NORMAL
	10	STATUS	FRONT DOOR GATE SWITCH MADE	OPEN	NORMAL
	11	STATUS	FRONT DOOR FULLY CLOSED	OPEN	CLOSED
	12	STATUS	FRONT DOOR FULLY OPEN	CLOSED	OPEN
	13	STATUS	FRONT DOOR REVERSAL ACTIVATED	OFF	ACTIVE
	14	STATUS	FRONT DOOR PROTECTION ACTIVATED	OFF	ACTIVE
	15	STATUS	REAR DOOR GATE SWITCH MADE	OPEN	NORMAL

WORD	BIT	FAULT TYPE	DESCRIPTION	“0” STATE	“1”STATE
3	0	STATUS	REAR DOOR FULLY CLOSED	OPEN	CLOSED
	1	STATUS	REAR DOOR FULLY OPEN	CLOSED	OPEN
	2	STATUS	REAR DOOR REVERSAL ACTIVATED	OFF	ACTIVE
	3	STATUS	REAR DOOR PROTECTION ACTIVATED	OFF	ACTIVE
	4	FAULT	DOOR REVERSAL DEVICE FAILURE	FAULT	NORMAL
	5	FAULT	ROPE BRAKE SET	FAULT	NORMAL
	6	FAULT	LEVELING SYSTEM FAILURE	FAULT	NORMAL
	7	FAULT	WATER INTRUSION ALARM ACTIVE	FAULT	NORMAL
	8	STATUS	ELEVATOR SLC 5/03 LOW BATTERY	FAULT	NORMAL
	9	STATUS	ELEVATOR SLC 5/03 COMM. ACTIVE	FAULT	NORMAL
	10	STATUS	ELEVATOR SLC 5/03 LOCAL/REMOTE	REMOTE	LOCAL
	11	STATUS	ELEVATOR SLC 5/03 RUN/PROG	PROG	RUN

	12	FAULT	FAULTED	FAULT	NORMAL
	13	STATUS	Out of Service	FAULT	NORMAL
	14		SPARE		
	15		SPARE		

WORD	BIT	FAULT TYPE	DESCRIPTION	“0” STATE	“1”STATE
4	0	STATUS	CAR POSITION 1	NOT AT POSITION	AT POSITION
	1	STATUS	CAR POSITION 2	NOT AT POSITION	AT POSITION
	2	STATUS	CAR POSITION 3	NOT AT POSITION	AT POSITION
	3	STATUS	CAR POSITION 4	NOT AT POSITION	AT POSITION
	4	STATUS	CAR POSITION 5	NOT AT POSITION	AT POSITION
	5	STATUS	CAR POSITION 6	NOT AT POSITION	AT POSITION
	6	STATUS	CAR POSITION 7	NOT AT POSITION	AT POSITION
	7	STATUS	CAR POSITION 8	NOT AT POSITION	AT POSITION
	8				
	9				
	10				
	11				
	12				
	13				
	14				
	15				

Words 5 through 20 are unused.

Table 3.4 Elevator Analog Data

WORD	DATA TYPE	MIN VALUE	MAX VALUE	UNITS	SCALE FACTOR	DESCRIPTION
1	INTEGER			AMPS	X10	DRIVE MOTOR AMPS
2	INTEGER			KWH	X1	PRE DAY KWH
3	INTEGER				X1	PRE DAY UP COUNT
4	INTEGER				X1	PRE DAY DOWN COUNT
5	INTEGER				X1	PRE DAY FRONT DOOR CYCLES
6	INTEGER				X1	FAULT CODE
7	INTEGER				X1	PRE DAY REAR DOOR CYCLES
8	INTEGER					
9	INTEGER					
10	INTEGER					
11	INTEGER					
12	INTEGER					
13	INTEGER					
14	INTEGER					
15	INTEGER					
16	INTEGER					
17	INTEGER					
18	INTEGER					
19	INTEGER					
20	INTEGER					

Note: All analog values are multiplied by 16 in the data concentrator to bit shift left 4 bits to align with QEI's 12 bit analog data types.

A note on communication loss

A 60 second watchdog timer is coded into each escalator file. If communications are lost between The data concentrator and the escalator controller for more than 60 seconds the watchdog timer will Timeout. When the timer has timed out the communications loss bit will be reset (0) to indicate the communications loss condition.

3. Time and date sync

The QEI RTU shall provide clock synchronization to the WMATA data concentrator PLC every 5 minutes. Table 4.1 defines the address and data format of the clock registers in the WMATA data concentrator PLC. The data concentrator PLC shall set the escalator controller date and time every day at 3 AM.

Table 4.1

FUNCTION	ADDRESS	FORMAT
YEAR	N13:10	4 DIGITS
MONTH	N13:11	2 DIGITS
DAY	N13:12	2 DIGITS
HOUR	N13:13	2 DIGITS 24 HOUR
MINUTE	N13:14	2 DIGITS
SECOND	N13:15	2 DIGITS

4. Data Concentrator PLC Program

The data concentrator PLC includes code to monitor up to 10 escalators and 5 elevators. Each escalators and elevators has an independent code file and a configuration bit. If an elevator is to be monitored the configuration bit must be set corresponding to the DH485 station address of the elevator controller. If the configuration bit is reset (0), the status and analog data table values for the elevator or escalator will be set to 0.

The configuration bits are as follows.

Escalator Configuration Bit	85 Address of Escalator Controller	Elevator Configuration Bit	85 Address of Elevator Controller
B9:0/1	1	B9:1/1	11

B9:0/2	2	B9:1/2	12
B9:0/3	3	B9:1/3	13
B9:0/4	4	B9:1/4	14
B9:0/5	5	B9:1/5	15
B9:0/6	6	B9:1/6	16
B9:0/7	7	B9:1/7	17
B9:0/8	8	B9:1/8	18
B9:0/9	9	B9:1/9	19
B9:0/10	10	B9:1/10	20

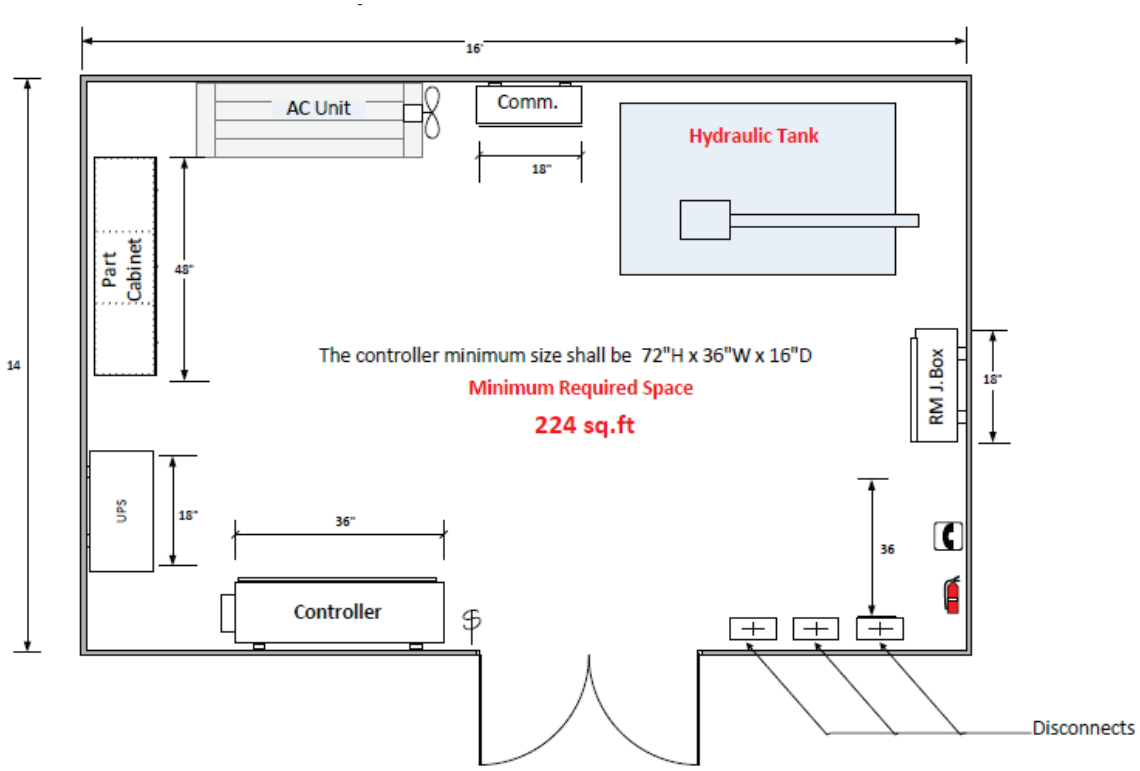
3. Data Concentrator Gateway IP addresses.

The Data concentrator PLC acts as a gateway between the Ethernet and DH485 networks. The PLC contains a list of IP addresses, known as the routing table which will be allowed access to the DH485 network. The routing table will contain 20 addresses.

Station	IP Address
1	TBD
2	
3	
4	
5	

6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	

3.07 EXIBIT 1. Hydraulic Single Elevator Macine Room



END OF SECTION

SECTION 14210

HYDRAULIC (DUAL JACK) ELEVATORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section specifies work pertaining to heavy-duty hydraulic passenger elevator systems including elevator cars, hoistway equipment, hydraulic piping, valves, cylinders, machinery, control systems, indicators, signs, elevator pit ladders and finish work in the vicinity of the hoistway doors as shown and specified in the Contract Documents.

B. Related Requirements:

1. Section 02205– Removal and Restoration of Existing Site Conditions
2. Section 05500– Metal Fabrication.
3. Section 08800– Glass and Glazing.
4. Section 09920– Field Painting
5. Section 07170 – Bentonite Waterproofing
6. See Division 15 for heating, ventilation, air conditioning and/or fire suppression requirements for elevator machine room heating, ventilating and/or air conditioning of elevator machine room.
7. See Division 16 for operation and maintenance of electrical service to elevator equipment, fire alarm systems and communications systems.

C.

1.03 REFERENCES

A. Definitions:

1. Heavy duty elevator: An elevator designed specifically for the harsh environment and duty load cycles common to transportation system usage.
2. 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.
3. Elevator, passenger - an elevator used primarily to carry persons other than the operator and persons necessary for loading and unloading.
4. Elevator, hydraulic - a power elevator in which the energy applied, by means of a liquid under pressure, in a hydraulic jack.

5. OEM: Original Equipment Manufacturer.
6. Dwell time: The period of time the elevator is at a landing while the doors open, passengers transfer and doors close.
7. Elevator 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.
8. Elevator 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.
9. Interim Maintenance: Maintenance from the point of substantial completion, but prior to Service.
10. Beneficial Use: When the elevator is placed into service, may be prior to the site being ready for public use.
11. Revenue Service: The station or facility opening date.
12. Notice to Proceed (NTP): within this document shall mean the date which the elevator installer is notified to proceed with the project.
13. Override Switch: A switch located in a kiosk panel, which disables the Hall Call Buttons.
14. MSDS: Material Safety Data Sheet.
15. BOM: Bill of Material.
16. SMNT: Systems Maintenance (WMATA).
17. WMATA: Washington Metropolitan Area Transit Authority.
18. Elevator MCP – Maintenance Control Program as defined in the ASME A17.1 Code

B. Reference Standards:

1. Comply with codes and regulations of the Authority Having Jurisdiction.
2. ASME A17.1 - Safety Code for Elevators & Escalators.
3. ASME A17.2 - Guide for Inspection of Elevators, Escalators and Moving Walks.
4. ANSI Z97.1 – Safety glazing materials used in buildings – safety performance specifications and methods of test.
5. ADA - Americans with Disabilities Act.
6. ICC/IBC - International Code Council – International Building Code
7. ICC A117.1 –Accessible and Usable Buildings and Facilities.
8. NEC (NFPA 70) - National Electrical Code
9. NFPA 72 – National Fire Alarm Code
10. NFPA_13_Standard for the Installation of Sprinkler Systems
11. ASTM A36 – Standard Specification for Carbon Structural Steel.
12. ASTM A123 – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
13. ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
14. ASTM A240 – Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

15. ASTM A264 – Standard Specification for Stainless Chromium-Nickel Steel-Clad Plate.
16. ASTM A276 – Standard Specification for Stainless Steel Bars and Shapes.
17. ASTM A500 – Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
18. ASTM A653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
19. ASTM B3 – Standard Specification for Soft or Annealed Copper Wire.
20. ASMT B8 – Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
21. ASTM C1048 – Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
22. ASTM D471- Standard Test Method for Rubber Property-Effect of Liquids.
23. AWS D1.1 – Structural Welding Code.
24. IEEE 1202 – Flame-Propagation Testing of Wire and Cable.
25. NAAMM C54 – Standard Designations for Chemical Finishes (Oxide).
26. NAAMM C55 – Standard Designations for Chemical Finishes (Sulfide).
27. NEMA WC70 – Power Cables Rated 2000 Volts or Less For The Distribution of Electrical Energy.
28. NEMA KS 1 – Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum).
29. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum).
30. NEMA C80.1 – Electrical Rigid Steel Conduit (ERSC).
31. NEMA PB 1 – Panelboards.
32. NEMA MG 1 – Motors and Generators.
33. UL 6 – UL Standard for Safety Electrical Rigid Metal Conduit.
34. UL 50 – UL Standard for Safety Enclosures for Electrical Equipment, Non-Environmental Considerations.
35. UL 62- UL Standard for Safety Flexible Cords and Cables.
36. UL 94 – UL Standard for Safety Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.
37. UL 98 – UL Standard for Safety Enclosed and Dead-Front Switches.
38. UL 360 – UL Standard for Safety Liquid-Tight Flexible Metal Conduit.
39. UL 486A/486B- UL Standard for Safety Wire Connectors.
40. UL 489 – UL Standard for Safety Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures.
41. UL 514 – UL Standard for Safety Metallic Outlet Boxes.
42. UL 1591 – UL Standard for Teflon Coated Wire.
43. Any additional requirements imposed by local agencies and/or codes having jurisdiction shall be incorporated into elevator installation.

44. In the event of a conflict between codes, regulations, these specifications or standards, the most stringent requirement as determined by the Contractor and approved by the Authority shall take precedence unless specifically addressed herein.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination

1. The elevators shall not be in service for passenger/public use until all of the following requirements have been met:

1) The Operations and Maintenance Manuals have been approved and received by WMATA.

2) The Training and Student Manuals as well as video record of all training sessions have been approved and received by WMATA

3) The required training has been completed in accordance with this specification.

4) All field tests have been successfully completed.

5) The acceptance testing has been successfully completed.

6) All spare parts have been delivered and received by WMATA.

7) All Special Tools/Equipment and Software have been delivered and received by WMATA.

8) All discrepancies identified by the WMATA's CEI (Certified Elevator Inspector) representative shall be completed.

2. Work by Other Trades

1) Hoistway conforming to code and specified requirements, plumb to within ¼ inch, including machine beams, pit, and pit ladders.

2) Intermediate rail bracket supports.

3) Grouting around hoistway entrances and sills.

4) Temporary and Permanent Electrical Power Services:

5) Contractor shall provide and coordinate the following:

1) For the elevator drive systems: 480V (460V), 3 phase, 3 wires, 60 Hz terminating in a disconnect switch within sight of the controller. The disconnect shall be free of any obstruction for a total of 36" from any part of the disconnect.

2) For lighting and GFCI receptacles: 120V, 1 phase, 3 wires, 60 Hz terminating at the elevator controller location.

3) Separate disconnect for cab lighting and wiring to cab. This disconnect shall be located close to the mainline disconnect.

4) Separate service for sill heaters where required.

6) Cutouts in hoistway walls for fixtures.

7) Smoke and/or heat sensors in machine room, in car and above each hoistway entrance.

8) Closed circuit television camera (CCTV) in elevator car.

9) Intrusion detectors on machine room doors.

10) Space in kiosk for elevator annunciator panels.

11) All embedded electrical conduit between elevator hoistway, machine room and kiosk.

12) Pit Drainage means to prevent water from accumulating in the pit for outdoor and indoor elevators. If pumps are used, they shall have a backup power source. The pit floor shall be sloped toward the pit drainage/ sump pump.

13) Lock and Key Requirements: Contractor shall coordinate with WMATA. The keys for all elevators except of Code requirements shall be keyed the same. Each station shall have a key and a master key shall be furnished which will operate all elevator locks in the Metro System, including previously installed elevators.

14) Contractor shall coordinate any alterations required to accommodate elevators with the Authority.

15) Contractor shall attend appropriate safety training programs provided by WMATA at no extra cost.

16) 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.

1.05 SUBMITTALS

A. Product Data

1. The summation of product information shall be submitted, in tabular form, of all parts incorporated in the entire group of elevators supplied under this Contract. Hard copies and electronic copies on the Flash Drive/Compact Discs (CDs) shall be submitted.

1) Manufacturer's design data, material specifications, drawings, installation and maintenance instructions including preventive, predictive and general maintenance, and other data pertinent to the components used in the elevator systems, including, but not limited to, detailed repair data for all components, including disassembly, inspection/gauging/torque requirements, reassembly, testing and other related information. Submittals shall cover all mechanical components, operating panels and indicators and electronic equipment to control and monitor elevator control functions. Exploded view drawings shall be included to facilitate repair and maintenance functions.

2) Lubricants, sealers, paints and any other potentially hazardous substances are subject to review and approval by the Authority. The Contractor shall submit the necessary Material Safety Data Sheets.

2. The following information shall be provided:

1) Nomenclature of part.

2) Elevator Contractor's part number.

3) Nomenclature of next higher assembly in which used.

4) Manufacturer and part number.

5) Model number(s) of elevator(s) on which used.

6) Total quantity in entire group of elevators.

7) Current unit price to the Authority.

8) Recommended spare parts list showing parts with prices for each part. The parts listing shall be provided on or before 90 days prior to scheduled completion.

3. Loads on supporting members, reaction points, and deflections under varying loads.

1) Loads imposed on the structure shall be coordinated with the Authority and not exceed agreed limits. This requirement shall be verified, documented, and stamped by a registered Professional Engineer Supporting calculations shall be provided for record file.

B. Shop Drawings

1. The contractor to provide detailed drawings that shows the dimensions and tolerance, specification that may include the material specification, hardness or electrical rating for each component that is being used. In regards to assemblies they must provide a top level drawing with BOM and quantities with detailed material specifications and drawings with dimensional tolerances. The contractor also to provide as-built CAD models of all elevator components.

2. The name of the manufacturer and type or style designation shall be listed on the each page of the equipment shop drawings. Drawings submitted shall include, but not be limited to, the following:

1) Fully dimensioned layout in plan and elevation, showing the arrangement of equipment and all pertinent details of each specified elevator unit, including as appropriate:

1) All equipment located in machine rooms.

2) Location of circuit breaker, switchboard panel or disconnect switch, light switch, and feeder extension points in machine room. These electrical components shall not be blocked by anything.

3) Location in hoistway of outlets for connection of traveling cables for car light, fire detectors, communication, and control system.

4) Car, hydraulic cylinder and plunger, supporting beams, guide rails, buffers, and other components located in the hoistway.

5) Maximum guide rail bracket spacing. Guide rail brackets shall be provided at every horizontal structural member and shall be of sufficient strength to meet the ASME Code.

6) Reactions at points of supports.

7) Weight of principal parts.

8) Top and bottom clearance and over-travel of car.

9) Complete wiring diagram of the elevator system and subsystems. Complete data regarding electrical characteristics and connection requirements.

10) Refuge space on top of car and pit.

11) Cab design, dimensions and layout.

12) Color/material schedule and selection chart for cab and entrance features.

13) Hoistway Ventilation - Thermostatically Controlled, positive mechanical ventilation system.

14) Hydraulic Jack Details

15) Machine/Pump Room area, pit, and hoistway layout.

16) Hydraulic piping layout indicating layout, type, size, and schedule of piping from machine room to elevator pit(s) indicating orientation of valve(s), and location of shut-off valve(s), and shall include calculations of working pressures.

2) Drawings of the hoistway entrances and doors showing their method of operation, details of construction, and fastenings to the structural members of the station structure.

3) Drawings of the car for each design specified, showing dimensions, details of construction, fastenings to platform, car-lighting, ventilation, air conditioning (if applicable), communication, and location of equipment.

4) Cuts or drawings showing details of all signal and operating devices, identifying graphics, and detailed design with diagram and schematic of kiosk annunciator panel.

5) Hydraulic drive:

1) Cylinders and plunger.

2) Power unit, including volume, rate of flow, working pressure, rpm of pump, and horsepower, voltage, frequency, service factor and rpm of the motor.

3) Piping, fittings, and couplings.

4) Valves.

5) Storage tank.

6) Muffler.

7) Hydraulic Jack Details Drawings

8) Fluid flow diagram showing all valves, operating devices, and controls.

9) Complete assembly detail of machine/pump,
hydraulic tank mounting, with all load calculations.

6) Elevator controller, including manufacturer's technical data and catalog cuts, and interface hardware and software requirements.

7) Power door operator.

8) Door interlocks and electrical contacts including test reports showing that hoistway door interlocks, car door contacts, and car top emergency contacts meet the requirements of the ASME Code and certification by the NIST or other approved laboratory.

9) Car ventilation fan.

10) Car Air Conditioning (if applicable).

11) Car lighting.

12) Cabling.

13) Buffer, including stroke and certified maximum striking speed for car.

14) Communication and intrusion system design details covering electrical, mechanical, and architectural aspects.

15) Design and architectural details, including light ray unit locations, of the electrical protective device for car doors.

16) Where the use of adjoining dissimilar metals is required, descriptions of protective measures to be employed to avoid corrosive damage.

17) Certification from independent testing laboratory that glazing gaskets meet the specified requirements.

18) Hall and car fixtures at each landing including the car operating panel (COP).

19) Interface wiring diagrams with other systems showing terminal board location and identification.

20) Expected heat dissipation of elevator equipment in machine room and control areas (i.e. BTU's/hr.) based on 240 round cycles per hour.

21) Complete wiring diagram of the elevator system and subsystems. Complete data regarding electrical characteristics and connection requirements.

22) Complete assembly detail of machine/pump, hydraulic tank mounting, with all load calculations.

23) Lubricants, sealers, paints and any other potentially hazardous substances are subject to review and approval by the Authority. The Elevator Contractor shall submit the necessary Material Safety Data Sheets.

C. Samples

1. Three of each of the following samples shall be submitted for approval:

1) Steel cladding: Baked-enamel finish, six inches square. The sample shall show the rust-proofed surface of the base metal on one side and the prime and finish coats (stepped) of enamel on the other side, although both sides of actual panels are to be enameled as specified.

2) Sheet metal: six inches square of thickness and finish specified.

3) Stainless steel cladding: 12 inches square of thickness and finish specified.

4) Glass: 12 inches square.

5) Floor covering: 12 inches square in the color and finish to be supplied.

6) Neoprene gasket: Each type.

7) Landing selector button mounted in cover plate with identity marking alongside button.

8) Signs: One of each type.

9) Ceiling material.

D. Certification

1. Certificates of inspection and acceptance issued by Jurisdictional Authority.

2. The Acceptance Inspection (Specifications and Code) by the Office of the Elevator and Escalator (ELES) shall take place prior to the Final Acceptance Inspection by the Jurisdictional Authority, and the elevators and associated equipment shall be free of defective material, imperfect work and faulty operation.

3. All defective work identified by ELES representatives shall be repaired or replaced at no additional cost to the Authority prior to the Final Acceptance Inspection by the Jurisdictional Authority.

E. Operation & Maintenance Manuals

1. Six sets and electronic copy of the approved manuals, elevator installation, operation instructions, troubleshooting techniques and related equipment drawings and software (all publication must be in English) – two copies of which to be delivered to the WMATA/ELES Engineer representing the Authority at least 60 days prior to the final acceptance. Each binder shall have the Binder Cover and Spine Insert which contain the Station Name and Unit ID.
2. Submit an electronic copy of the Manual for the review and approval, after installation and at least 90 days prior to the final acceptance. The Information shall be saved/presented as follows:
   1) Graphic images in ".dwg" AutoCad and ".pdf" formats. All revisions shall be made by using computer software. Hand written changes are not acceptable.
   2) Text in Microsoft Word .doc, ".pdf" or approved equal format.
3. The manuals shall include the following:
   1) Complete operation and maintenance Instructions of the elevator equipment included complete illustrated, exploded views of all assemblies and a complete illustrated, exploded view for identification all system parts.
   2) 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.
   3) Furnish a summation, in tabular form, of all parts incorporated in the elevators supplied under the Contract. Include but not be limited to the following:
      1) Nomenclature of part.
      2) Contractor's part number.
      3) Nomenclature of next higher assembly in which used.
      4) Manufacturer and part number.
      5) Model number of elevator on which used.
      6) Total quantity.
      7) Current unit price to the Authority.
      8) Serial numbers of all serialized assemblies, subassemblies, motors, and other major components supplied and installed.
   4) Control and schematic electrical wiring diagrams of controller including wiring of safety devices.
      1) Wiring Diagrams shall be full size (11x17), ladder type, complete "as built" wiring and single line diagrams showing the electrical connections, functions and sequence of operation of apparatus connected with each elevator, using standard symbols or proprietary symbols defined on the diagram, both in the machine room and in the hoistway, shall be furnished in duplicate for each elevator.
      2) Wiring diagrams shall incorporate the wiring identification labeling to identify the controller and field wiring used for each circuit. Wiring diagrams shall have sheets numbered with an indication of the total number of sheets in the diagram set. Each page should include unit number where the diagram belongs to.
      3) After approval, a copy of each print (11x17) shall be laminated and mounted with non-metallic holder in each elevator machine room. A hard copy set of wiring diagrams for each elevator shall be delivered to ELES Engineering Office.
      4) Coded diagrams are not acceptable.

5) Complete detailed drawings and wiring diagram of elevator system.

6) Lubricants, sealers, paints and any other potentially hazardous substances are subject to review and approval by the Authority.

   a) Provide MSDS for all the lubricants/chemicals.

   b) Provide manufacturer part number.

   c) Provide name of the manufacturer.

7) Detailed lubrication and cleaning schedule.

8) Procedures for adjusting all elevator components.

9) Complete set of contract software including operating control software.

10) Detailed, record and as-built layout drawings.

11) The entire manual, all software upgrades and service tools for elevators shall be provided in an electronic format on Flash Drive/CD-ROM that is acceptable to the WMATA Engineering and Maintenance Department.

12) All hard copy publications shall be in loose-leaf form, on 30-pound paper and with punch holes reinforced with plastic, cloth or metallic material.

   a) The O&M manual shall only contain information related to equipment installed under this contract. Generic information that does not pertain to the equipment installed shall not be included. Scanned documents are not allowed. The fonts should be standard format.

   b) All covers shall be resistant to oil, moisture, and wear commensurate with their intended use. Diagrams and illustrations shall not be loose or in pockets. All printed material shall be capable of being reproduced on dry copying machines.

13) Each elevator shall be treated as a whole and not as a grouping of disassociated parts. The material in the Wiring Diagram Manual shall be organized and indexed by the elevator classifications included in this Specification. All manual sections shall be sub-divided, to the extent required by the subject matter, and shall include, but not necessarily limited to the following topics:

   a) General system or sub-system description and operation.

   b) Sequence of operation.

   c) Replacement and step by step adjustment procedure for all components and systems.

   d) Block diagrams.

   e) Functional schematics.

   f) Functional as-built wiring diagram.

   g) Lubrication and cleaning, including frequency, methods, and trade identifications of recommended materials.

   h) Component location and description.

   i) Inspection and maintenance standards including wear limits, settings, and tolerances.

j) Installation and removal sequence.

k) Test and evaluation procedures.

l) Spare parts lists and special tools.

14) The contractor shall provide all information: manuals, drawings, design changes, modifications, techniques, procedures and any other documents related to maintenance, safety, operations which relate to any part, component, system, subsystem or material and applicable to the elevator equipment. All operating, programming, control software and licensing keys (if applicable) to the PLC control system for the installation.

15) 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. During the ten (10) years period, In case of any items are obsolete or no longer available from the manufacturer the Elevator Contractor shall provide the alternative products.

F. Elevator Maintenance Control Program (MCP).

1. Provide a separate Maintenance Control Program (MCP) for each unit as required by A17.1 Code.
   a. Submit an electronic copy of the MCP to ELES Engineering for the review and approval.
   b. Provide one copy of the the approved MCP at each elevator machine room.
   c. Three (3) sets of hard copies and electronic version of the approved MCP shall be submitted to the WMATA/ELES Engineer representative.
2. The MCP shall include, but not be limited to, the Code required maintenance tasks, maintenance procedures, examination and tests.
3. The MCP shall specify examinations, tests, cleaning, lubrication, and adjustments to applicable components at regular intervals.
4. The MCP shall only contain information related to equipment installed under this contract. Generic information that does not pertain to the equipment installed shall not be included. Scanned documents are not allowed.
5. The instructions shall be permanently legible with characters a minimum of 0.125 in. (3 mm) in height.
6. All covers shall be resistant to oil, moisture, and wear commensurate with their intended use. Diagrams and illustrations shall not be loose or in pockets. All printed material shall be capable of being reproduced on dry copying machines.
7. Each unit shall be treated as a whole and not as a grouping of disassociated parts. The material in the MCP shall be organized and indexed by the elevator classifications. Each binder shall has the Binder Cover and Spine Insert which contain the Station Name and Unit ID.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Training

1. Training: The Contractor shall develop and provide operation, troubleshooting and maintenance training in accordance with the General Requirements. The following training requirements shall be met:

   1) Three days of classroom plus two days hands on training on the field shall be provided for 10 students per class. Six training session for a total of 60 students is required.

   2) Time and place of training will be determined by the Authority, but must be completed no later than 30 days prior to the Final Completion.

   3) Training shall be organized to make optimum use of the required maintenance and operation manuals including training for replacement of all parts contained in the Parts Inventory list.

   4) At the completion of the first training session, a narrated and properly edited training video shall be submitted for the authority on DVD or flash drive. The video shall be taken by the professional camera operator with quality image and sound track and will be used for the future trainings. The video shall cover operation of the elevator, function of the devices, maintenance, adjustment procedures and troubleshooting. The following items shall be included as minimum requirements:

      1) Step by step adjustment procedure on the followings:

         a) Door operators, DCL, DOL, full door opening, and so on…

         b) Valve adjustment

         c) Car Leveling and adjustment of leveling sensors and vans

         d) Door: door interlock, proper pressure, restrictors ...

         e) Pump motor: belt tension and alignment

      2) General overview of major items:

         a) Packing:

         b) Piston:

         c) shut of valve

         d) Controller:

         e) Controller display:

         f) Hydraulic pump

         g) Hydraulic tank

         h) Door sills

         i) Guide rails

      3) Daily operation and sequence of operation

      4) Replacement and Installation of components:

         a) hydraulic packing

         b) door photo eye

         c) Hydraulic valve

         d) Door clutch

         e) Door pickup rollers

5) Proper guide roller adjustment
6) Verification of safety circuit
7) Maintenance procedure and Frequency of maintenance
8) Proper access of pit and top of car for inspection
9) Proper test of fire service operation
10) Proper lubrication of components
11) Troubleshooting techniques
12) How to use proper communication device, machine room, car top, and kiosk

5) Provide one additional copy of all required submittals to the ELES Engineer for Authority use.
6) Provide two copies in DVD format of training materials along with visuals and handouts to the Engineer for the Authority use.
    1) Video shall be narrative.
    2) Video shall be separated by major components Sections
    3) Equipment Identification shall be as a part of the section title.
7) Separate training manual shall be submitted for approval prior the scheduling of the training. The O&M manual shall not be used as a training manual.

2. Scope of Work

1) All training, as described below, shall take place prior to Final Acceptance of equipment or materials by the Authority. Operations and maintenance training may take place as a combined class by agreement of the Office of Elevators and Escalators (ELES). The minimum number of ELES employees to be trained will be no fewer than 60 total with a maximum of 10 per class. Those persons will be identified by WMATA. The contractor shall video tape all training sessions and provide WMATA/ELES with edited copy of the recording as stated above.
2) Operations training shall be tailored specifically to the furnished and installed equipment, and designed to teach the day-to-day operation of all equipment. The training shall be sufficient to bring personnel to a level of operating proficiency such that routine vendor support is not needed.
3) Maintenance Training shall be tailored specifically to the furnished and installed equipment, and designed to develop the knowledge and skills required to maintain all item(s) delivered.
4) Maintenance training shall be subdivided into two major levels as follows:
    1) System Level Maintenance Training, covering:
        a) Theory of operation of the system and its major components.
        b) System configuration.
        c) Preventative maintenance, consisting of written `procedures and schedules for the periodic maintenance of all equipment.
        d) Written and validated inspection procedures and a system-level trouble-shooting guide (to the lowest field-replaceable unit).
    2) Shop Level Maintenance Training, covering

a) Detailed theory of operation to module, board, and/or device level.

b) Component level troubleshooting and component replacement and adjustment.

c) Testing and alignment procedures of repaired units.

3. Deliverables

1) The following course materials shall be delivered by the Contractor, according to the following specifications:

1) An Instructor's Guide containing all the information and direction necessary for the instructor to make an effective presentation. It shall include adequate guidelines to conduct a comprehensive training program. Individual lessons within the course shall be organized as separable blocks (or modules) which may be taught as a unit. The Instructor's Guide shall contain, as a minimum:

a) Discussion of student prerequisites (if any).

b) Program overview.

c) A statement of overall program goals.

d) Lesson plans (a session-by-session outline containing the following):

i. Student learning objectives, stated in measurable term

ii. Overview of each lesson.

2) A Student Manual including all materials for the student to interact in the learning situation. It shall contain, as a minimum:

a) Program overview and introduction.

b) Statement of overall program goals.

c) Learning objectives, stated in measurable terms that specifically describe desired behaviors or knowledge to be gained.

d) A fully developed prose treatment (not outline format) of content presentation, developed in the same modular format as the Instructor's Guide.

e) Illustrations, charts, photos and other graphics of actual system components as needed to enhance content presentation.

f) The training manuals shall be prepared and submitted for approval to WMATA/ELES prior to training. The training manuals shall include procedures for adjustment and replacement of all electrical and mechanical components, and a troubleshooting guide.

3) Audio-visual Aids consisting of a narrated video of not less than 90 minutes duration to include, but not limited to, the following:

a) General overview of major features.

b) Daily operations.

c) Maintenance procedures (lubrication, adjustments, critical measurements, etc.).

d) Frequency of maintenance procedures.

e) Parts replacement safety devices, lighting, etc.

f) Verification of safety circuits, methods of accessing and preserving computerized functional data if required.

g) Step by step adjustment procedures and installation of components.

h) Handouts, transparencies and/or slides as necessary to ensure clear and comprehensive presentations.

i) The training video shall be taken from actual equipment installed under this contract by the professional camera operator.

4. Supplemental Materials consisting of a functional mock-up or a functional representation is required of any equipment that requires theoretical discussion. This may be in the form of an animated schematic, a model of the equipment, an actual device, an interactive video training device, or an Authority approved substitute. All mock-ups shall become the property of the Authority for eventual turn over to WMATA/ELES.

5. The final copies shall be delivered to the Authority as follows:

1) One complete set of training materials that is completely camera-ready. Camera-ready copy is defined as typewritten or typeset originals or high-quality copies such that further copies can be made from them with no noticeable decrease in copy quality.

2) Five copies of all student and instructor materials, to be used for archival purposes, in the WMATA ELES Technical Library.

3) A set of complete student materials including training manuals for each participant enrolled in training classes. The O&M manual, training manuals and special tools shall be approved by the Engineer and delivered to the Authority for eventual turn over to WMATA ELES.

4) The contractor shall video record all training sessions and provide WMATA/ELES with edited DVD copy of the recording to be used as training guide for other WMATA ELES employees.

6. The following specifications shall be met in instructional delivery:

1) Instructor Qualifications. A description of instructor qualifications, a resume, curriculum vitae, or other description of instruction qualifications must be submitted at least 60 days prior to the presentation of training. The description shall document a thorough knowledge of the equipment being taught, an understanding of the adult learning process, and demonstrated experience in vocational instructional. The ELES Engineering Office will review and approve the Instructor candidacy.

2) Course length - The length of the course shall be 5 working days with 3 days in the classroom and 2 days hands-on training.

3) Student qualifications - For the purposes of course development and presentation, vendors shall assume all WMATA students are high school graduates (or equivalent), and that maintenance personnel will possess the ability to use basic hand tools and electronic test equipment.

4) Testing: Instructors must give written and/or practical tests as a measuring device to determine knowledge transference. Tests shall use a multiple-choice or short answer format, and have been validated in a pilot course or by some other means agreed to by the Authority and Contractor. Whenever possible, a practical hands-on test shall be developed to demonstrate the transference of operational/ mechanical skills.

B. Special Tools

1. A complete set of special tools and instruments necessary for troubleshooting, maintenance, repair and making all adjustments on every part of the elevator installation, including software

and hardware shall be furnished for each elevator and delivered to the Engineer as part of the spare parts inventory. Tools that are designed specifically for tasks associated with elevator inspection, maintenance and repair or that are required for these tasks, and are not readily available through normal purchasing channels are defined as special tools.

2. Any “Special Tool equipment” that is required to troubleshoot, maintain, adjust, and test the system; the tool/equipment shall remain operational for the life of the equipment.

1) Provide all special tools and equipment necessary for making all system adjustments to the signal and speed controller and door equipment. A programming unit, approved by equipment manufacturer (OEM) such as a laptop with 4GB memory, 15-inch display and DVD drive, with all software packages required to setup and program all equipment in the elevator system shall be provided, one per station or location. Software shall be provided for the display unit, DeviceNet, motor drive, if applicable, and any other programmable devices, as well as for the controller PLC. Any hardware or software required for configuring, programming and or communicating to controller or any parts of the elevator shall be submitted to ELES engineering. Using the provided laptop, the contractor shall demonstrate loading, downloading (programming) any and all software that is required for the elevator for all operating needs. This includes display, PLC and any I/O controls. All special tools shall be new and to be provided with casing. No special tools with decaying circuits or clocks are permitted. All application programs included in this escalator shall be the property of WMATA and shall not be considered proprietary to OEM.

3. Keys: Provide ten (10) sets of keys per elevator to operate all keyed switches and locks prior to completion of the first unit.

1.07 EXTRA MATERIALS

A. Spare Parts

1. At the expiration of the warranty requirements of the General Provisions, the Contractor is responsible to provide a source for spare parts and service facility in the United States which can be obtained for an additional five years. If product source is another vendor, Contractor shall include name and address of other vendor.

1) The Contractor shall propose and provide a spare parts inventory to be approved by the Engineer and provided to the Authority not less than 90 days prior to scheduled completion, equal in value to seven percent of the cost of each elevator.

2) This provision requires the furnishing of a Recommended Spare Parts and Special Tools List based on manufacturer’s recommendations, defines criteria to be used by the Contractor in developing spare parts recommendations; defines the manner of identifying spare parts on the list and the labeling and identification of spare parts upon delivery; and the timing of delivery of spare parts.

3) Elevator parts list, grouped by system and subsystem for stocking identification and the list shall contain the following information for each item listed:

1) Component name and Part number(s).

2) Manufacturer's name.

3) Model number(s).

4) A blank column for WMATA's part number.

5) Manufacturer's recommended quantity (see Section 1.08A.4 below).

6) Anticipated annual usage.

7) Unit price.

8) Special storage and handling requirements.

4) The manufacturer's recommended quantities shall be based upon the following reliability, usage and lead time considerations:

1) Wear: Components which may be expected to require replacement under normal maintenance schedule and operations, such as mechanical parts subject to continuous operation within projected mean time between failure levels.

2) Consumables or Expendables: Components which are consumed, used up, destroyed, or upon failure, are otherwise made usable for their intended purpose and are economically unrecoverable except for inherent scrap value.

3) Recoverable or Repairable: Components which, upon failure, are capable of being repaired or remanufactured to a serviceable, operational condition and maintained available for use within their initial intended purpose.

4) Long Lead: Components that is not available from commercial distributors or within 48 hours from the manufacturers such as specifically made or selected components.

5) Cross referencing: Where replacement components are common to more than one system or subsystem, include a cross reference and indexing system in the replacement components list.

6) Non-Unique parts: In all components lists, items that are not unique to the system and have been manufactured by others shall be identified by the manufacturer's name and part number.

7) WMATA will provide the Elevator Contractor with shipping instructions, with WMATA part numbers for each item the Elevator Contractor is required to furnish.

8) The parts shall be shipped to the locations as directed by the Authority. Shipping documents shall identify the Contract number, manufacturer's part number, quantity, unit price and WMATA part number.

9) Spare parts shall be properly packaged or crated so as to prevent damage during shipment and long-term storage. An individual packing slip shall be included inside the package or crate.

10) Spare parts shall be the same in all respects as their counterparts furnished as a part of the assembled equipment to be delivered.

11) Parts furnished in accordance with this provision are WMATA spares, separate and distinct from any Contractor obligation to replace parts, components or assemblies under any warranty provision.

12) Parts lists contained in Operations and Maintenance Manuals provided under the Contract shall include assigned WMATA part numbers.

13) A Manufacturer’s Recommended Spare Parts List shall be provided. Parts to be provided shall be based on the criteria described herein and require Authority approval and shall be provided prior to Final Acceptance.

14) Any Special Tool(s) used including, but not limited to, troubleshooting, maintaining the elevator, software and/or hardware shall be provided as part of the spare parts to the Authority. Any tools provided shall be the same as those issued to the Adjuster and equivalent members of the subcontractor’s staff.

B. The finished elevator installations shall be completely barricaded and enclosed to preclude their use without permission of the Contractor until Final Acceptance and release by the Contractor for general use. The enclosure shall be fabricated to allow easy access for maintenance, testing and adjustment.

C. The Contractor shall be responsible for the security of the contents of each machine room. The Contractor shall control access to that room, and ensure that it shall remain secure at all times until the completion of the Contractor's interim maintenance obligation.

1.08 QUALITY ASSURANCE

A. Manufacturer Qualification: Shall provide documents stating that their firm has successfully produced elevators for transit system applications for a minimum of ten (10) years and regularly engaged for the past five (5) 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: Shall be the original manufacturer of elevator equipment or manufacturer's authorized agent who is trained and approved for installation of units required for this Project.

C. The Contractor shall obtain and pay for all permits and licenses and perform all required inspections.

D. The elevator contractor shall guarantee the materials and workmanship of the apparatus furnished under these specifications and will correct any defects not due to ordinary wear and tear within two (2) years from date of completion of each elevator, inclusive of labor and traveling expenses. Defective work shall be repaired or replaced at no additional cost to the Authority.

E. 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.

F. Labeling Requirements: Every elevator shall be clearly marked with rated load and speed, manufacture serial number and the designated Authority identification.

1. All elevators shall be permanently numbered with number designations corresponding to the indications on the kiosk annunciator panel. A station sketch showing the elevator numbers shall be submitted for WMATA ELES Engineering. The elevators shall be numbered in sequence, starting at the north entrance left to right facing to the elevator at each station and proceeding clockwise around the station. The numbering shall proceed into the station toward the end of the platform. Corresponding numerical identification shall be affixed to the equipment in the machine rooms. The elevator numbering shall be approved by the ELES Engineer.

1.09 QUALITY CONTROL

A. Project Site Conditions

1. The project site premises shall be visited by the Contractor to thoroughly familiarize with all details of work and working conditions. All dimensions shall be verified in the field and by comparison with the station structural and finish (information) drawings and the Authority shall be informed of any discrepancy before ordering equipment or performing work. Coordination and proper relation of this work to the structure and to the work of all trades shall be performed.

2. The elevator installer shall install all elevators wiring in the embedded conduit provided by other trades including that to the kiosk. Other trades will bring wiring for their services to either the elevator machine room or the elevator pit, terminated on a terminal block. The elevator installer shall extend wires from the terminal blocks to the appropriate location or device within

the elevator enclosure or hoistway. Some of these circuits shall require shielded wires or separate isolated circuits.

1.10 WARRANTY

A. Warranty: A Two (2) year warranty of construction shall start at Final Contract completion.

1. The OEM shall warrant in writing that all equipment manufactured and installed under this specification, for a period of twenty four (24) months from the date of Final Acceptance by the Authority, be free of defects in design, materials, and workmanship, under normal use and service. Defective work shall be repaired or replaced at no additional cost to the Owner.
2. The warranty shall include materials and labor necessary to correct defects.
3. The warranty does not begin until all of the following requirements have been met.
   1) The Operations and Maintenance Manuals are accepted by WMATA.
   2) The required training has been completed to the satisfaction of WMATA.
   3) All field tests have been successfully completed.
   4) The acceptance testing has been successfully completed.
   5) The elevators are in service for passenger/public use.
   6) The State and local jurisdictions have inspected the elevators and issued the respective certificates of Operation.
   7) All spare parts have been delivered and received by WMATA.
   8) Any discrepancy identified by the ELES representative shall be repaired or replaced by the Contractor at no additional cost to the Authority.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. The major elevator components shall be the products of one of the three manufacturers of established reputation, except they may be the products, either wholly or in part, of another manufacturer of established reputation provided such items are capably engineered and produced under coordinated specifications to ensure a high grade, safe, and smooth operating system.

B. Also, the major components to be furnished for this project shall be of a make or makes that have performed satisfactorily together under conditions of normal use for not less than one year in at least two other elevator installations of equal or greater capacity and speed.

2.02 SYSTEM DESCRIPTION AND PERFORMANCE REQUIREMENTS

A. General:

1. Elevators furnished under this Contract shall be of the heavy duty automatic hydraulic-type with direct –acting plunger.

2. All parts shall be built to standard dimensions, tolerances, and clearances so that similar machines and devices supplied under contract are completely interchangeable. Elevators shall be designed with provision for thermal expansion and contraction of complete elevator assemblies and for any movement of the facility.

3. Fasteners: Fasteners shall be compatible with materials being fastened. Fasteners shall be furnished with self-locking nuts or retaining rings (spring washers, toothed disks). Fasteners

shall be equal to or of greater corrosion resistance than the most corrosion resistant metals being fastened. The mechanical fastening used throughout the equipment on parts subject to wear and requiring replacement shall be key and seat, nut, screw, or other removable and replaceable type not requiring physical deformation or field positioning. The use of rivets or similar devices will not be acceptable as mechanical fastenings for such parts.

4. Doors of elevators shall be of the horizontal sliding type, single speed, and center-opening. The doors shall be arranged for low-speed electric power operation.

B. Capacity, Speed, Travel, Platform Size

1. All part of the elevator equipment shall be of such design, size, and material as to satisfactorily function under all conditions of loading and operation within its rated load and speed, all with a proper factor of safety, maximum mechanical and electrical efficiency, and a minimum wear on parts.
2. Hydraulic elevators shall have sufficient capacity to lift the rated load at 150 feet per minute, with a tolerance of plus or minus 8.0 percent.
3. The rated load shall be exclusive of the weight of the complete car and shall be determined in accordance with ASME Code requirements for passenger-elevators required to carry freight, Class C3 (ASME A17.1 Section 2.16) or 4500 lbs, whichever is greater.
4. The travel, location, terminal floors, number of stops and openings, and the overall car platform size shall be as shown on the Contract Drawings.
5. The anticipated freight load (cart) will be approximately 4 feet-1 inch by 2 feet in plan, supported on four 8-inch wheels with 2-inch wide treads spaced approximately 2 feet-4 inches center-to-center longitudinally and one foot five inches center-to-center transversely. The loaded cart will weigh approximately 1,260 pounds.
6. The entrance of the cart into the elevator car will produce eccentric forces which, acting through the guide rails, will result in additional deflections and deformation on the hoistway. These deflections and deformations shall not exceed 1/16 inch and shall not be permanent.
7. The top enclosure shall be reinforced to support two men and capable of sustaining, without damage or permanent deformation, a load of 300 hundred pounds on any area one foot square and 100 pounds applied at any point. An emergency exit shall be installed in the car top in conformance with the Code.
8. Car travel shall not exceed 15 feet with Hole-less type hydraulic elevator.

2.03 PERFORMANCE REQUIREMENTS

A. The elevators shall be designed for continuous operation seven days per week, 24 hours per day.

B. Elevators shall be designed to be capable of operating with full specified performance capability while exposed to the climatic and environmental conditions described in the following paragraphs. In addition, during installation and until the beginning of scheduled maintenance service, the elevators will be subject to more extreme environmental conditions. The elevator shall be furnished the amount of protection necessary to prevent any damage to or deterioration of the elevators during this period.

1. Elevators shall be designed to operate in dry bulb temperature range of -10^0F to 140^0F and operate while exposed to the natural elements of weather, including sunlight, rain, snow, slush, salt; all condition of relative humidity, de-icing chemicals, debris, airborne dust, and corrosive elements.

2. The elevators shall have a special winter operation. The elevators shall be designed to operate in the event the outside temperature falls below a pre-established minimum value. The elevator contractor shall furnish and install the necessary timers and thermostat to accommodate the desired function.

C. Sound Level: No elevator car or elevator power unit shall generate noise in excess of NC-45 sound level. Measurement of noise shall be made at a point 3 feet from the hoistway, machine room entrances, and ventilation openings, either free running or under load. For multiple elevator installation, 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.

D. Hoistway Movement:

1. Elevators shall be designed to sustain the load and operate with the following lateral movements of the hoistway structures:

1) In any individual glazed area: 1/4 inch.

2) In total height of hoistway structure:

1) Aerial and surface structures: 5/8 inch.

2) Underground structures: ½ inch.

E. The elevator assembly shall be designed in a manner to avoid corrosion and galvanic action due to physical contact between dissimilar metals or due to other causes.

F. Reliability:

1. Each elevator shall be capable of operating at full load under any of the normal modes of operation at a level of availability of not less than 98 percent over a period of 365 days.

2. Availability (A) is defined as the portion of normal operational time during which the equipment is available for use. Or

$$A = \frac{MTBF}{MTBF + MTTR}$$

Where:

MTBF= Mean time between failure in days

= Operating time, t (in days) /Number of failures in time t.

MTTR= The average time in days required to restore an elevator to operation after a report of a failure.

G. Seismic Loads

1. In accordance with Building Code all structures shall be designed to resist the effects of earthquake motions.

2. The elevator shall be designed to comply with the seismic zone 2 requirements of ASME A17.1.

H. Make provision for and provide a closed circuit television camera (CCTV), in the elevator car(s) with the ability to monitor the CCTV from the Kiosk annunciator panel. Submit drawings for approval before fabrication.

1. Provide electrical connections, through shielded traveling cables, between camera and the communications terminal block in machine room or pit.

I. Painting: The pit, pit walls and machine room floor shall be painted. All machine room equipment shall be given two coats of approved mahinery paint. All new iron work shall be given one coat of rust-inhibiting paint.

J. Workmanship:

1. Joints shall be welded their full length and dressed smooth and flush on exposed surfaces. Spot welding shall be sued where practicable in preference to screw or rivet fasteners.
2. Sheet metal materials shall be accurately rolled and leveled, and have smooth finish and uniform color. Joints shall be formed to a tight fit, with abutting edges flush, and shall be securely welded or riveted together in such a manner as to give strength equivalent to the solid sheet. Riveted construction shall have heavy reinforcement on the back, and no rivets shall show on exposed surfaces, Welds shall be solid and dressed flush, and holes for screws or bolts shall be drilled and countersunk.
3. Wrought work shall have joints milled to a tight even fit and, where possible, shall be made without screws. Square turns and comers shall be sharp, Curves and loops shall be true and without visible joints. Abutting members shall be welded, riveted or both. Similar bars shall be halved at intersections and wide bars shall be punched for the small bars to pass through.
4. The finished work shall be strong, rigid and neat, painted in appearance. Plane surfaces shall be smooth and free from warp or buckle. Molded members shall be clean cut, straight, and true. Miters shall be well formed and in true alignment. Fastenings shall be concealed from face side of the material.

K. Corrosion Protection: The contractor shall design the elevator assembly in such a manner to avoid corrosion and galvanic action due to physical contact between dissimilar metals or due to other causes.

2.04 MATERIALS

A. Stainless Steel
1. Shapes and Bars:
1) ASTM A276, Type 304 or 301 for non-exposed components, and Type 316, all finish panels and exposed components.
2. Plate, Sheet, and Strip
1) Over 1/8 inch, ASTM A264 with ASTM A240, Type 316 on ASTM A36 base;
2) Under 1/8 inch, Type 304, Type 316, for all finish panels and exposed components.
3. Stainless steel finish shall be NAAMM NO.4 with vertical grain.
4. Stainless steel screws, bolts and nuts shall be used for fastening and shall be AISI Alloy 303.

B. Steel Sheet and Steel Fabrications

1. Steel sheet for top enclosure shall be minimum 12-gauge.
2. Steel sheet for hoistway door frame shall be minimum 12-gauge.

3. Steel sheet for corrugated floor decking shall be minimum 10-gauge.
4. Steel sheet for subfloor shall be minimum 3/8-inch thick.
5. Galvanized steel material shall comply with ASTM A123, ASTM A153, and ASTM A653 (G90 Coating) as applicable. All steel sheet and steel fabrications, except lubricated machinery parts, which are not shown or specified to have other applied finishes, shall be galvanized.

C. Steel Finishes

1. Where visible to the public, steel surfaces shall have a baked enamel finish unless otherwise shown.

1) Color shall meet the requirements as shown in the finish schedule on the contract drawings.

2) Baked enamel finish shall consist of a thorough hot chemical cleaning process, a six-step zinc-phosphate process, two prime coats, and one finish coat of sprayed acrylic enamel (1.25 mils thickness minimum), baked at 350ºF for a minimum of 30 minutes.

2. Fasteners

1) Fasteners securing removable sheet metal materials shall be operable with the aid of simple tools and concealed wherever possible. When the framework to which the metal is fastened is less than 1/4-inch thick, steel backup plate's 1/4-inch thick shall be added with tapped holes and clearance holes where necessary. Exposed fasteners shall match the color and finish of the material being fastened, and shall be tamperproof flat-head machine screws of a captive screw fastener design.

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.

2.05 COMPONENTS AND EQUIPMENT

A. The hydraulic elevator drive shall be of the oil-electric type with direct-acting plunger, power unit, oil storage tank, and control equipment. The power unit, storage tank, and associated control equipment shall be mounted in the machine room.

1. Cylinder and Plunger:

1) The cylinder and plunger unit shall be designed and constructed in accordance with the applicable requirements of the ASME Code and other applicable codes. It shall be of sufficient size to lift the gross load to the height specified and shall be factory-tested at a pressure of 400 psi. Gray cast iron or other brittle materials shall not be used in the construction of the cylinder and plunger unit. The cylinder shall be coated on the outside to prevent rust and corrosion. The bottom of the cylinder shall be closed and the top provided with an internal guide bearing and a cylinder head. The cylinder head shall be equipped with an adjustable packing gland designed to effectively prevent leakage of oil. A scavenger pump shall be provided to return oil to the system. It shall be located so as not to obstruct the path between the pit entrance and the cylinder.

2) The packing gland shall be constructed to permit easy repacking.

3) The cylinder shall be provided with a means to release air or other gas and shall have a drip ring below the packing gland to collect all oil leakage.

4) The cylinder shall be secured to a support, provided by the Contractor, which will transfer and distribute the load to the floor of the hoistway pit.

5) Plunger of built-up construction shall be secured to the car platform by means of a suitable platen.

6) Plunger shall be designed to prevent its leaving the cylinder.

7) The cylinder shall be isolated from rails, pit channel, building structure and other sources of possible corrosive or galvanic damage by dielectric insulation of the cylinders.

8) The cylinder shall be coated with corrosion-rust resistant primer and painted with a dark gray industrial epoxy or other approved paint.

2. Cathodic Protection

1) The cathodic protection shall be provided for cylinders and piping and shall be provided by dielectrically isolating the cylinder and piston from the car platen, pit support structure, and pressure piping.

2) Gaskets and pads for dielectric insulation shall be neoprene or approved alternative. Insulating sleeves, washers, and oil line coupling shall be provided where specified or shown.

3. Power Unit

1) The power unit shall consist of a screw-type or gear-type oil pump driven by an electric induction motor with oil control valves, combined in a self-contained unit fabricated of structural steel. Power unit drive motor is specified under Electrical Work (See Section. Submersible units will not be accepted.

2) The oil pump shall be especially designed and manufactured for hydraulic elevator service. It shall be designed for a steady discharge with minimum pulsation to give smooth and quiet operation. The pump shall be of proper size and shall deliver oil into the cylinder in sufficient quantity and pressure to lift the elevator car with specified load at specified speed. During downward trip of elevator, the oil shall be returned to the tank by gravity.

3) Geared pumps, when used, shall be provided with accurately cut herringbone or helical gears. The gears shall operate under flooded suction in an accurately machined case with close clearances to assure maximum efficiency. An effective strainer shall be provided in the suction line to the pump. The power unit shall be equipped with a vibration isolation device suitable for use with and approved by the power unit manufacturer. The vibration isolation shall effectively prevent the transmission of power unit vibration to the machine room structure.

4. Piping, Fittings, and Couplings

1) Piping, fittings, and couplings shall be furnished and installed between the storage tank, pump, muffler, valves, and cylinder complete with necessary supports.

2) All connections between the discharge sides of the pump check valve, muffler, cylinder, and lowering valves shall be of rigid steel with screw, flanged, welded, or approved mechanical couplings.

3) Pipe supports shall be provided within 12 inches of every change of direction in piping.

1) Supports shall not be more than 10 feet apart.

2) Secure vertical runs properly with iron clamps at sufficiently close intervals to carry weight of pipe and contents and provide supports under pipe to floor.

3) Furnish and install all piping from remote machine room to hoistway, including necessary supports and/or hangers.

4) Size of pipe and couplings between cylinder and pumping unit shall be such that fluid pressure loss is limited to 10 pounds.

5) Mechanical couplings, when used, shall be of a self-centering type that provide for some degree of deflection, contraction, and expansion.

1) Couplings that provide for partial or full separation of the two sections of piping being connected are acceptable, provided all other specified requirements are met.

2) Couplings shall be rated for a pressure at least three times the working pressure of the elevator and shall be so designed that failure of the flexible sealing element or gasket shall not permit the separation of the parts connected.

3) Flexible sealing elements or gaskets shall be of a type and material suitable for use with the hydraulic fluid furnished.

6) Where piping, fittings, and couplings supplied by the Contractor are contained within sleeves, conduit, trenches, troughs, or other passage means provided by others to allow for the connection of the power unit with the cylinder and plunger, the Contractor shall provide appropriate devices which shall effectively prevent the transmission of vibration to the surrounding structure.

7) The Contractor shall install all piping, fittings, and couplings used to connect the power drive to the cylinder and plunger in such a way that these may be removed and replaced at a future date. When Victaulic is used, there shall be access for inspection and maintenance. Destruction of portions of these items in the process of removal is acceptable but efforts shall be made in the designs to minimize the necessity to destroy items.

5. Valves

1) Valves shall be of the unitized manifold type with no more than four solenoids and arranged so that all adjustments are individually adjustable without the need for sequential readjustment. Valve shall be designed to ensure that oil flow will be controlled in a positive and gradual manner, thereby ensuring smooth starts, operation, and stops of the elevator car.

2) Valves shall be designed for quiet operation and shall be mounted above the storage tank in a manner that allows leakage to drain back to the tank.

3) A safety check valve shall be provided which will function to hold the elevator car with rated load at any point when the pump stops or the maintained pressure drops below the minimum operating pressure required holding the car in place.

4) A manually operated lowering valve shall be provided, which shall permit the manual lowering of the elevator car in the event of power failure. The location of the lowering valve and access to it shall be described in white stenciled lettering on the front panel of the pump unit. The lowering valve operating means shall be easily and readily accessible and unobstructed by the valve wiring, conduits or other equipment. A tank shut-off valve shall be provided to permit isolating the oil in the tank during maintenance operations. The location and orientation of the valve shall allow for safe operation of the handle throughout its range of travel.

5) All additional pump relief valves and other auxiliary valves required by the ASME Code or necessary to provide smooth, safe and satisfactory operation of the elevator shall be furnished and installed.

6) Any relief valves having exposed pressure adjustment shall have their adjustment sealed after being set to the correct pressure.

7) Manual shut-off valves shall be provided in the hydraulic oil line in the elevator pit and in the elevator machine room. In any portion of its travel, the machine room shutoff valve handle shall not intrude in the walk space or work space or obstruct access to other equipment.

6. Storage Tank

1) The storage tank shall be constructed of steel and shall be provided with a steel cover, protected vent opening, overflow connection and a valve drain connection. Tank shall act as a storage tank only. Suitable gauge glasses shall be provided if the top of the tank is over 4 feet above the floor. An initial supply of oil sufficient for proper operation of the elevator shall be provided. The tank shall have a capacity equal to the volume of oil required to lift the elevator to the top terminal plus a reserve of not less than 10 gallons.

2) The oil storage tank cover shall be arranged for easy unobstructed access. Clearance of 24 inches vertical and 18 inches horizontal from tank cover shall be maintained for ease of service.

3) The permissible minimum liquid level shall be clearly indicated. The manufacturer's recommendation of type of oil to be used shall be included in the written instruction for the care, adjustment, and maintenance of the equipment. The flash point of oil used shall be not less than 400 degrees F.

4) Provide an oil filtering system that removes contaminants that can clog valves and settle in the bottom of the tank.

7. Blowout-proof foil-hydraulic muffler of an approved make shall be furnished and installed in the oil line near the power unit to reduce noise to a minimum.

8. Oil Temperature Control/Tank Heater: Hydraulic oil viscosity/temperature control shall be provided by the application of an internally mounted, thermostatically controlled, tank heater. The oil temperature shall be maintained at a maximum 110 degrees Fahrenheit with the use of a 120V AC powered tank heater. Unit shall be permanently mounted, integral with oil reservoir, and with a lighted switch/indicator to visually confirm unit is powered. Tank heater shall include the switch for disconnection of power during maintenance/repair operations. Unit shall be hard wired to electrical source per ASME A17.1.

9. Elevator Car Buffers: Heavy-duty spring buffers shall be provided, mounted on the supporting channel or block on the pit floor. The buffers shall comply with the requirements of the ASME Code. Buffer anchorage at pit floor shall be arranged to avoid damaging the waterproofing.

10. Car guides consist of a guide rail and guide-rollers. Guide rails for the elevator cars shall be of planed steel standard T-section. Guide rails shall be erected plumb and parallel with a maximum deviation of 1/8 inch and shall be securely fastened to the bracket or other supports by approved heavy rail clamps.

11. Car Roller Guides:

1) The elevator car shall be provided with roller guides.

2) Roller guides shall be spring-loaded and allow rail-to-rail and front-back adjustment of the rollers.

3) Three or more rollers per guide and shall have 4-inch minimum sound-deadening wheels.

B. Operation:

1. Operation shall be automatic. Automatic operation by means of car and landing buttons. Stops registered by momentary actuation of car buttons to be made irrespective of number of buttons actuated or of sequence in which buttons are actuated.

2. Operating station in car containing bank of buttons numbered to correspond to landing served position indicators. EMERGENCY CALL button, keyed EMERGENCY STOP button, DOOR OPEN/DOOR CLOSE buttons, independent maintenance key switch, and key-operated light and fan switches, with legends as specified. Identification as specified for emergency telephone. Emergency call button connected to bell that serves as emergency signal. Panel finish: Stainless Steel.
3. Landing: Single push button fixture at each terminal landing. Button fixture having push buttons with UP and DOWN legends at intermediate landing. Button identification as specified for Person with disabilities per latest ADA regulation (ADA rule 4.10.3).
4. Momentary pressure on car button or landing button illuminates that button, which remains illuminated until call is answered. Illuminated buttons serve as visual indication that call has been registered and that car will stop at that landing. The Push Buttons shall be round, have a Metalized Halo and center jewel. The metalized halo shall be from different color and approved by ELES Engineer.
5. Stops, registered by momentary actuation of landing buttons. All stops subject to respective car or landing button being actuated sufficiently in advance of arrival of car at that landing to enable stop to be made. Direction of travel for idle car established by first car or landing button actuated.
6. UP landing calls answered while car is traveling in up direction and DOWN landing calls answered while car is traveling down, car reversing after uppermost or lowermost car or landing call has been answered and proceed to answer car calls and landing calls registered in opposite direction of travel.
7. Elevators to park at the secure landing level selected by the Engineer.
8. Push button units to be PB-46 NEMA-4 Series or approved equal with button identification as specified by latest ADA regulation.
9. Emergency stop shall be key operated rather than push-pull arrangement with key removal only in off position.
10. All elevator car control panel operating devices shall be designated by Braille and by raised standard alphabet characters for letters, Arabic characters for numerals, and standard symbols as required by the Code and ADAAG.
11. Lettering shall have a highly visible coloring, such as white, that is permanently affixed.
12. 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. Car door shall remain open unless closed fully by the door close button.
13. Two Stop Collective Simplex Automatic Operation:
    1) The two stop collective simplex automatic operation shall be used and checked for the following:
        1) System shall be designed so that when the car is standing at either terminal landing, pressure on car button for the other terminal shall automatically dispatch car to that landing. Pressure of landing button at either terminal landing shall call car automatically to that landing. If a landing call is registered while the car is making its trip that call shall remain registered until the car responds to that call. If no car calls are registered car shall start automatically and respond to hall calls. Provide time limit relay arranged to hold car at landing at which it has stopped for predetermined time after car stops. After all car landing calls have been answered,

car shall remain parked at landing where last used with car and hoistway doors closed until another call is registered. Pressing the landing button at floor at which car is parked shall automatically open car and hoistway doors. In all normal operations, the starting of the car shall be contingent upon establishment of hoistway door interlock and car door circuits.

2) Automatic dispatching operation: all two stop elevators shall include “Step-in-and-Go” feature. Calls for the opposite landing will be automatically set when the elevator opens its doors for a hall call. This feature shall be provided for all elevators that have public access for two stops (i.e., any elevators with key operated service landings will be included).

C. Position Indicators:

1. Car indicator: In accordance with ADA requirements. Mounted in vertical row in car-operating panel to show position of car in hoistway by illumination of indicators corresponding to landing at which the car is stopped or passing. Finish for exposed-to-view metal components: Stainless Steel.
2. Landing indicator: In accordance with ADA requirements. Two-element direction-of-travel indicator mounted above call station or hoistway entrance as shown, including one red and one white indicator. Direction of car's operation shown by illumination of red indicator for DOWN and white indicator for UP.
3. In car signals: Audible signal indicating car's direction of travel, signal sounding once for UP direction and twice for DOWN direction.
4. Landing signals: Audible signal at each hoistway entrance indicating car's direction of travel, signal sounding once for UP direction and twice for DOWN direction.

D. Lighting:

1. Machine Room Emergency Lighting: Emergency lighting shall be provided in each elevator machine room.
   1) There shall be a minimum of one lighting fixture.
2. Car interior: LED fixture, 120V operation, with clear prismatic glass diffuser, flush mounted in ceiling, cool white bulbs. Illumination level shall be 15-foot candles minimum at car operating panel.
3. Car top and underside of car floor: Medium base porcelain lamp receptacles, with wire lamp guards.
4. Car Emergency Lighting:
   1) Fixture: Recess mounted, with stainless steel frame, location as shown.
   2) Diffuser: Prismatic polycarbonate plastic.
   3) Lamps: Two, size 16 51
   4) Remote power supply:
      1) Power pack: Sealed gel cell battery with integral regulating charger and an alarm bell.
      2) Capable of operating bell for one hour minimum and light at car-operating panel at 0.2 low candles minimum for four hours minimum.
      3) Location: in top of car or COP with easy access provided.

E. Inspection Operation: Key switch in car to nullify car and landing buttons permitting operation of elevator from top of car for inspection purposes:

1. Top of Car Inspection Station: The Inspection Station contains continuous pressure UP and DOWN buttons, emergency stop button and toggle switch to activate inspection devices. The device shall also have an 110v ac outlet for extension cord and provided with a light and guard.

F. Leveling: Automatic leveling device to stop car within 1/8 inch of landing level regardless of load or direction of travel. Landing level maintained within leveling zone irrespective of hoistway doors being open or closed.

G. Emergency Service:

1. Controls to return elevator to designated floor by means of key-operated switch outside street or ground floor hoistway entrance in compliance with ASME A17.1.
2. In car control during emergency operation by means of key switch in compliance with ASME A17.1.
3. Terminals on elevators controllers for connection of circuit from heat and smoke sensing devices, with wiring from sensing devices to elevator controller.

H. Telephone Facilities:

1. Provide all audio/visual communication, signaling, and monitoring in accordance with ADA. “Hands-free” phone integral with control panel, mounted in accordance with ADA requirements; having inscription EMERGENCY TELEPHONE as specified for Person with disabilities; finish exposed-to-view components to match stainless steel control panel; color of letters to contrast with panel.
    1) Provide emergency communicators in accordance with ADA requirements to include auxiliary push button to summon help and visual feedback indicating that the call has been responded to.
2. Provide wiring and jacks for a portable self-contained battery-powered maintenance telephone system. Jacks shall be located on car top, inside car, and in machine room. Furnish three telephone instruments for use of maintenance personnel.

I. Electrical Equipment:

1. Electric equipment for elevator shall be designed, selected, and fabricated in accordance with NEC, NEMA, IEEE Standards, applicable jurisdictional codes, and additional specified requirements. All equipment including motors, controllers, service cabinets, circuit breakers, switches, panelboards, indicators, lighting, wiring, conduit, boxes and other appurtenances for proper installation and operation of the elevator shall be furnished and installed by the Contractor.
2. Cable and wire for external circuits between the various items of elevator equipment, exclusive of the traveling cable, shall comply with the requirements specified below. The talk pair of the voice communications intercom system shall be shielded with 0.008-inch, minimum, copper shield.
    1) General Requirements for Single-Conductor and Multiple-Conductor Cable:
        1) Type and size: As shown or as required by code.
        2) Rated voltage: 600 volts.
        3) Conductors:

a) ASTM B3 or ASTM B8 annealed copper

b) Size 10 AWG and smaller: Solid or Class B or Class C stranded.

c) Size 8 AWG and larger: Class B stranded.

d) Other constructions as specified.

4) Standards: Except as modified, wires and cable complying with the following:

a) Cross-linked polyethylene (XLPE) insulated cable: NEMA WC 70.

b) Other cable: NEMA WC 70.

5) Nonmetallic jacket for single-conductor cable and individual conductors of multiple-conductor cable and as overall covering on multiple-conductor cable:

a) Choro-sulfonated polyethylene or cross-linked polyolefin.

b) Cross-linked polyolefin complying with the following physical requirements.

6) Properties tested in accordance with NEMA WC 70 if ethylene-propylene-rubber (EPR) insulation is used or with NEMA WC 70 if cross-linked polyethylene insulation is used. Jacket material free of PVC and PVC-based compounds.

a) Tensile strength, minimum pounds per square inch: 1,800.

b) Elongation at rupture, minimum percent: 150.

c) Aging requirement: After 168 hours in air oven test at 100EC, plus or minus one degree C:

i. Tensile strength, minimum percentage of unaged value: 100.

ii. Elongation at rupture, minimum percentage of unaged value: 80.

d) Oil immersion: 18 hours at 121EC, plus or minus one degree C, ASTM D471, Table 1, No. 2 oil:

i. Tensile strength, minimum percentage of unaged value: 80.

ii. Elongation at rupture, minimum percentage of unaged value: 80.

iii. Jacket materials other than cross-linked polyolefin complying with NEMA WC 70. Jacket material free of PVC and PVC-based compounds.

e) Flame Retardancy: Single-conductor and multiple-conductor cable demonstrating flame retardancy in accordance with the following:

i. Single-conductor cable and individual conductors of multiple-conductor cable passing vertical flame test in accordance with UL 1591 or NEMA WC 70. Cable size for testing: 14 AWG.

ii. Single-conductor and individual conductors of multiple-conductor cable passing vertical tray flame test using ribbon gas burner in accordance with IEEE 1202.

iii. Multiple conductor cable passing vertical tray flame test, using ribbon gas burner in accordance with IEEE 1202.

f) Applied voltage testing:

i. Single-conductor cable and individual conductors of multiple-conductor cable to be given applied ac voltage dielectric strength test, i.e., six-hour water-immersion test.

ii. For single conductors of multiple-conductor cable, conduct tests prior to assembly as multiple-conductor cable.

iii. Test procedures:

1st. Polyethylene insulated conductors in accordance with NEMA WC 70.

2nd. Other conductors in accordance with NEMA WC 70.

2) Single-Conductor Cable:

1) Insulated with ethylene-propylene-rubber with non-metallic jacket or unjacketed filled cross-linked polyethylene. UL-labeled Type RHW or XHHW.

2) Color coding: In accordance with paragraphs 200-6, 200-7 and 210-5 of the NEC.

3) Multiple-Conductor Cable:

1) Individual conductors:

a) Number of conductors: As shown or as required by code.

b) Construction: Complying with one of the following:

i. Insulated with ethylene-propylene-rubber, with or without nonmetallic jacket as specified.

ii. Insulated with composite compound of ethylene-propylene-rubber and polyethylene, UL Class EPCV, without outer jacket.

iii. Insulated with filled cross-linked polyethylene without jacket.

c) Phase and neutral conductors: Individually insulated.

d) Neutral conductors: Same size as phase conductors.

e) Bare ground conductors: Sized in accordance with the NEC, unless otherwise shown.

f) UL-listed as Type RHW or XHHW.

2) Conductors assembled with non-wicking, flame-retardant filler to form cable of circular cross section.

3) Metallic-sheath: Provide one of the following

a) Continuous smooth aluminum sheath in accordance with NEMA WC 70.

b) Continuous corrugated aluminum sheath in accordance with NEMA WC 70.

c) Interlocked aluminum tape armor.

d) Multiple-conductor cable provided with overall nonmetallic jacket as specified.

e) Cable UL-listed as follows: Metallic-sheathed cable: Type MC, suitable for wet and dry locations.

4) Color coding:

a) Power cables: In accordance with paragraphs 200-6, 200-7 and 210-5 of the NEC.

b) Control cables: In accordance with NEMA WC 70.

4) Fixture Wire: UL 62, with the following additional requirements:

1) Type: Suit temperature rating of lighting fixture, minimum 194EF.

2) Conductor: Stranded copper conductor 16 AWG or larger as shown.

5) Bare Conductor: ASTM B3 or B8, annealed copper conductor; 8 AWG and larger, class B stranded.

3. Traveling Cable

1) The elevator car traveling cable shall be type ETT conforming to the requirements of the NEC with minimum conductor sizes as specified in the NEC. Individual conductors in the cable shall have a distinctive color code for identification. Each traveling cable shall have one two-conductor stranded 18 AWG, twisted shielded pair for elevator intercom and a minimum of ten spare conductors. Traveling cable exceeding 100 feet in length shall have steel supporting fillers. Traveling cable 100 feet or less in length shall have steel or non-metallic fillers.

2) For surface elevators only, the traveling cable shall be provided in addition to the above requirements, with one RG 6u coaxial cable, and one two-conductor, twisted shielded pair, stranded 18 AWG power cable for CCTV camera.

4. Connector, Terminal Lugs and Fittings

1) In accordance with UL 486.

2) For 10 AWG and smaller conductor cable: Tin-plated copper pressure connectors with nonflammable, self-extinguishing insulation grip with temperature rating equal to that of conductor insulation.

3) For 8 AWG to 4/0 AWG conductor cable: Tin-plated copper compression connectors and terminal lugs with insulating sleeve or heat shrinkable insulator for insulation grip.

4) For multiple-conductor cable: Watertight aluminum fittings with stainless steel pressure ring and set screws or compression cone for grounding of aluminum sheath of Type MC Cable.

5) Terminal lugs used for bonding connections to metallic structures shall be installed on bare/uncoated metallic surfaces to assure minimum contact resistance.

6) All wires shall run inside conduits. Wires and cables shall not be spliced inside or outside of conduit. Wire and cable shall only be connected at terminal strips or devices inside boxes, controller or approved enclosures.

5. Self-extinguishing nylon bundling straps having a temperature range of minus 65EF to plus 250EF shall be used for bundling or cabling of conductors where required. Strap shall have a hub complete with stainless steel locking barb on one end and a taper on the other.

6. Conduits and Fittings:

1) Rigid conduit and fittings shall be UL-Listed rigid galvanized steel conforming to the requirements of UL 6 and NEMA C80.1. The minimum diameter shall be 3/4 inch for power circuits, one inch for fire and intrusion circuits, and two inches for audio and control circuits.

2) Liquid-tight flexible conduit shall conform to the requirements of UL 360 and consist of a flexible galvanized steel core containing a copper bonding conductor spiral-wound between convolutions and a neoprene or PVC jacket overall. Fittings for liquid-tight flexible conduit shall be watertight and shall conform to the requirements of UL 514.

3) All conduits (rigid steel and liquid tight flexible) should be permanently secured with metallic clamps. Zip ties are not acceptable to use as permanent use.

7. Auxiliary gutters, wireways, and raceways shall be constructed of galvanized sheet steel conforming to the requirements of the NEC and shall be UL-listed. Raceway, conduit and wireways within the hoistway exposed to public view shall be concealed within steel cladding.

8. Electrical Boxes:

1) Outlet, junction and pull boxes shall be galvanized sheet steel or galvanized malleable iron, cast iron or ductile iron conforming to the requirements of UL 50, UL 514 and NEC paragraph 370-C. Pull boxes shall have screw cover with a liquid-tight gasket.

2) Junction boxes on car bottom and hoistway connecting the traveling cable shall contain approved terminal blocks for connection of traveling cable conductors. Terminal blocks shall have indelible identification numbers for each terminal connection.

3) All wire connection terminal blocks shall have the same identification number as labeled on the associated electrical wiring. All electrical wires shall use a labeling tube and heat shrink and match the terminal numbers.

4) During field installation of junction boxes or control boxes, the contractor/subcontractor shall not drill or cut into the top sides of the box for wiring.

5) All boxes shall be accessible without removal of other components.

6) All boxes in machine room or pit shall be mounted on strut channels in order to prevent future corrosion and water damage. The strut channels shall be mounted on the wall and has a minimum of 1-1/2 inches thickness and 18 inches above the floor.

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

9. Disconnect Switches for Car Lights and Mainline Power

1) Disconnect switches shall be the following: UL 98, NEMA KS 1, heavy-duty, quick-make/quick-break switching mechanism with operating handle external to enclosure, with positions labeled ON and OFF, defeat able interlock to prevent opening of enclosure door when switch is ON. Enclosures shall be NEMA 250 Type 4X. Label disconnects switches in accordance with the NEC.

2) Mainline power disconnect switch shall be located in close proximity to the machine room entrance and shall be easily identifiable from other disconnect.

10. Circuit Breakers and Panelboards

1) Circuit breakers shall be the following: UL 489, molded-case, bolt-on quick-make/quick-break, mechanically trip-free switching mechanism, with thermal trip for inverse time delay overcurrent protection and magnetic trip for instantaneous short-circuit protection. Designed to carry continuous rating in ambient temperature of 40ºC.

2) Panelboards shall be the following: UL 50, NEMA PB 1, latch and handle in accordance with UL 50, minimum side gutter size of four inches, bus bar of 98-percent-conductivity copper with contact surfaces silver-plated or tin-plated, rating of neutral and ground buses equal to phase bus rating, neutral bus mounted on insulated block, neutral and ground buses equipped with integral mechanical connectors, one-inch high engraved plastic nameplate with 2-inch high letters on black and attached with stainless steel fasteners. Enclosures shall be NEMA 4.

11. Pit Receptacles and Lights

1) Electrical power receptacles shall be furnished and installed in the elevator hoistway, pit, and top of car as shown or required by code. Each receptacle shall be duplex, ground fault interrupter type, resettable at the receptacle; waterproof; grounded; rated for 120V at 20A.

2) Maintenance lighting shall be furnished and installed in the elevator hoistway as shown or required by code. Lighting shall be vapor-tight service lights with quick start type PL compact fluorescent lamp. Furnish and install light switches; waterproof; grounded. The light switches shall be so located as to be accessible from the pit access door.

12. Drive Unit Motor

1) Motor shall be designed specifically for elevator service. The drive motor shall be of the alternating current, intermittent duty, 120 starts per hour, 1.15 service factors, squirrel cage induction type design adapted to the severe requirements of elevator service. Elevator drive motor shall be single-speed. The motor shall be suitable for operation on a 480V, three-phase, and 60Hz supply and capable of developing the required starting torque.

2) The motor shall be rated in accordance with NEMA Standard MG 1 for 60-minute rating motors and shall have sufficient capacity to operate the elevator with specified rated load at specified rated speed without overheating. The insulation and the starting and running torque of the motor shall be capable of permitting operation in accordance with NEMA MG 1. Standard factory motor test data and motor dimensions shall be submitted to the Contractor for approval. Each motor nameplate shall include the motor HP rating, voltage; full-load amperes, locked rotor amperes, full-load speed, design temperature rise, and NEMA design rating of the motor. Each motor shall be provided with ring or other suitable lifting means. The motor frame shall be tapped and drilled for a copper cable grounding connection.

3) Insulation of windings shall be NEMA Class B, fully impregnated and baked to prevent the absorption of moisture and oil. The insulation resistance between motor frame and windings shall be greater than one megohm.

4) Motor bearings shall be of the ball or roller type, arranged for grease lubrication and fitted with grease gun connections and drain plugs or fitted with sealed-for-life bearings. The bearings shall incorporate dust-tight lubricant seals.

5) Motor shall be provided with an electronic soft start feature and thermal overload protection for each phase.

6) Connect motor and pump with multiple V-belt.

    1) Belts and sheaves shall be sized for duty involved and designed to prevent any metallic contact between motor and pump shaft.

    2) Furnish and install isolation units of rubber in shear to prevent transmission of pump and motor vibration to building.

    3) Furnish and install expanded metal sheave guard that can be easily removed for servicing and inspection.

13. Elevator Controller:

1) An Allen Bradley (or ELES Engineering approved equal) PLC-based controller shall be provided, governing starting and stopping as well as preventing damage to the motor from overload or excessive current. It shall automatically cut off the motor current and bring the car to rest in the event any of the safety devices are activated.

    1) System shall coordinate the functioning of elevator drive unit relative to actual location and status of elevator. It shall interface with door control and all required

safety circuits, switches and devices. The controller shall be mounted in a NEMA 4X stainless steel air-conditioned cabinet within the controller room.

2) The diagnostic system shall be an integral part of the controller and provide user-friendly interaction between the service person and the controller system.

3) The supervisory logic shall be performed by a main controller or coordinated between the elevator controllers which will interface directly into the Allen Bradley DH485 protocol Remote Monitoring network, transmitting data from the elevator controller through a data concentrator to the Authority's AEMS RTU computer control and data system. The supervisory logic will coordinate dispatching assignments, interfacing operational demand data accumulated from car and corridor operating fixtures, selector and door control functions.

4) Controller shall be capable of operating with an operating temperature range of 32^0 F to 140^0 F with non-drip environment and no more than 90 percent relative humidity. However the air conditioner on controller cabinet shall maintain the operating temperature in range of 50^0 F to 80^0 F.

2) An Allen Bradley Compact Logix 1769-L32E (or ELES Engineering approved equal) based PLC control system shall be provided.

1) The exclusive Allen Bradley DH485 protocol data port will transmit data from the elevator controller to the station or facility data concentrator. The contractor shall provide a controller data interface to a DH 485 network. Contractor shall provide Data cables to connect from the PLC controller to data concentrator in the station and available for connection to the controller DH485 interface. The contractor shall pull Belden 9842, or ELES Engineering approved equal, cables to connect the controller into the monitoring DH485 network. The DH 485 controller interface shall be programmable for date rates up to 115 Kbps. The interface shall allow other nodes such as other elevators and escalators to be readily incorporated into the DH 485 network.

2) A data concentrator PLC shall be installed using an Allen Bradley CompactLogix 1769 L32E or SLC5/05 per station to function as data concentrated or to consolidate data from all controllers in the station. The software for the data concentrator shall receive controller data over the local monitoring DH 485 network and provide formatted data to the AEMS RTU through an RS232 link. The data concentrator shall provide an Ethernet port for interfacing with the WMATA wide area network. A data concentrator connection to the WMATA wide area network shall be provided.

3) The PLC shall accommodate the following Signal List, as Applicable, and provide data to the data concentrator as specified in specification.

4) The PLC CPU module shall store the last 99 faults, accessible via laptop connection, controller fault/status display and remote communications. The contractor shall provide WMATA with a programming and monitoring unit, such as a laptop computer with the newest version of Allen Bradley RS-Logix and any other software required to setup and program all electronic items in the control system, for each elevator, for the purpose of troubleshooting and remote monitoring modifications. The laptop should allow uploading, editing, and downloading any software that is being used on this elevator for any operation.

5) An Allen Bradley PanelView Plus 6, EZ Automation or ELES Engineering approved equal, fault/status display/interface shall be provided in the controller cabinet. Control system timers

and other setup criteria shall be programmable through this unit. All fault, status and setup data shall be stored in the controller CPU module.

6) In cases where the programming is done by the supplier, the supplier shall provide a copy of all working programs, including labels for all inputs and outputs, data tables and internal logic points, on Flash Drives/CD-R disks as well as a printed program listing. The programs and setup data shall require a password for access and modification. The password shall be provided to ELES Engineering as part of the Submittal.

7) The main control of an elevator shall contain at least the following devices or electronic sensing: phase failure line voltage monitor, motor current and ground fault monitor.

8) The controller cabinet shall contain a permanently mounted fault indicator panel with LED indicator lights. Tripped safety devices, door position, door reversal, car running status, and control system status shall be indicated.

9) All terminals shall have identification markings and all wires, including field wires, shall be provided with permanent heat shrink sleeve cable markers. These wiring identifications shall be provided in the wiring diagram at each end of the circuit connections.

10) The controller shall be equipped with the AC vector drive installed in-line before the motor contactor and the motor.

11) The AC vector drive shall be capable of accelerating and decelerating the motor smoothly and gradually.

12) Adjustable settings for acceleration and deceleration ramps shall be provided.

13) The controller shall have, at least, one dedicated serial port for interface to the DH485 monitoring network and programming access without disconnecting any other port.

14) The Programmable Controller shall have, at least, one dedicated port to support the controller fault/status display.

15) The controller PLC shall provide the following Remote Monitoring and diagnostic network support:

    1) All applicable faults, statuses and data listed in Table 1 shall be provided

    2) Fault indications shall remain until reset in the controller.

    3) Status and analog data shall be provided for the duration of the condition.

    4) Software in the controller PLC shall format monitoring data responses to data concentrator polling as specified in the specification.

    5) The monitoring data port in the controller shall be setup for DH485 protocol with the port network identification number programmed for the particular elevator identification. For instance, identification number 11 applies to elevator 1, 12 to elevator 2, etc.

    6) All faults, statuses and data shall be held by the controller CPU and sent from the CPU when polled by the data concentrator.

16) Provide sufficient non-volatile CPU memory, for non-volatile retention of program memory, system status and operating parameters.

17) Diagnostics

    1) 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 LEDs 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 data concentrator, provided the fault is not a catastrophic hardware failure where the processor is unable to power up.

2) 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.

3) 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:

   a) CPU is in RUN mode

   b) CPU is FAULTED

   c) CPU battery is LOW

   d) I/O points are FORCED and are not under program control COMMUNICATION channels are active.

18) Input/output Modules

1) The Input/output modules shall be compatible with the PLC processor I/O structure. Each module shall be provided with a detachable terminal strip to connect wiring to the module. Each wire on the terminals shall be identified by the module terminal.

2) Discrete Input Modules: Suitable for the input voltage and compatible with the Allen Bradley system.

3) Discrete Output Modules: Suitable for the voltage and load and compatible with the Allen Bradley system.

4) Analog Input Modules: Converts analog signals to proportional twelve-bit binary values. The module shall accept 4 to 20 mA signals. Provide modules compatible with the Allen-Bradley system.

19) I/O Chassis and Power Supply

1) The controller chassis shall have an additional three spare modules

2) Power supplies shall provide power to the PLC processors, I/O and other function modules. The power supply shall be suitable for operation of 120V AC, single phase power. Power supply capacity shall be a minimum of 150% of the connected load.

20) Air Conditioning

1) Provide an independent air conditioning unit for each controller to maintain manufacturers' recommended operating temperatures. Condensate from the air conditioning unit must be piped to a suitable drain.

21) Selective Collective Operating: As defined by ASME A17.1 and shall be the pressure upon one or more car buttons to correspond to 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) Momentary pressure on car button or landing button illuminates that button, which remains illuminated until call is answered. Illuminated buttons serve as visual indication that call has been registered and that car will stop at that landing.

2) 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.

3) UP landing calls answered while car is traveling in up direction and DOWN landing calls answered while car is traveling down, car reversing after uppermost or lowermost car or landing call has been answered and proceed to answer car calls and landing calls registered in opposite direction of travel.

4) Should both an up and a down call be registered at an intermediate landing, only the call responding to the direction in which the car is traveling shall be canceled upon the stopping of the car at the landing.

22) Supervisory Control: A processor based system to coordinate dispatching assignments, interfacing operational demand data accumulated from car and corridor operating fixtures and other special feature commands issuing from computer processing, selector and door control functions. Incorporate in the system specific operational features as herein described.

1) Allocate service to demand, make decisions to prevent crowding, save energy, and provide efficient coverage throughout the building. Respond in real time to prevailing traffic conditions as well at historical traffic patterns.

2) Constantly compare passenger demand, car load, anticipated demand, car motion status, machine status and other prevailing conditions and evaluate this information in the context of the following dispatching approaches:

a) Give priority to contiguous calls, assigning calls on adjacent floor to the same car if other criteria are satisfied.

b) Give priority to coincident calls, having the same car let a riding passenger off and a waiting passenger on at the same floor.

c) Anticipate demand based on hall calls and car calls already registered and floors with a high possibility of demand.

d) Evaluate relative system response time for each car in the group, weighing all of the above factors.

e) Allocate calls and position cars to minimize waiting time, response time and travel time. The other elevator shall respond for hall calls without any delay after the first elevator leaved the door zone.

f) When there is a hall call registered and an elevator left the landing, the other elevator shall run toward opposite landing.

3) Provide the capability to make both cars to call or call to car assignments.

4) During light traffic conditions, assign cars without demand to specific parking areas until requested for a hall call. Continuously evaluate dispatching assignment and immediately release a car from its assigned area to meet heavy demand elsewhere in the building.

5) In determining relative system response time for a car to answer a hall call, factor in round-trip calculations for each car as well as other system parameters before deciding which car shall respond to a hall call.

23) Other Features:

1) Independent Operation: Provide TWO position keyed switch (Chicago Lock 7500) marked Independent Service, OFF and ON in the lower portion of the car operating panel of all cars. The switch shall be spring loaded type. When placed in ON position, car will be removed from the automatic operating system and will not respond to demands registered at the hall push buttons. It will respond only to floor with doors open until another demand is registered in the car. Demands registered at the landing will remain registered until answered by another elevator. The car only responds to car calls and that the doors remain open after a stop until closed by continuous pressure on the door close button.

2) The controller shall be designed to operate automatically on standby power.

24) Control Room Two Way Communication Device: Provide within each controller/machine room a two way communication device that will interface with any type of ADA compliant telephone. The device shall be mounted directly on or within hands distance proximity to the elevator controller.

25) Any junction boxes installed in the machine room or hoistway shall be accessible for Maintenance.

1) Drilling or opening top end of enclosure is not acceptable.

2) Wire nuts or splicing without terminal strips is prohibited.

3) All openings shall be properly sized for the conduits.

J. Emergency Lowering

1. Provide a separate battery powered unit that senses loss of power and which shall operate as follows:

1) Elevator automatically descends to bottom landing.

2) Doors open automatically when car arrives at bottom landing and remain open until power is restored.

3) Elevator shall remain inoperative until normal power is restored.

2. The system shall differentiate between actual power failure and manual operation of disconnect switch.

3. Failure protection (operational/power) battery shall be a 12V minimum, sealed, lead-acid, or approved alternative. The separate box shall be used for battery and not stored within the main controller.

1) Unit shall be connected to a power source

2) Unit shall automatically maintain the battery at its proper charge.

4. Provide a manual lowering valve to allow the car to return to the lowest landing. The manual lowering shall be easily accessible and reachable.

5. Provide all wiring, sensors and associated connections to the main line power and disconnect.

K. Elevator Hoistway Entrances and Doors

1. Doors of elevators shall be of the horizontal sliding type, single-speed, and center-opening. All elevator door openings shall be a minimum of 42-inches wide per the Americans with Disabilities Act.

2. Entrance frames shall be of welded or bolted construction for complete one-piece unit assembly. All frames shall be securely fastened to fixing angles mounted in the hoistway and

shall be type 316 stainless steel. Provide an additional type 316 stainless steel sill angle support. The landing sills shall be extruded stainless steel with a mill finish.

3. All materials and finished surfaces exposed to public view shall be stainless steel with embossed finish and/or glass panels as indicated on Contract drawings. Glass panels (if provided) to be completely flush with door assembly. In a glass hoistway the struts or any brackets should not be visible to public.
4. Fascia and Dust Cover in the hoistway shall be galvanized or type 316 stainless steel and extend at least the full width of door opening on each side. Toe guard shall be fastened to the sill at the lowest landing.
5. Hoistway doors are to be stainless steel and provided with keyways as required for operating mechanisms and door hangers. Provide glass panels that are completely flush with door, as indicated in A17.1. Each door panel shall have stainless steel bottom guides that run in landing sill slots. Guides shall be replaceable without removing door panels. All doors shall have fixed fire gibs.
6. Interlocks and Contacts:
   1) The doors at each hoistway entrance shall be equipped with approved hoistway door interlocks of the hoistway unit system type tested as required by the Code. 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.
   2) Provide key-operated hoistway door unlocking devices. A device shall conform to the requirements of the Code and shall permit authorized persons to open the hoistway doors from the landing when car is away from landing. The key for emergency use shall be mounted in a receptacle with a breakable transparent cover clearly marked in letter at least 1/8 inch high ELEVATOR DOOR KEY FOR FIRE DEPARTMENT AND EMERGENCY USE ONLY. The location of the receptacle shall be as directed by the Engineer.
7. Provide raised floor/level designations in characters and Braille on each jamb at 60 inches from floor to centerline. Characters shall be two inches high and in accordance with ADA requirements.
   1) Sills shall be stainless steel and shall be supported on and attached to galvanized steel anchors securely fastened to the sill plate support. The sill and its assembly shall be capable of supporting 1260-pound service load for the transfer cart used by WMATA. Grooves for the door guides shall be machined with minimum clearance for the guides. The Contractor shall provide sill plates. Sill plates and all other sill support structure including shims and jack bolts shall be hot-dipped galvanized.
   2) Struts and closer angles shall be hot-dipped galvanized structural steel angles of sufficient size to accommodate and support the hoistway door header plate. Angles shall be continuous and securely bolted to the sills and building beams or structure above.
8. Hanger supports shall be 1/8-inch minimum thickness formed sections securely bolted to the strut angles.
9. Fascia Plates: Galvanized Steel cladding reinforced to ensure a flat, even surface throughout, and shall be securely fastened to hanger supports and sills above.
10. Dust Covers: galvanized or stainless steel cladding which shall extend over the hanger support the width of the jamb opening plus the jamb flanges, at the top landing for which fascia plates are not supplied.

11. Hanger cover plate sections above the door openings shall be arranged for opening or removal from within the car.
12. Sill guards: Sill guards (galvanized steel cladding) shall be supplied for the lowest landing. On glass hoistway, they shall extend the full width of the hoistway and to bottom of pit.
13. Door hangers and tracks shall be provided for each hoistway, sliding door sheave type, two-point suspension hangers and tracks, complete. Sheaves shall not be less than 2-1/4 inch diameter with ball bearings properly sealed to retain grease lubrication and shall be mounted on stands arranged for attaching to the doors by two cap screws. Hangers shall be equipped with adjustable ball bearing rollers to take the up-thrust of the doors.
14. The tracks shall be high-carbon steel or formed steel with nylon inserts, shaped to permit free movement of the sheaves.
15. All inside surfaces of doors shall have baked-enamel finish as shown on the finish schedule.

L. Elevator Components

1. The elevator car and car components shall conform to the requirements of the Code, and shall operate without squeaks or metallic sounds.
2. Entire car assembly, including car frame and platform, shall be free from warps, buckles, and squeaks and rattles. Joints shall be lightproof.
3. Frame and Platform
   1) The car frame shall be constructed of structural steel members. The platform shall consist of a steel frame with necessary steel stringers all welded together. The frame and platform shall be braced and reinforced to prevent the transmission of strain to the elevator car. Steel framing shall conform to the requirements of ASTM A500, Grade B, modified to minimum yield strength if required. The variation in straightness of individual members and the frame as a whole shall not exceed 1/8 inch. Secondary straightening may be performed if necessary. The car enclosure shall be securely fastened to the car platform and so supported that it cannot loosen or become displaced during ordinary service, on the application of the car safety or on buffer engagement.
   2) Platform shall be provided with a steel floor designed for specified loading and sealed watertight. The platform shall be isolated from the cylinder by suitable rubber pads or other equally effective platen isolation.
   3) All structural steel in the frame and platform shall be hot-dipped galvanized.
4. Car enclosure walls shall be structural steel tubing with stainless steel cladding, in-filled with aluminum framed laminated fully tempered safety glass. Stainless steel cladding shall be #4 satin finishes.
5. Railings and Handrails: Car handrails shall be 1/2 inch by 6 inch stainless steel #4 satin finished tubes suitably mounted.
6. Car threshold shall be stainless steel with a non-slip surface.
7. Toe Guard Aprons:
   1) The toe guard apron (cladding) at entrance side of elevator cab shall be not less than 16 U.S. Standard Gauge (USSG) galvanized steel or stainless steel, and shall extend at least three inches beyond entrance jambs at each side. Toe guard shall have a straight vertical face, extending below the level of finished car floor, of not less than the depth of leveling zone plus three inches. The bottom of guard shall extend three inches below vertical face and be beveled at a 15-degree angle from the vertical. The toe guard shall be secured to car platform

construction and be reinforced and braced to withstand a constant force of 150 pounds on its face without permanent deformation or deflection exceeding 1/4 inch.

2) On glass elevators, the toe guard shall extend full width of cab.

8. Suspended Ceiling:

1) The suspended ceiling shall be faced and edged with solid stainless steel panels, 0.075-inch thick with a fully adhered ¾-inch thick core of noncombustible, sound-absorbent material and backed with galvanized sheet steel. ASTM A653M, G90 coating or better.

2) Mounting brackets and any necessary holes for the CCTV camera shall be provided on the top of the ceiling, as further specified. Coordinate bracket configuration and location with the CCTV subcontractor.

3) Mounting brackets and any necessary holes for the smoke and fire detection sensors shall be provided on the top of the ceiling, as further specified. Coordinate bracket configuration and location with the fire and intrusion system subcontractor

9. Glass shall be laminated fully tempered safety glass conforming to ANSI Z97.1 and the requirements of Specification Section (08 81 00).

1) Glass shall be laminated. Heat-strengthened, safety glass conforming to requirements of ASTM C1048 and ANSI Standard Z97.I and shall consist of two pieces of ¼ inch thick glass and a 0.060 inch thick polyvinyl butyryl interlayer, laminated together.

2) Color: Tint by Globe-Amerada Co., used as a standard of quality, or comparable and approved equal.

3) Weatherproof tape for field installation of final edge seating shall be compatible with the interlayer.

10. Dry Pressure Glazing Materials:

1) The setting blocks, edge blocks, and face gaskets shall be ozone-resistant, virgin neoprene.

2) Setting blocks for installation at each quarter point of the sill shall be 90 durometer, shore hardness, approximately full channel width, four inches long, and high enough to afford correct cover and 3/8-inch edge clearance for the glass.

3) Edge blocks, for vertical installation at the bottom of each joint channel, shall be 50 durometer, shore hardness approximately full channel width, three inches long, and provide 3/8-inch edge clearance for the glass.

4) Face gaskets shall be continuous, 50 durometer hardness, and provide 3/16-inch face clearance both inside and outside.

11. Sub floor material to be nominal ¼” stainless steel to prevent water infiltration between finished floor, cab and platform base.

12. Floor covering: Poured Acrylic Epoxy, polymer system or approved equal, color selection and samples to be submitted to the Authority for approval by the Engineer, with slip-resistant surface, ¼ inch thickness, covering elevator car floor area. Flooring shall be non-shrinking, manufactured of prime quality compound, free of calendaring and curing defects, resistant to grease, oil, chemicals, aging, and ozone. Flooring shall be poured incorporating a full membrane system for the entire cab floor width and depth.

13. Emergency exit: Car shall have a top emergency exit conforming to the requirement of the ASME Code, and the applicable jurisdictional requirements. The door shall open toward the top of elevator and shall have a latching mechanism to keep it in place.

14. Ventilation: A 350-cfm two-speed exhaust fan for continuous car ventilation shall be provided and located above the car ceiling or outside the enclosure.
    1) Ventilating fans shall be securely mounted in place.
    2) Ventilation openings shall comply with the ASME and local codes, and shall be suitably sized and distributed to provide uniform airflow within the car.
    3) Connect continuous ventilation fan to emergency power system. Provide battery backup for fan operation of at least 1 hour in the event of power loss.
    4) The exhaust fan shall be controlled from the car operating panel with EPCO-1 (similar to existing WMATA Elevators keys).
15. Cab air conditioning (if applicable), in addition to the exhaust fan, shall be installed as specified in the contract and shall be a self-contained, packaged design for easy mounting, maintenance, and replacement.
    1) Packaged air conditioners shall be installed on the top of the elevator car.
        1) If not installed in original scope, space provisions shall be made for future installation of packaged air conditioning units.
        2) Installation area shall be coordinated with electrical, structural, and other trades to ensure no interferences with current or future installation.
        3) Electrical power of the proper voltage and capacity shall be available for the air conditioning unit installation current or future.
16. Lighting Fixtures and Plug Receptacles:
    1) Car lighting shall provide a minimum of 15-foot candles measured at any point on the cab floor and shall of the LED type. 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.
    2) Exterior car lighting shall be as specified. On glass-enclosed elevators they shall be concealed under access panels flush with cab top or bottom surfaces, respectively. A duplex plug receptacle shall be provided in the pit and on top and bottom of each car. The lighting fixtures and receptacles on exterior of car shall be controlled by a switch adjacent to each fixture.
    3) Provide 115V AC plug receptacle (GFCI) within 12 inches of CCTV camera location. Coordinate the installation of CCTV equipment within the design of the elevator cab as the elevator contractor is responsible for the installation of the camera and wiring to the control room.
17. Car Doors and Door Equipment:
    1) Car doors and door frames shall be suitably reinforced and provided with a laminated stainless steel #4 finish on cab side and baked enamel finish on hoistway side. Doors shall protect the full width and height of car entrance opening when in the fully closed position. Car door frame shall be integral with front wall of cab.
    2) Hanger cover plate sections above the door opening shall be removable from the hoistway. Doors shall be guided at the bottom by composition gibs engaging threshold grooves with minimum clearance.
    3) 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.

4) Door operation automatic at each landing with door opening being initiated as car arrives at landing and closing taking place after expiration of specified time interval, with electric contact to prevent starting elevator away from landing unless car door is in its fully closed position.

    1) Time door closing to start 5 seconds minimum from notification that car is answering landing call.

    2) Time doors to remain open five seconds minimum.

    3) Time shall be adjustable to 20 seconds.

    4) The interval of time that the doors remain open at intermediate landings shall be less for a stop made in response to a landing call. Door open time at a dispatching terminal shall be longer than the time for a stop in response to an intermediate landing call.

    5) All door timers shall be adjustable from the controller display panel.

18. Capacity Plate:

1) The car capacity plate shall be of plain stainless steel and, in addition to data required by the ASME Code, but shall not bear the name of elevator manufacturer.

19. Door Operator Equipment:

1) Provide a water resistant heavy-duty GAL MOVFR- or ELES Engineering approved equal door operator with encoder less 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) Designed for interior and exterior applications.

2) Provide a non-contact door reversal device with light immunity: The Door Reopening Device shall cause both the car and hoistway doors to reverse, should they detect an obstruction in the elevator entrance. The device electrical wiring shall be supplied with quick disconnects terminals to facilitate replacement. The infrared curtain detector shall include the following:

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

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

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

M. Normal and final terminal stopping devices shall be provided for elevator conforming to the ASME Code requirements.

1. Final terminal stopping devices, located in hoistway or on the car and operated by cams, shall be fitted with rollers having a rubber or other approved composition tread to provide silent operation when actuated by the cam.
2. Normal terminal stopping device may be mounted in hoistway, on top of the car, or in the machine room.

N. Signal Devices and Fixtures:

1. Car Operating Station:

1) Provide one (1) main station in the front and one (1) auxiliary station. The COP shall be a vertical type.

2) 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.

3) 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.

4) Car Operation Station shall have a locked service cabinet for keyed switches of the car light; exhaust fan, independent operation, GFI duplex outlet as indicated on the Contract drawings. The service cabinet key shall be EPCO-1 security switch.

5) Provide Emergency Communication: “Hands-free” ADA compliant telephone/intercom.

6) Hall Station: Riser of hall stations of the push-button, call acknowledging, stainless steel, tamper resistant type shall be mounted at all elevator landings. Highest landing shall have a single DOWN button. Lowest landing shall have a single UP button. Incorporate ADA compliant telephone with each hall station. Braille Indicator Plate shall be provided. Faceplate finish shall be Type 316L stainless steel #4 finish. The Hall Station shall be flush to the surface and shall not be projected out.

7) Hall Lanterns:

1) Tamper resistant hall lanterns shall be equipped with illuminated (LED type) 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.

8) Bell Alarm System: Bell alarm system for each elevator shall be properly located within building and audible outside hoistway when activated by the EMERGENCY ALARM call button on each car control building/station. When emergency stop switch is activated inside fire service box, the bell alarm system should not be activated.

9) Firefighters' Service System: Firefighters' service system shall be provided in compliance with code requirements.

O. Drip pans constructed of 26 USSG galvanized sheet steel shall be provided below all bearings to catch lubricant drippings, except for bearings that are fitted with effective approved grease seals.

P. Metal parts visible to the public shall be field painted.

Q. A metal cabinet of suitable size shall be provided in each machine room for the storage of special tools and necessary spare parts. The cabinet shall be mounted on legs or a pedestal, a minimum of 4 inches off the floor. A Mobile Tool Storage Cabinet with wheels is not allowed.

R. A complete set of special tools or wrenches that are designed specifically for tasks associated with elevator inspection, maintenance and repair shall be provided with a case or suitably mounted in the storage cabinet.

S. At the expiration of the warranty requirements, the Contractor shall provide a spare parts and service facility in the United States at no additional cost to the Authority from which all manufactured parts and components of the equipment furnished and installed can be obtained for an additional three years.

T. Kiosk Surveillance Control And Communication:

1. Surveillance Camera Provisions (Surface Elevators). All requirements for CCTV shall comply with the WMATA SMNT Department.

1) Space provisions and mounting holes shall be provided for closed-circuit television (CCTV) cameras to be furnished and install by CCTV subcontractor.

1) The Contractor shall coordinate with the CCTV subcontractor and install wiring from the CCTV location within the elevator cab to an interface terminal and video transmitter located on the elevator car. Final equipment selection has not been performed and is subject to change. Coordinate model, configuration, and location with the CCTV subcontractor.

a) Power will be required by the video transmitter and CCTV camera and shall be provided.

b) Equipment: Fiber Optic Video Transmitters (Elevator Cameras)

2) The Contractor shall work with the CCTV subcontractor to install CCTV subcontractor-provided fiber-optic cable and transmitter to a terminal location specified by the CCTV subcontractor. The Contractor shall tag the cables appropriately, indicating that they are for future use by others.

2. Supply the following status indication, control, and communication functions for each elevator car and landing at an annunciator panel in the kiosk: indication, control, and communication functions in each elevator and landing; and all interconnecting wiring required to provide a complete and operable system. Systems to be provided and installed include the following:

1) Kiosk annunciator panel: Panel shall be a single panel approximately 7-½ by 19 inches. Coordinate design to ensure that the panel is compatible with the mounting provisions, previous designs, and human factors. The panels shall contain:

1) Indicators:

a) Visual display of elevator car status, to include landing stopped at or being approached and direction of travel:

i. Designate elevator by functional name, e.g., Garage 1.

ii. For garage elevators designate landing by garage floor level.

b) Out of service because of malfunction.

c) In-Car stop switch is actuated.

d) Continuous audible alarm activated when emergency alarm switch in car is initiated.

e) Indicator lamps shall be LEDs, with life expectancy of 50,000 average rated hours.

2) Controls:

a) Out of service.

b) Override control.

c) Door open.

d) Landing selection.

e) Push button switches shall have limited over-travel to prevent damage due to abuse and shall be equipped with lift-up covers to avoid inadvertent operation, have mechanical and electrical life of 25,000 cycles, with integral or isolated illumination circuit and be normally open with momentary action or alternate action circuitry.

f) When the override control switch is OFF, the kiosk controls shall function in parallel with the car and landing controls, i.e., the selective/collective control system shall respond to a kiosk-initiated landing selection with the normal priority afforded the remaining system landing selection and call buttons.

g) When the override control switch is ON, the following actions shall take place:

i. If the car is stationary at a landing, it shall remain at the landing and the doors, if open, shall close and remain closed.

ii. If the car is in motion, it shall stop at the first landing reached and the doors shall remain closed.

iii. The elevator control system shall then respond only to the kiosk controls and car station.

iv. The car shall park at the designate landing.

h) When the OUT OF SERVICE switch is actuated, the elevator shall return to the lowest landing before shutting off.

2) Elevator fire detection sensor: Provide space and mounting holes for smoke and fire detection sensors to be furnished and installed as required by building, electrical, elevator and local codes. Install wiring from the sensor location in the car to interface terminal cabinet in the machine room, for connection from the sensors to the smoke and fire detection system. Coordinate with installers to allow installation of sensors and operational checkout of the system.

3) Passenger - Kiosk communications (VIOP) system:

1) Communications signal button in elevator car momentary contact to illuminate back-lighted signal button in car and latch on a continuous audible signal and illuminated indicator in the kiosk.

2) Communications buttons at landings, momentary contact, to illuminate back lighted signal button at the landing and latch on a continuous audible signal and illuminated indicator in the kiosk.

3) Push button in kiosk to activate intercom system and reset indicator lamps and audible alarm.

4) Each passenger operated device shall have identification markings as specified for car operating devices.

5) The voice communication intercom system shall function as a master remote network. The master station shall be located in the kiosk annunciator panel and shall include a speaker-microphone, audio amplifier, on-off indicator lamp, audible signal device control and push button lamp for the operations. A remote station shall include a speaker-microphone and a communications signal button shall light the signal button and cause a continuous audible signal at the master station and light indicator lamp corresponding to the calling remote station. Communications between master and remote station shall be established upon the actuation of the master station push-button control corresponding to the calling remote station with the master station push to talk control determining the direction of transmission.

6) If successive calls are received from other remote stations while communication is in progress with one remote station, the audible signal shall sound the indicator lamps corresponding to the calling remote stations shall light and both shall remain on the indicate waiting calls.

7) Means shall be provided to clear the indicating lamps independently. Communication initiated from the master station shall be established upon actuation of the push button control corresponding to the called remote station, with the master station push-to-talk control determining the direction of transmission.

8) The audio amplifier at the master station shall be all solid state in construction and shall control incoming and outgoing volumes for all of the remote stations. The volume levels shall be preset during installation and shall be adjustable to provide a maximum of five watts rms at the speaker-microphones.

9) The power supply shall supply all AC and DC voltages necessary for all circuitry associated with the voice communications intercom system, and shall operate from the 120V AC, 60 Hz emergency power supply located in the elevator machine room.

10) The audio amplifier and the speaker-microphones shall have a frequency response of plus or minus three Db from 300 Hz to 5,000 Hz. Power consumption shall be 5 watts maximum in standby and 50 watts maximum under load.

11) The Contractor shall be responsible for shielding, grounding and other measures necessary to protect the voice communications intercom system from interference from other electrical systems.

12) Speaker grilles shall have a minimum of 35 percent open area over the entire surface of the speaker cone.

13) Switches and relays used with this system shall have an operating life exceeding 5,000,000 cycles. Documentation shall be provided by the Contractor to the Engineer, for his approval, to substantiate this life cycle level.

14) The system shall perform adequately, as approved by the Engineer, with both the remote and the master station test personnel speaking from three feet away from the speaker-microphones.

15) Communication in the car shall also rollover to a 24-hour manned site (Rail Operations Control Center) in the event that the kiosk does not respond to the call.

16) Each passenger-operated device shall be identified in accordance with ADA/ADAAG requirements.

a) ADA requirement for providing emergency two-way communications between an elevator and a point outside the hoistway (the Kiosk).

b) Device mounting heights shall comply with:

i. ADAAG requirements.

ii. ASME A17.1 - The highest operable part of the two-way communication system shall be a maximum of 48 inches from the floor.

c) A Braille Instruction Plate shall be permanently affixed on each remote intercom unit.

i. ADA Standards: Raised symbol and lettering (Signage) located adjacent to the device.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to beginning installation of elevator equipment, examine the following and verify that no irregularities exist that would affect quality or execution of work as specified.

1. Hoistway size and plumbness.
2. Sill pockets.
3. Anchor brackets
4. Sill supports.
5. Spreader/Divided beams.
6. Machine beams and any other supplied by others.
7. Pit Depth
8. Overhead clearance

B. Do not proceed with installation until previous work conforms to project requirements.

3.02 PREPARATION

C. Elevator Protection

1. The finished elevator installations shall be completely barricaded and enclosed to preclude their use without permission of the Contractor until Final Acceptance and release by the Contractor for general use. The enclosure shall be fabricated to allow easy access for maintenance, testing and adjustment.

2. The Contractor shall be responsible for the security of the contents of each machine room. The Contractor shall control access to that room, and ensure that it shall remain secure at all times until the completion of the Contractor's interim maintenance obligation.
3. Protection: During installation and until all elevator systems are fully operational and accepted by WMATA, make all necessary provisions to protect all elevator components from damage, deterioration, and adverse environmental conditions. Do not use or allow the use of the elevator for construction purposes such as hauling materials or worker transport during construction.
4. Security of Machine Rooms: The Contractor shall be responsible for the security of the contents of each machine room. The Contractor shall control access to that room and ensure it shall remain locked and secure at all times.
5. Field Painting:
    1) The pit, pit walls and machine room floor shall be painted. All machine room equipment shall be given two coats of approved machinery paint. All new iron work shall be given one coat of rust- inhibiting paint.
    2) Metal parts visible to the public may be field painted where specifically shown or authorized by the Authority.

3.03 INSTALLATION

A. Electrical Installation

1. The Contractor shall install all raceways and wiring necessary for the proper connection and operation of all equipment. The installation shall comply with the applicable requirements of the NEC and local codes.
2. Raceway:
    1) Rigid conduit connecting the various items of elevator equipment and electrical boxes in the machine room and hoistway shall be run parallel to the ceilings and walls. Metal wireway and auxiliary gutters in the machine room shall run exposed in readily accessible locations and shall not protrude into the working space around equipment.
    2) Liquid-tight flexible conduit shall be used for connections to motor, limit switch, interlock push-button box, door operator motor and similar devices. A length of liquid-tight flexible conduit 18 to 24 inches long shall be used for connection to the elevator drive motor.
    3) Raceway terminal fittings shall be free from burrs, shoulders, or other projections that will reduce internal passage area or cause abrasion of conductors.
    4) Electrical boxes shall be installed in accordance with the requirements of NEC paragraph 370.
3. Wiring:
    1) All wiring shall be run in conduit, metal wireway, or auxiliary gutter, with the following exceptions:
        1) Flexible hard-service cord, type SO, used between fixed car wiring and switches on car doors.
        2) The traveling cable connection to the elevator car.
    2) Wire and cable shall be sized for their respective duty so that the maximum current carried shall not exceed limits prescribed by the NEC and local codes. The minimum sizes of

conductor shall be 12 AWG for lighting and receptacle circuits and 16 AWG for operating, control and signal circuits, except for traveling cable, where 14 AWG shall be the minimum size for elevator lighting circuit conductors.

3) In glass hoistway, wiring shall be installed only in the locations shown with the requirement that wiring and conduit be hidden from public view.

4) The traveling cable shall run from a junction box on the bottom of car to a junction box approximately midway in the hoistway. The cable shall be anchored and suspended to minimize any strain on individual cable conductors. The cable shall be free from contact with the hoistway construction, car, or other equipment. The overall covering of cable shall remain intact between junction boxes. The Contractor shall ensure that the cable shall not bend to a radius less than 12 times the outer diameter at any position of elevator travel.

5) Traveling cable shall be suspended by the wire rope center or self-gripping devices where cable weight will not cause excessive crushing forces.

4. Splices and terminations of conductors shall be made only in outlet, junction. Splices in conduit or raceways will not be permitted. Splices and terminal connections shall be made only by means of solderless connectors and terminal lugs as specified. Splices shall be covered with electrical insulating tape to an insulation level equivalent to that of the conductors. Terminal lugs used for bonding connections to metallic structures shall be installed on bare/uncoated metallic surfaces to assure minimum contact resistance.

5. Grounding:

1) The Contractor shall be responsible for grounding and bonding all parts of the elevator metallic structure, equipment and raceway in accordance with the applicable requirements of the NEC and the codes and regulations of the jurisdictional authorities. An equipment grounding conductor will be furnished and installed by other trades in each feeder to the elevator machine room and terminated in a disconnect device or junction box.

2) The Contractor shall provide equipment grounding conductors from the disconnect devices or junction boxes for all feeders and branch circuits as shown and required. Electrical equipment shall be provided with a minimum of two ground paths. One path shall be a green insulated equipment grounding conductor. The second path shall be a connection to grounded metallic structure using metallic fasteners, metallic conduit and/or bonding jumper. In elevator car, bond exposed metallic structures, ac equipment enclosures and lighting fixtures to grounded elevator metallic structure with metallic fasteners as shown.

6. Each device, each terminal, and each wire on the controller panels shall be properly identified by name, letter, or standard symbol in an approved indelible manner, on the device, panel, or wire. The identification markings shall be identical to markings used on the wiring diagrams.

B. Machine Room Equipment:

1. Machine room shall be 224 sq. ft. minimum.

2. Machine Room Emergency Lighting: Maintained Emergency lighting fittings shall be provided in each elevator machine room.

1) There shall be a minimum of one maintained lighting fixture.

3. Clearance around equipment in each machine room shall comply with provisions of all applicable codes. Clear distance for the maintenance purposes shall be at least 18”. In no case shall this clearance supersede minimum Code requirements.

4. Equipment in elevator machine room shall be so arranged that replaceable items can be removed for repair or replacement either by overhead hoist and dolly, or other conventional

means, without dismantling or removing other equipment components in the same machine room.

5. Machine rooms must be air conditioned and heated to maintain an ambient temperature of 50^0 F to 80^0 F degrees and a relative humidity between 35% and 50%. The Air Conditioner shall be Split System. The heating system for the machine room is also a built in system. A forced removal should be done by moving the air from the room to the outside of the building to another part of the building to keep an air exchange through the equipment room. Intake and exhaust vent should not be located close to each other.
6. Any component attached to the controller shall have a minimum clearance of 18 inches from the side(s) of the component requiring access for maintenance and free air circulation.
7. One set of approved electrical and hydraulic diagrams of elevator shall be mounted in an aluminum channel frame with Lucite cover and waterproof fiberglass backing and installed adjacent to the appropriate drive machine.
8. Provide Mats of insulating rubber or other suitable floor insulation in the front of the Controllers.
   1) The Resistance range shall be 1x104<1x106 and shall meet ANSI/ESD requirements.
   2) The rubber mat shall be the width of the controller plus 12".
   3) The length of rubber mat shall be a minimum of 24".
   4) The rubber mat shall be a ¼" thickness and beveled at each end.

C. Hydraulic Elevator Cylinder

1. The Contractor shall set the hydraulic elevator cylinders true and plumb
   1) Dielectric Insulation Installation
      1) Each cylinder shall be electrically isolated from the building steel and other earth ground sources
      2) The following are minimum requirements:
         a) Install an insulating gasket between the platen plate and floor of the elevator cab. Use insulating sleeves and washers on the bolts.
         b) Use insulating pads to insulate the cylinder support members (channels) from the guide rails and other structures at ground potential.
         c) Use insulating sleeves and washers on the bolts that connect the cylinder to the support channels.
         d) Install an insulating coupling on the oil supply line between the pump and cylinder, located as close to the cylinder as possible.
2. Insulating gaskets shall be installed in the same manner as a normal gasket.
   1) Sleeves shall not be forced through misaligned bolt holes. Where misalignment occurs, the holes shall be reamed true, and all metal, chips shall be carefully removed.
   2) The sleeves shall extend into the plastic washer on both sides of the flange. Any sleeves or washer cracked during installation shall be replaced immediately.
   3) After making up the flange, the resistance of each bolt to the flange shall be tested using a 500V megohm meter. If the resistance of any bolt is less than 50 megohms, the sleeve and washer shall be checked and changed, if necessary, to provide the required resistance.

3.04 MAINTENANCE SERVICE

A. The Contractor shall perform full maintenance service for a period of two years on each elevator in accordance with the manufacturer's maintenance manual and WMATA ELES maintenance program prior to WMATA providing permanent maintenance. The period of maintenance shall begin after test(s) and Provisional Acceptance of each elevator and shall extend to the scheduled date of Final Acceptance for all units in the same facility plus a period of two years. In no case shall the interval between inspections and testing be greater than one month. The maintenance service during the warranty period shall be provided by fully trained elevator mechanics. The maintenance tasks shall include, but not be limited to, the following:

1. Inspection of completed installation and periodic testing to maintain the elevators in completely operable condition.
2. Contractor shall provide support for periodic, accident and incident, and PM compliance inspections.
3. Lubrication of parts, and the protection of the equipment.
4. Replacement of defective parts at no additional cost to the Authority.
5. Annual clean down of the elevator and hoistway enclosure is required. Make necessary arrangements with Authority in order to minimize any inconvenience.
6. Contractors performing maintenance are responsible for all service, repair work and emergency call. The contractors shall provide unlimited service during revenue hours and twenty-four (24) hour emergency call back service at no additional cost.
   1) Provide twenty (24) hour emergency service during the maintenance period consisting of a prompt response (within 1 hour) to emergency request by telephone or otherwise from Authority or designated representative if an elevator is inoperable or in case of injury, entrapment, or potential injury to persons.
   2) Unlimited service callbacks are included with a required response time of one (1) hour (including Holidays). .
7. Periodic maintenance (based on WMATA schedule) shall be performed off peak hours to minimize service interruption as long as the other elevator serving the same platform is operational.
8. Reporting: Detailed monthly records of tasks performed including names of individuals performing the tasks, date and time performed, and other pertinent data. In addition, the reports are to be provided in an electronic format acceptable to WMATA's needs.
9. Contractor performed maintenance shall follow the WMATA Office of Elevator and Escalator Operations procedures, schedules and check charts.

B. Within three (3) months prior to the termination of this contract, the Authority or his designated representative(s) shall make a thorough maintenance inspection of all equipment covered under this contract. The contractor shall provide personnel to remove, test, and operate equipment as necessary. All deficiencies found as a result of this inspection shall be corrected by the Contractor as required in this agreement with no additional cost for the Authority.

3.05 REMOTE MONITORING SPECIFICATIONS

A. Allen Bradley DF1 or ELES Engineering approved equal industry standard Modbus protocol shall be provided to transmit data from the Elevator/Escalator controller to the Authority's AEMS RTU computer control and data system. The Design-Builder shall provide a controller data interface to a DH-485

network located in the Elevator /Escalator machine room. The DH-485 controller interface shall be programmable for data rates up to 115Kbps. The interface shall allow other nodes such as other Elevator or Escalators to be readily incorporated into the DH-485 network. The controller data interface shall include one Allen Bradley SLC PLC per station to function as a data concentrator to consolidate data from all the controllers in the station. The software for the data concentrator shall be as specified by the Authority. The data concentrator shall receive controller data over the DH-485 data network and provide formatted data to the AEMS RTU through a RS 232 link. This data transmission may be accomplished by a separate PLC controller integrated into the control system.

B. The Elevator /Escalator control system shall automatically initiate the transmittal of data when data is requested by the Authority's AEMS system and continue until all data is received by the AEMS RTU in the station AC switchboard room. The Authority will perform final integration of the data in the AEMS system.

C. The Contractor shall also provide the required hardware to download data from any fault finding annunciator panel to a supplied laptop PC being utilized at the Elevator/Escalator location. The provided software shall permit the downloading and storage of data on the supplied laptop PC from multiple fault finding annunciator panels.

D. The Contractor shall install an Allen Bradley network interface module, (model 1761-NET-AIC or approved alternative) beside the PLC in the controller and provide 24 VDC power to the module. The Allen Bradley PLC will be used for remote monitoring capabilities into WMATA established engineering monitoring network.

1. The Contractor shall provide all wiring and programming of the PLC to communicate with station data concentrators on the DH-485 network. Coordinate work with WMATA ELES Engineering.
2. The Contractor shall pull all remote monitoring cables to the interface in the elevator controller from the remote monitoring network going back to WMATA's Automated Energy Management System (AEMS) remote terminal unit (RTU).
3. Provide Ethernet communication between the elevator machine room and WMATA's communication room. The communication port shall be located less than 6' from the controller and shall have minimum of two ports for data communication.

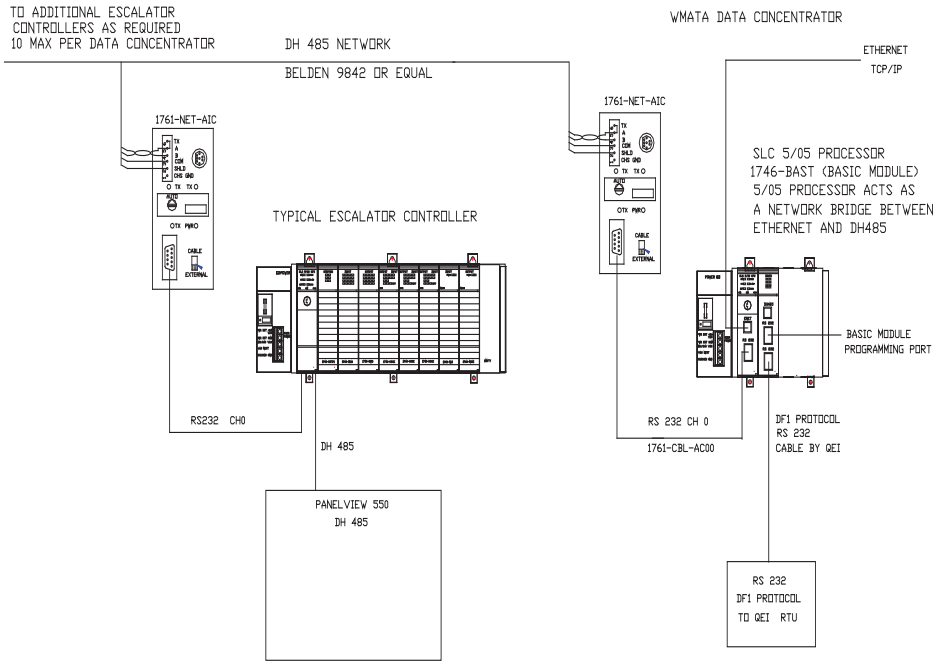
E. Terms and Definitions

1. Boolean - A single bit data type.
2. DF1 - A Rockwell Automation Company proprietary communications protocol.
3. DH485 - An industrial communications network used by Allen Bradley programmable controllers.
4. Integer - A data type 16 bit signed (range -32768 to 32767).
5. PLC - Programmable Logic Controller.
6. QEI - QEI Inc. Springfield NJ
7. RTU - Remote Terminal Unit

F. Elevator Remote Monitoring Data Specification

1. Overview

1) The design of the WMATA escalator & elevator monitoring system shall include a data concentrator PLC to gather data from the elevator control PLC's over an Allen Bradley DH 485 network or ELES Engineering approved equal. The QEI RTU shall read data from the WMATA data concentrator PLC via an RS 232 serial connection to a 1746-BAST (or ELES Engineering approved equal) module using Allen Bradley DF1 (or ELES Engineering approved equal) protocol. See figure 1.1 for reference. This specification defines data to be presented by the WMATA data concentrator PLC to the QEI RTU. The WMATA data concentrator PLC station shall pole the escalator & elevator controller(s) periodically for data and format the data into blocks within the WMATA data concentrator. An Ethernet TCP/IP connection is available at the Data concentrator PLC. The data concentrator PLC has been designed to collect data from up to (10) escalators and/or elevators. The data concentrator PLC is to be mounted into the existing QEI RTU enclosures and powered by a 120 V AC source from within the RTU. For Metro stations where more than (10) escalators and elevators are present additional data concentrator PLC's will be required.



2. Data Concentrator PLC Data File Assignments.

The WMATA data concentrator PLC shall store data for up to (10) escalators and/or elevators in any combination as defined in table 2.1.

Table 1

Escalator DH485 node #	Elevator H485 node #	Status bits File	Analog Data File	DC PLC MSG file#	DC PLC MSG buffer file#
1		N20	N21	N81	N101
2		N22	N23	N82	N102
3		N24	N25	N83	N103
4		N26	N27	N84	N104
5		N28	N29	N85	N105
6		N30	N31	N86	N106
7		N32	N33	N87	N107
8		N34	N35	N88	N108
9		N36	N37	N89	N109
10		N38	N39	N90	N110
	11	N40	N41	N121	N141
	12	N42	N43	N122	N142
	13	N44	N45	N123	N143
	14	N46	N47	N124	N144
	15	N48	N49	N125	N145
	16	N50	N51	N126	N146
17		N52	N53	N127	N147
18		N54	N55	N128	N148
19		N56	N57	N129	N149

20		N58	N59	N130	N150
Concentrator PLC (DC)	25	N80	N79		

Each data file shall begin with word 1 (example: escalator #1 status bits begin with N20:1 and end at N20:20)

The data concentrator PLC communication ports shall be configured as follows:

Channel 1

Driver: Ethernet

IP Address: TBD

Subnet Mask: TBD

Gateway Address: TBD

Channel 2

Driver: DH485

Baud Rate: 19.2K

Node Address: 25

1756-BAST basic module communication ports shall be configured as follows.

Port 1: Programming port

Settings -- 19,200 Baud, No parity, 8 bits, 1 stop bit, No handshaking

Port 2: DF1 port

Settings -- 19,200 Baud, No parity, 8 bits, 1 stop bit, No handshaking

DF1 – Op Code 19 (Full Duplex, NHS, ER, Enable DPD, CRC error checking,

Timeout = 50

Retries = 3

RTS on delay = 20 msec

RTS off delay = 20 msec

Module address = 10

DH485 Port – Not Available

3. Data Format

Data Concentrator status in File N80 per table 3.0

Table 3.0 Data Concentrator Status Bits

WORD	BIT	DATA TYPE	DESCRIPTION	"0" STATE	"1" STATE
1	0	BOOLEAN	Spare		
	1	BOOLEAN	Data Concentrator PLC Battery Status	FAULT	NORMAL
	2	BOOLEAN	Data Concentrator Basic Module Battery Status	FAULT	NORMAL
	3	BOOLEAN			
	4	BOOLEAN			
	5	BOOLEAN			
	6	BOOLEAN			
	7	BOOLEAN			
	8	BOOLEAN			
	9	BOOLEAN			
	10	BOOLEAN			
	11	BOOLEAN			
	12	BOOLEAN			
	13	BOOLEAN			
	14	BOOLEAN			
	15	BOOLEAN			

WORD	BIT	DATA TYPE	DESCRIPTION	"0" STATE	"1" STATE
2		BYTE	Data Concentrator checksum byte1		
3		BYTE	Data Concentrator checksum byte2		

Words 4 through 20 of the Data Concentrator status file (N80) are unused.
The Data Concentrator Analog data file (N79) is unused.

Elevator Data:

Two 20 word (40 BYTE) blocks of data shall be developed for each elevator one block for status bits and one lock for analog data. Table 3.3 defines the format of data for status bit. Table 3.4 defines the format for analog data.

Table 3.3 Elevator Status Bits

WORD	BIT	FAULT TYPE	DESCRIPTION	"0" STATE	"1" STATE
1	0	FAULT	24 VDC POWER SUPPLY	FAULT	NORMAL
	1	FAULT	SAFETY CIRCUIT GOOD	FAULT	NORMAL
	2	FAULT	TOP FINAL LIMIT TRIPPED	FAULT	NORMAL
	3	FAULT	BOTTOM FINAL LIMIT TRIPPED	FAULT	NORMAL
	4	FAULT	DRIVE FAULTED	FAULT	NORMAL
	5	FAULT	OVERLOAD TRIPPED	FAULT	NORMAL
	6	FAULT	STOP BUTTON ACTIVATED	FAULT	NORMAL
	7	STATUS	IN-CAR ALARM BUTTON PRESSED	ALARM	NORMAL
	8	FAULT	OUT OF SERVICE BY DELAY	FAULT	NORMAL
	9	FAULT	MOTOR LIMIT TIMER TRIPPED	FAULT	NORMAL
	10	FAULT	VALVE LIMIT TIMER TRIPPED	FAULT	NORMAL
	11	STATUS	INSPECTION OPERATION ON	ON	OFF
	12	STATUS	INDEDENDANT SERVICE ON	ON	OFF

	13	STATUS	VISCOSITY CONTROL ON	ON	OFF
	14	STATUS	CONTROLLER TEST SWITCH ON	ON	OFF
	15	STATUS	FIRE SERVICE PHASE 1 ON	ON	OFF

WORD	BIT	FAULT TYPE	DESCRIPTION	"0" STATE	"1" STATE
2	0	STATUS	FIRE SERVICE PHASE 2 ON	ON	OFF
	1	FAULT	SMOKE SENSOR @ MAIN ON	ON	OFF
	2	FAULT	SMOKE SENSOR @ OTHERS ON	ON	OFF
	3	STATUS	EMERGENCY POWER OPERATION	ON	OFF
	4	STATUS	OVERRIDE ON	ON	OFF
	5	STATUS	CAR IS RUNNING UP	NOT-RUN	RUNNING
	6	STATUS	CAR IS RUNNING DOWN	NOT-RUN	RUNNING
	7	STATUS	BRAKE LIFTED	LIFTED	NORMAL
	8	STATUS	CAR IS IN DOOR ZONE	)T IN ZONE	IN ZONE
	9	STATUS	INTERLOCKS ARE MADE	OPEN	NORMAL
	10	STATUS	FRONT DOOR GATE SWITCH MADE	OPEN	NORMAL
	11	STATUS	FRONT DOOR FULLY CLOSED	OPEN	CLOSED
	12	STATUS	FRONT DOOR FULLY OPEN	CLOSED	OPEN
	13	STATUS	FRONT DOOR REVERSAL ACTIVATED	OFF	ACTIVE
	14	STATUS	FRONT DOOR PROTECTION ACTIVATED	OFF	ACTIVE
	15	STATUS	REAR DOOR GATE SWITCH MADE	OPEN	NORMAL

WORD	BIT	FAULT TYPE	DESCRIPTION	"0" STATE	"1"STATE
3	0	STATUS	REAR DOOR FULLY CLOSED	OPEN	CLOSED
	1	STATUS	REAR DOOR FULLY OPEN	CLOSED	OPEN

	2	STATUS	REAR DOOR REVERSAL ACTIVATED	OFF	ACTIVE
	3	STATUS	REAR DOOR PROTECTION ACTIVATED	OFF	ACTIVE
	4	FAULT	DOOR REVERSAL DEVICE FAILURE	FAULT	NORMAL
	5	FAULT	ROPE BRAKE SET	FAULT	NORMAL
	6	FAULT	LEVELING SYSTEM FAILURE	FAULT	NORMAL
	7	FAULT	WATER INTRUSION ALARM ACTIVE	FAULT	NORMAL
	8	STATUS	ELEVATOR SLC 5/03 LOW BATTERY	FAULT	NORMAL
	9	STATUS	ELEVATOR SLC 5/03 COMM. ACTIVE	FAULT	NORMAL
	10	STATUS	ELEVATOR SLC 5/03 LOCAL/REMOTE	REMOTE	LOCAL
	11	STATUS	ELEVATOR SLC 5/03 RUN/PROG	PROG	RUN
	12	FAULT	FAULTED	FAULT	NORMAL
	13	STATUS	Out of Service	FAULT	NORMAL
	14		SPARE		
	15		SPARE		

WORD	BIT	FAULT TYPE	DESCRIPTION	“0” STATE	“1”STATE
4	0	STATUS	CAR POSITION 1	NOT AT POSITION	AT POSITION
	1	STATUS	CAR POSITION 2	NOT AT POSITION	AT POSITION
	2	STATUS	CAR POSITION 3	NOT AT POSITION	AT POSITION
	3	STATUS	CAR POSITION 4	NOT AT POSITION	AT POSITION
	4	STATUS	CAR POSITION 5	NOT AT POSITION	AT POSITION
	5	STATUS	CAR POSITION 6	NOT AT POSITION	AT POSITION
	6	STATUS	CAR POSITION 7	NOT AT POSITION	AT POSITION
	7	STATUS	CAR POSITION 8	NOT AT POSITION	AT POSITION
	8				

	9				
	10				
	11				
	12				
	13				
	14				
	15				

Words 5 through 20 are unused.

Table 3.4 Elevator Analog Data

WORD	DATA TYPE	MIN VALUE	MAX VALUE	UNITS	SCALE FACTOR	DESCRIPTION
1	INTEGER			AMPS	X10	DRIVE MOTOR AMPS
2	INTEGER			KWH	X1	PRE DAY KWH
3	INTEGER				X1	PRE DAY UP COUNT
4	INTEGER				X1	PRE DAY DOWN COUNT
5	INTEGER				X1	PRE DAY FRONT DOOR CYCLES
6	INTEGER				X1	FAULT CODE
7	INTEGER				X1	PRE DAY REAR DOOR CYCLES
8	INTEGER					
9	INTEGER					
10	INTEGER					
11	INTEGER					

12	INTEGER					
13	INTEGER					
14	INTEGER					
15	INTEGER					
16	INTEGER					
17	INTEGER					
18	INTEGER					
19	INTEGER					
20	INTEGER					

Note: All analog values are multiplied by 16 in the data concentrator to bit sift left 4 bits to align with QEI's 12 bit analog data types.

A note on communication loss

A 60 second watchdog timer is coded into each escalator file. If communications are lost between the data concentrator and the escalator controller for more than 60 seconds the watchdog timer will timeout. When the timer has timed out the communications loss bit will be reset (0) to indicate the communications loss condition.

Time and Date Sync

The QEI RTU shall provide clock synchronization to the WMATA data concentrator PLC every 5 minutes. Table 4.1 defines the address and data format of the clock registers in the WMATA data concentrator PLC. The data concentrator PLC shall set the escalator controller date and time every day at 3 AM.

\

Table 4.1

FUNCTION	ADDRESS	FORMAT
YEAR	N13:10	4 DIGITS
MONTH	N13:11	2 DIGITS
DAY	N13:12	2 DIGITS
HOUR	N13:13	2 DIGITS 24 HOUR
MINUTE	N13:14	2 DIGITS
SECOND	N13:15	2 DIGITS

Data Concentrator PLC Program

The data concentrator PLC includes code to monitor up to 10 escalators and 5 elevators. Each escalators and elevators has an independent code file and a configuration bit. If an elevator is to be monitored the configuration bit must be set corresponding to the DH485 station address of the elevator controller. If the configuration bit is reset (0), the status and analog data table values for the elevator or escalator will be set to 0.

The configuration bits are as follows:

Escalator Configuration Bit	5 Address of Escalator Controller	Elevator Configuration Bit	85 Address of Elevator Controller
B9:0/1	1	B9:1/1	11
B9:0/2	2	B9:1/2	12

B9:0/3	3	B9:1/3	13
B9:0/4	4	B9:1/4	14
B9:0/5	5	B9:1/5	15
B9:0/6	6	B9:1/6	16
B9:0/7	7	B9:1/7	17
B9:0/8	8	B9:1/8	18
B9:0/9	9	B9:1/9	19
B9:0/10	10	B9:1/10	20

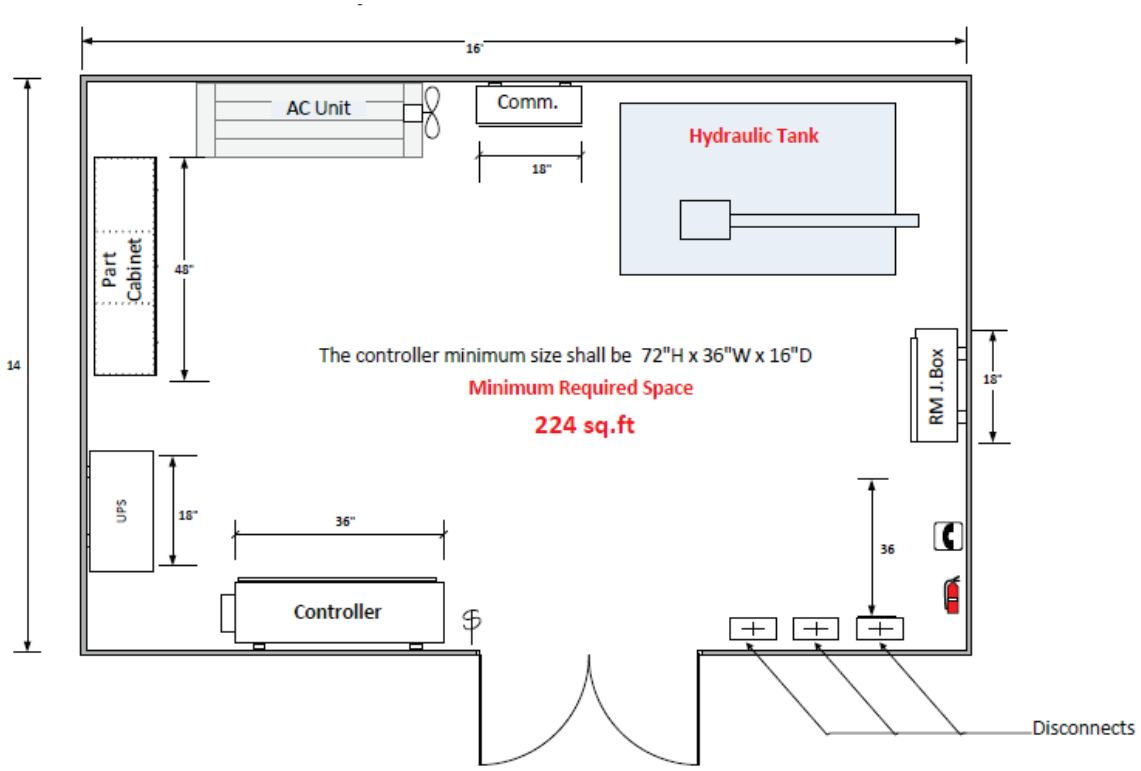
Data Concentrator Gateway IP addresses.

The Data concentrator PLC acts as a gateway between the Ethernet and DH485 networks. The PLC contains a list of IP addresses, known as the routing table which will be allowed access to the DH485 network. The routing table will contain 20 addresses.

Station	IP Address
1	TBD
2	
3	
4	

5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	

3.07 EXIBIT 1. Hydraulic Single Elevator Machine Room



3.07 DEMONSTRATION

A. Acceptance Tests:

1. The Contractor shall submit an operational test plan to the Authority for approval. When each elevator, furnished, installed, and tested, is ready to be placed in interim service, the Contractor, at no additional cost to the Authority, shall perform operational tests described below. The Authority shall be notified at least 48 hours prior to each scheduled test so that arrangements can be made for the presence of appropriate personnel to witness the tests. Acceptance Tests and inspections will be based upon the elevator meeting the requirements of the Specification and as evidenced by the operational test shall be witnessed by WMATA representative.

B. Elevator Tests

1. When the elevator work is fully completed, the Contractor shall demonstrate to the satisfaction of the Authority and Authorities Having Jurisdiction that the proper operation of every part of the equipment complies with all applicable requirements including the ASME Code.

1) The inspection procedure outlined in the ASME A17.2 will form a part of the final inspection.

2) No shop test of elevator motor and no certified test sheets will be required.

3) The heating, insulation and resistance of the motors will be determined under actual conditions after installation.

2. The Elevator Contractor shall furnish all test instruments and materials, required at the time of final inspection, to determine compliance of the work with the Contract requirements. Materials and instruments furnished shall include standard 50-pound test weights, megohmmeter, voltmeter and ammeter, Centigrade calibrated thermometers, spirit level, and stop watch. At the time of final inspection, tests shall include, but not be limited to, the following:

1) After installation, each elevator shall be tested without load by the Contractor. The elevator shall be subjected to a test for a period of eight-hours continuous run. During the test run, the car shall be stopped at top and bottom levels, in both directions of travel with a standing period of 10 seconds at each landing.

2) Full-Load Run Test

    1) The elevator shall be subjected to a test for a period of one-hours continuous run, with full specified rated load in the car. During the test run, the car shall be stopped at top and bottom levels, in both directions of travel with a standing period of 10 seconds at each landing.

3) Speed Test

    1) The actual speed of the elevator car shall be determined in both directions of travel, with full specified rated load and with no load in the elevator car.

    2) Speed tests shall be made before and after the full-load run test.

    3) For hydraulic elevators, speed shall be determined with a temporarily mounted tachometer on the guide rail or stop.

    4) Car speed when ascending shall be not more than 10 percent above not more than 10 percent below the specified car speed.

    5) Car speed when descending shall be not more than 25 percent above not more than 10 percent below the specified car speed.

4) Temperature Rise Test

    1) The temperature rise of the drive unit motor shall be determined during the full-load test run. Temperatures shall be measured as specified in NEMA and IEEE Standards. Under these conditions the temperature rise of the motor shall not exceed NEMA and IEEE specified temperature rise. Test shall be started only when all parts of equipment are within 9 degrees Fahrenheit of the ambient temperature at time of starting test.

5) Car Leveling Test

    1) Elevator car leveling devices shall be tested for ¼-inch accuracy of landing at all floors with no load in car and with full load in car, in both directions of travel.

    2) One re-level operation is permitted when full load is in the car.

    3) Accuracy of floor leveling shall be determined both before and after the full-load run test.

6) Insulation Resistance Test

1) The complete wiring system of elevator shall be free from short circuits and accidental grounds. The insulation resistance of the system shall be more than one megohm when tested by using a 500V megohmmeter. The elevator structure, equipment, and raceway shall be tested for continuity to ground.

END OF SECTION

SECTION 14240

GEARLESS TRACTION PASSENGER ELEVATORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section provides guidelines for the fabrication, installation, and testing of the heavy-duty gearless traction passenger elevators, signs, and Kiosk information system.

B. Related Requirements:

1. Section 02205– Removal and Restoration of Existing Site Conditions
2. Section 05500– Metal Fabrication.
3. Section 07170– Bentonite Waterproofing
4. Section 08800– Glass and Glazing
5. Section 09920 – Field Painting
6. See Division 15 for heating, ventilation, air conditioning and/or fire suppression requirements for elevator machine room heating, ventilating and/or air conditioning of elevator machine room.
7. See Division 16 for operation and maintenance of electrical service to elevator equipment, fire alarm systems and communications systems.

1.03 REFERENCES

A. Abbreviations and Acronyms:

1. American Institute of Steel Construction (AISC).
2. American Iron and Steel Institute (AISI).
3. American National Standards Institute (ANSI)
4. American Welding Society (AWS)
5. Environmental Protection Agency (EPA).
6. Federal Transit Administration (FTA).
7. Institute of Electrical and Electronic Engineers (IEEE)
8. International Code Council (ICC) – International Building Code (IBC).
9. National Association of Architectural Metal Manufacturers. (NAAMM)
10. National Institute of Standards and Technology (NIST).

11. National Electrical Code (NEC).
12. National Electrical Manufacturers' Association (NEMA)
13. National Electrical Safety Code (NESC)
14. National Elevator Industry, Inc. (NEII)
15. National Fire Protection Association (NFPA).
16. Occupational Safety and Health Act (OSHA).
17. Society of the Plastics Industry (SPI).
18. American with Disabilities Act (ADA).
19. Uniform Federal Accessibility Standard (UFAS).
20. United States Department of Transportation (DOT).
21. Material Safety Data Sheet (MSDS).
22. Bill of Material (BOM).
23. Systems Maintenance (SMNT) WMATA.
24. Washington Metropolitan Area Transit Authority (WMATA).
25. “Code” – Elevator Code of the local jurisdiction.

B. Definitions:

1. Heavy duty elevator: An elevator designed specifically for the harsh environment and duty load cycles common to transportation system usage.
2. 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
3. Elevator, passenger - an elevator used primarily to carry persons other than the operator and persons necessary for loading and unloading.
4. Gearless: a traction machine, without intermediate gearing, that has the traction sheave and the brake drum mounted directly on the motor shaft.
5. Contractor: The General Contractor.
6. Installer: The responsible party who installs the elevator.
7. OEM: Original Equipment Manufacturer.
8. Dwell time: The period of time the elevator is at a landing while the doors open, passengers transfer and doors close.
9. Elevator 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.
10. Elevator 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.
11. Interim Maintenance: Maintenance from the point of substantial completion, but prior to Revenue Service.
12. Beneficial Use: When the elevator is placed into service, may be prior to the site being ready for public use.
13. Revenue Service: The station or facility opening date.

14. Notice to Proceed (NTP): within this document shall mean the date which the elevator installer is notified to proceed with the project.

15. Override Switch – A switch located in a kiosk panel, which disables the Hall Call Buttons.

16. Elevator MCP – Maintenance Control Program as defined in the ASME A17.1 Code.

C. Reference Standards:

1. ANSI Z97.1 – Safety glazing materials used in buildings – safety performance specifications and methods of test.
2. ASME A17.1 – Safety Code for Elevators and Escalators Includes Requirements for Elevators, Escalators, and Dumbwaiters, Moving Walks, Material Lifts, and Dumbwaiters with Automatic Transfer Devices.
3. ASME A17.2 – Guide for Inspection of Elevators, Escalators, and Moving Walking Includes Inspection Procedures for Electric Traction and Winding Drum Elevators, Hydraulic Elevators, Inclined Elevators, Limited-Use/Limited-Application Elevators, Private Residence Elevators, and Escalators and Moving Walks.
4. ASTM A123 – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
5. ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
6. ASTM A568 – Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.
7. ASTM A653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) for Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
8. ASTM C1048 – Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
9. AWS D1.1 – Structural Welding Code – Steel.
10. ICC A117.1 – Accessible and Usable Buildings and Facilities
11. IEEE 1202 – Flame-Propagation Testing of Wire and Cable.
12. NAAMM C54 – Oxide chemical finish (conversion coatings).
13. NAAMM C55 – Sulfide chemical finish (conversion coatings).
14. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum).
15. NEMA C80.1 – Electrical Rigid Steel Conduit (ERSC).
16. NEMA KS 1 – Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum).
17. NEMA MG 1 – Motors and Generators.
18. NEMA PB 1 – Panelboards.
19. NFPA 130 – Standard for Fixed Guideway Transit and Passenger Rail Systems.
20. NEMA WC 70 – Power Cables rated 2000 Volts or less for the Distribution of Electrical Energy.
21. UL 6 – UL standard for Safety Electrical Rigid Metal Conduit – Steel.
22. UL 50 – UL Standard for Safety Enclosures for Electrical Equipment, Non-Environmental Considerations.
23. UL 62 - UL Standard for Safety Flexible Cords and Cables.
24. UL 94 – UL Standard for Safety Tests for Flammability of Plastic Material for Parts in Devices and Appliances.
25. UL 98 - UL Standard for Safety Enclosed and Dead-Front Switches.

26. UL 360 - UL Standard for Safety Liquid-Tight Flexible Metal Conduit.
27. UL 486A/486B - UL Standard for Safety Wire Connectors.
28. UL 489 – UL Standard for Safety Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures.
29. UL 514 A,B,C,D - UL Standard for Safety Metallic Outlet Boxes
30. UL 1591 – Teflon Coated Wire
31. Any additional requirements imposed by local agencies and/or codes having jurisdiction shall be incorporated into elevator installation.
32. In the event of a conflict between codes, regulations or standards, the most stringent requirement as determined by the Contractor and approved by the Authority shall take precedence unless specifically addressed herein.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination

1. The elevator installer shall install all elevators wiring in the embedded conduit provided by other trades including that to the kiosk. Other trades will bring wiring for their services to either the elevator machine room or the elevator pit, terminated on a terminal block. The elevator installer shall extend wires from the terminal blocks to the appropriate location or device within the elevator enclosure or hoistway. Some of these circuits shall require shielded wires or separate isolated circuits.
2. The elevators shall not be in service for passenger/public use until all of the following requirements have been met.
    a. The Operations and Maintenance Manuals have been approved and received by WMATA.
    b. The Training and Student Manuals as well as video record of all training sessions have been approved and received by WMATA.
    c. The required training has been completed in accordance with this specification.
    d. All field tests have been successfully completed.
    e. The acceptance testing has been successfully completed.
    f. All spare parts have been delivered and received by WMATA.
    g. All Special Tools/Equipment and Software have been delivered and received by WMATA.
    h. All discrepancies identified by the WMATA's CEI (Certified Elevator Inspector) representative shall be completed.
3. Work by Other Trades
    a. The following will be provided in accordance with other sections of the Contract Specifications or by separate contracts; coordination is the Contractor's responsibility:
        1) Hoistway conforming to code and specified requirements, plumb to within ¼ inch, including machine beams, pit, and pit ladders.
        2) Intermediate rail bracket supports.
        3) Grouting around hoistway entrances and sills.
        4) Temporary and Permanent Electrical Power Services:
        5) Contractor shall provide and coordinate the following:

a) For the elevator drive systems: 480V (460V), 3 phase, 3 wires, 60 Hz terminating in a disconnect switch within sight of the controller. The disconnect shall be free on any obstruction for a total of 36” from any part of the disconnect.

b) For lighting and GFCI receptacles: 120V, 1 phase, 3 wires, 60 Hz terminating at the elevator controller location.

c) Separate disconnect for cab lighting and wiring to cab. This disconnect shall be located close to the main line disconnect.

d) Separate service for sill heaters where required.

6) Cutouts in hoistway walls for fixtures.

7) Smoke and/or heat sensors in machine room, in car and above each hoistway entrance.

8) Closed circuit television camera (CCTV) in elevator car.

9) Intrusion detectors on machine room doors.

10) Space in kiosk for elevator annunciator panels.

11) All embedded electrical conduit between elevator hoistway, machine room and kiosk.

12) Pit Drainage means to prevent water from accumulating in the pit for outdoor and indoor elevators. If pumps are used, they shall have a backup power source. The pit floor shall be sloped toward the pit drainage/ sump pump.

13) Lock and Key Requirements: Contractor shall coordinate with WMATA. The keys for all elevators except of Code requirements shall be keyed the same. Each station shall have a key and a master key shall be furnished which will operate all elevator locks in the Metro System, including previously installed elevators.

14) Contractor shall coordinate any alterations required to accommodate elevators with the Authority.

15) Contractor shall attend appropriate safety training programs provided by WMATA at no extra cost.

16) 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.

1.05 SUBMITTALS

A. Submit the following for approval in accordance with the General Requirements and the additional requirements as specified for each to WMATA/ELES.

1. Shop Drawings:

a. The contractor to provide detailed drawings that shows the dimensions, tolerance and specification that may include the material specification, hardness or electrical rating for each component that is being used. In regards to assemblies, they must provide a top level drawing with BOM and quantities with detailed material specifications and drawings with dimensional tolerances. The contractor also to provide as-built CAD models of all elevator components.

b. The name of the manufacturer and type or style designation shall be listed on the equipment shop drawings. Drawings submitted shall include, but not be limited to, the following. Submit six sets include the following:

1) Fully dimensioned layout in plan and elevation, showing the arrangement of equipment and all pertinent details of each specified elevator unit, including as appropriate:

a) All equipment located in machine rooms.

b) Location of circuit breaker, switchboard panel, disconnect switches, light switch, and feeder extension points in machine rooms,

c) Location in hoistway of outlets for connection of traveling cables for car light, fire detectors, communication, and control systems.

d) Car, drive and motors, safeties governors, supporting beams, guide rails, buffers, and other components located in the hoistway for each elevator.

e) Maximum Rail bracket spacing and maximum horizontal forces on guide rails in accordance with Part 2.23 of the ASME Code.

f) Reactions at points of supports.

g) Weight of principal parts.

h) Loads on hoist beams.

i) Loads imposed on racks requiring transfer to building structure.

j) Top and bottom clearance and travel of car and counterweight runby.

k) Refuge space on top of car and pit.

l) Cab design, dimensions and layout.

m) Color/material schedule and selection chart for cab and entrance features.

2) Complete wiring diagram of the elevator system and subsystems. Complete data regarding electrical characteristics and connection requirements.

3) Drawings of the hoistway entrances and doors showing their method of operation, details of construction, and fastenings to the structural members of the station structure.

4) Drawings of the car for each design specified, showing details of construction, and fastenings to platform car floor covering, car-lighting, ventilation, communication, provision for closed circuit television monitor, and location of equipment.

5) Cuts or drawings showing details of all signal and operating devices, identifying graphics and kiosk interface where applicable.

6) Electrical characteristics and connection requirements.

7) Complete assembly detail of machine, machine mounting, machine beam assembly, dead end hitch and beam assemblies.

8) Machine performance data sheets.

9) Elevator controller, including manufacturer's technical data and catalog cuts, and interface hardware and software requirements.

10) Power door operator.

11) Door interlocks and electrical contacts including test reports showing that hoistway door interlocks, car door contacts, and car top emergency contacts meet the requirements of the ASME Code and certification by the NBS or other approved laboratory.

12) Car ventilation.

13) Car lighting.

14) Cabling.

15) Hall and car fixtures at each landing including the car operating panel (COP).

16) Buffer, including stroke and certified maximum striking speed for car.

17) Mechanical, electrical, and architectural design details of communication systems and intrusion systems for both elevator and kiosk systems. Provide diagram and schematic of kiosk annunciator panel.

18) Design and architectural details of electrical protective device for car doors.

19) Where use of adjoining dissimilar metals is required, descriptions of protective measures to be employed to avoid corrosive damage.

20) Certification from independent testing laboratory that glazing gaskets meet the specified requirements.

21) Conduit and wire-way cladding configuration from the point of origin to the final destination. .

22) Interface wiring diagrams with other systems showing terminal board location and identification.

23) Expected heat dissipation of elevator equipment in machine room and control areas (i.e. BTU's/hr.) based on 240 round cycles per hour.

2. Samples:

a. Three of each of the following samples shall be submitted for approval.

1) Stainless Steel: One of stainless steel sheet of thickness and finish specified, 6 inches square.

2) Glass: One, 12 inches square.

3) Floor covering: One, 12 inches square in the color and finish to be supplied.

4) Neoprene gasket: One of each type.

5) Landing selector button mounted in cover plate with identify marking alongside button.

6) Ceiling material.

7) Signs: One of each type.

3. Certification:

a. Certificates of inspection and acceptance issued by jurisdictional authority.

b. The Acceptance Inspection (Specifications and Code) by Office of Elevator and Escalator (ELES) shall take place prior to the Final Acceptance Inspection by the Jurisdictional Authority, and the elevators and associated equipment shall be free of defective material, imperfect work and faulty operation.

c. All defective work identified by ELES representatives shall be repaired or replaced at no additional cost to the Authority prior to the Final Acceptance Inspection by the Jurisdictional Authority.

4. Operation and Maintenance Manuals:

a. Six sets and electronic copy of the approved manuals, elevator installation, operation instructions, troubleshooting techniques and related equipment drawings and software (all publication must be in English) – two copies of which to be delivered to the WMATA/ELES Engineer representative of the Authority at least 60 days prior to the final acceptance. Each binder shall have the Binder Cover and Spine Insert which contain the Station Name and Unit ID.

b. Submit an electronic copy of the Manual for the review and approval, after installation and at least 90 days prior to the final acceptance. The Information shall be saved/presented as follows:

c. Graphic images in ".dwg" AutoCAD and ".pdf" formats. All revisions shall be made by using computer software. Hand written changes are not acceptable.

d. Text in Microsoft Word .doc, ".pdf" or approved equal format.

e. The manuals shall include the following:

1) Complete operation and maintenance Instructions of the elevator equipment included complete illustrated, exploded views of all assemblies and a complete illustrated, exploded view for identification all system parts.

2) 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.

3) Furnish a summation, in tabular form, of all parts incorporated in the elevators supplied under the Contract. Include but not be limited to the following:

a) Nomenclature of part.

b) Contractor's part number.

c) Nomenclature of next higher assembly in which used.

d) Manufacturer and part number.

e) Model number of elevator on which used.

f) Total quantity.

g) Current unit price to the Authority.

h) Serial numbers of all serialized assemblies, subassemblies, motors, and other major components supplied and installed.

4) Control and schematic electrical wiring diagrams of controller including wiring of safety devices.

a) Wiring Diagrams shall be full size, ladder type, complete "as-built" wiring and single line diagrams showing the electrical connections, functions and sequence of operation of apparatus connected with each elevator, using standard symbols or proprietary symbols defined on the diagram, both in the machine room and in the hoistway, shall be furnished in duplicate for each elevator.

b) Wiring diagrams shall incorporate the wiring identification labeling to identify the controller and field wiring used for each circuit. Wiring diagrams shall have sheets numbered with an indication of the total number of sheets in the diagram set. Each page should include unit number where the diagram belongs to.

c) After approval, a copy of each p*rint shall be laminated and mounted in each elevator machine room. A* hard copy set of wiring diagrams for each elevator shall be delivered to ELES Engineering.

d) Coded diagrams are not acceptable.

5) Complete detailed drawings and wiring diagram of elevator system.

6) Lubricants, sealers, paints and any other potentially hazardous substances are subject to review and approval by the Authority.

7) Detailed lubrication and cleaning schedule.

8) Procedures for adjusting all elevator components.

9) Complete set of contract software including operating control software.

10) Detailed, record and as-built layout drawings.

11) The entire manual, all software upgrades and service tools for elevators shall be provided in an electronic format on CD-ROM that is acceptable to the WMATA Engineering and Maintenance Department.

12) All hard copy publications shall be in loose-leaf form, on 30-pound paper and with punch holes reinforced with plastic, cloth or metallic material.

f. The O&M manual shall only contain information related to equipment installed under this contract. Generic information that does not pertain to the equipment installed shall not be included. Scanned documents are not allowed. The fonts should be standard format.

g. All covers shall be resistant to oil, moisture, and wear commensurate with their intended use. Diagrams and illustrations shall not be loose or in pockets. All printed material shall be capable of being reproduced on dry copying machines.

h. Each elevator shall be treated as a whole and not as a grouping of disassociated parts. The material in the Wiring Diagram Manual shall be organized and indexed by the elevator classifications included in this Specification. All manual sections shall be sub-divided, to the extent required by the subject matter, and shall include, but not necessarily limited to the following topics:

1) General system or sub-system description and operation.

2) Sequence of operation.

3) Replacement and step by step adjustment procedure for all components and systems.

4) Block diagrams.

5) Functional schematics.

6) Functional as-built wiring diagram.

7) Lubrication and cleaning, including frequency, methods, and trade identifications of recommended materials.

8) Component location and description.

9) Inspection and maintenance standards including wear limits, settings, and tolerances.

10) Installation and removal sequence.

11) Test and evaluation procedures.

12) Spare parts lists and special tools.

i. The contractor shall provide all information: manuals, drawings, design changes, modifications, techniques, procedures and any other documents related to maintenance, safety, operations which relate to any part, component, system, subsystem or material and applicable to the elevator equipment. All operating, programming, control software and licensing keys (if applicable) to the PLC control system for the installation.

j. 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. During a ten (10) years period, In case of any items are obsolete or no longer available from the manufacturer the Elevator Contractor shall provide the alternative products.

k. Elevator Maintenance Control Program (MCP).

1. Provide a separate Maintenance Control Program (MCP) for each unit as required by A17.1 Code.

a. Submit an electronic copy of the MCP to ELES Engineering for the review and approval.

b. Provide one copy of the approved MCP at each elevator machine room.

c. Three (3) sets of hard copies and electronic version of the approved MCP shall be submitted to the WMATA/ELES Engineer representative.

2. The MCP shall include, but not be limited to, the Code required maintenance tasks, maintenance procedures, examination and tests.

3. The MCP shall specify examinations, tests, cleaning, lubrication, and adjustments to applicable components at regular intervals.

4. The MCP shall only contain information related to equipment installed under this contract. Generic information that does not pertain to the equipment installed shall not be included. Scanned documents are not allowed.

5. The instructions shall be permanently legible with characters a minimum of 0.125 in. (3 mm) in height.

6. All covers shall be resistant to oil, moisture, and wear commensurate with their intended use. Diagrams and illustrations shall not be loose or in pockets. All printed material shall be capable of being reproduced on dry copying machines.

7. Each unit shall be treated as a whole and not as a grouping of disassociated parts. The material in the MCP shall be organized and indexed by the elevator classifications. Each binder shall have the Binder Cover and Spine Insert which contain the Station Name and Unit ID.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Training

1. Training: The Contractor shall develop and provide operation, troubleshooting and maintenance training in accordance with the General Requirements and as follows:

a. Three days of classroom plus two days hands on training on the field shall be provided for 10 students per class. Six training session for a total of 60 students is required.

b. Time and place of training will be determined by the Authority, but must be completed no later than 30 days prior to the Final Completion.

c. Training shall be organized to make optimum use of the required maintenance and operation manuals including training for replacement of all parts contained in the Parts Inventory list.

d. At the completion of the first training session, a narrated and properly edited training video shall be submitted for the authority on DVD or flash drive. The video shall be taken by the professional camera operator with quality image and sound track and will be used for the future trainings. The video shall cover operation of the elevator, function of the devices, maintenance, adjustment procedures and troubleshooting. The following items shall be included as minimum requirements:

1) Step by step adjustment procedure on the followings:

a) Door operators, DCL, DOL, full door opening.

b) Car Leveling and adjustment of leveling sensors and vans.

c) Door: door interlock, proper pressure and restrictors.

2) General overview of major items:

a) Controller.

b) Controller display.

c) Door sills.

d) Guide rails.

3) Daily operation and sequence of operation.

4) Replacement and Installation of components:

a) Door photo eye.

b) Door clutch.

c) Door pickup rollers.

5) Proper guide roller adjustment.

6) Verification of safety circuit.

7) Maintenance procedure and Frequency of maintenance.

8) Proper access of pit and top of car for inspection.

9) Proper test of fire service operation.

10) Proper lubrication of components.

11) Troubleshooting techniques.

12) How to use proper communication device, machine room, car top, and kiosk.

13) Proper adjustment of shaft and drive encoders.

14) Proper run learn adjustment.

15) Operation of Governor and adjustment procedure.

16) How to perform governor tripping test.

17) Function of Rope gripper.

18) Lubricate rope and check for wear.

19) Maintenance and inspection of buffer.

20) Test and inspection of safety plunk.

21) Overview of car and counterweight run-by.

22) Operation of brake and proper adjustment procedure.

23) Check Gear box for wear and oil check.

24) Inspect Sheave for wear and bearings lubrication.

e. Provide one additional copy of all required submittals to the Engineer for Authority use.

f. Provide two copies in DVD format of training materials along with visuals and handouts to the Engineer for Authority use.

1) Video shall be narrative.

2) Video shall be separated by major components Sections.

3) Equipment Identification shall be as a part of the section title.

g. Separate training manual shall be submitted for approval prior the scheduling of the training. The O&M manual shall not be used as a training manual.

2. Scope of Work

a. All training, as described below, shall take place prior to Final Acceptance of equipment or materials by the Authority. The contractor shall video tape all training sessions and provide WMATA/ELES with edited copy of the recording.

b. The training shall be tailored specifically to the furnished and installed equipment, and designed to teach the day-to-day operation of all equipment. The training shall be sufficient to bring personnel to a level of operating proficiency such that routine vendor support is not needed.

c. Maintenance Training shall be tailored specifically to the furnished and installed equipment, and designed to develop the knowledge and skills required to maintain all item(s) delivered.

d. The training shall be subdivided into two major levels as follows:

1) System Level Maintenance Training, covering:

a) Theory of operation of the system and its major components.

b) System configuration.

c) Preventative maintenance, consisting of written procedures and schedules for the periodic maintenance of all equipment.

d) Written and validated inspection procedures and a system-level trouble-shooting guide (to the lowest field-replaceable unit).

2) Shop Level Maintenance Training, covering:

a) Detailed theory of operation to module, board, and/or device level.

b) Component level troubleshooting and component replacement and adjustment.

c) Testing and alignment procedures of repaired units.

3. Deliverables

a. The following course materials shall be delivered by the Contractor, according to the following specifications:

1) An Instructor's Guide containing all the information and direction necessary for the instructor to make an effective presentation. It shall include adequate guidelines to conduct a comprehensive training program. Individual lessons within the course shall be organized as separable blocks (or modules) which may be taught as a unit. The Instructor's Guide shall contain, as a minimum:

a) Discussion of student prerequisites (if any).

b) Program overview.

c) A statement of overall program goals.

d) Lesson plans (a session-by-session outline containing the following):

i. Student learning objectives, stated in measurable term

ii. Overview of each lesson.

2) A Student Manual including all materials for the student to interact in the learning situation. It shall contain, as a minimum:

a) Program overview and introduction.

b) Statement of overall program goals.

c) Learning objectives, stated in measurable terms that specifically describe desired behaviors or knowledge to be gained.

d) A fully developed prose treatment (not outline format) of content presentation, developed in the same modular format as the Instructor's Guide.

e) Illustrations, charts, photos or other graphics of actual system components as needed to enhance content presentation.

f) The training manuals shall be prepared and submitted for approval to WMATA/ELES prior to training. The training manuals shall include procedures for adjustment and replacement of all electrical and mechanical components, and a troubleshooting guide.

3) Audio-visual Aids consisting of a narrated video of not less than 90 minutes duration to include, but not limited to, the following:

a) General overview of major features.

b) Daily operations.

c) Maintenance procedures (lubrication, adjustments, critical measurements, etc.).

d) Frequency of maintenance procedures.

e) Parts replacement safety devices, lighting, etc.

f) Verification of safety circuits, methods of accessing and preserving computerized functional data if required.

g) Step by step adjustment procedures and installation of components.

h) Handouts, transparencies and/or slides as necessary to ensure clear and comprehensive presentations.

i) The training video shall be taken from actual equipment installed under this contract.

4. Supplemental Materials consisting of a functional mock-up or a functional representation is required of any equipment that requires theoretical discussion. This may be in the form of an animated schematic, a model of the equipment, an actual device, an interactive video training device, or an approved substitute. All mock-ups shall become the property of the Authority for eventual turn over to WMATA/ELES.

5. The final copies shall be delivered to the Authority as follows:

a. One complete set of training materials that is completely camera-ready. Camera-ready copy is defined as typewritten or typeset originals or high-quality copies such that further copies can be made from them with no noticeable decrease in copy quality.

b. Five copies of all student and instructor materials, to be used for archival purposes, in the WMATA ELES Technical Library.

c. A set of complete student materials including training manuals for each participant enrolled in training classes. The O&M manual, training manuals and special tools shall be approved by WMATA prior to the training.

d. The contractor shall video record all training sessions and provide WMATA/ELES with edited DVD copy of the recording to be used as training guide for other WMATA ELES employees.

6. The following specifications shall be met in instructional delivery:

a. Instructor Qualifications. A description of instructor qualifications, a resume, curriculum vitae, or other description of instruction qualifications must be submitted at least 60 days prior to the presentation of training. The description shall document a thorough knowledge of the equipment being taught, an understanding of the adult learning process, and demonstrated experience in vocational instructional. The ELES Engineering Office will review and approve the Instructor candidacy.

b. Course length. The length of the course shall be 5 working days with 3 days in the classroom and 2 days hands-on training.

c. Student qualifications. For the purposes of course development and presentation, vendors shall assume all students are high school graduates (or equivalent), and that maintenance personnel will possess the ability to use basic hand tools and electronic test equipment.

d. Testing. Instructors must give written and/or practical tests as a measuring device to determine knowledge transference. Tests shall use a multiple-choice or short answer format, and have been validated in a pilot course or by some other means agreed to by the Authority and Contractor. Whenever possible, a practical hands-on test shall be developed to demonstrate the transference of operational/ mechanical skills.

B. Special Tools

1. A complete set of special tools and instruments necessary for troubleshooting and making all adjustments on every part of the elevator installation, including software and hardware shall be furnished for each elevator machine room and delivered to the Engineer as part of the spare parts inventory. Tools that are designed specifically for tasks associated with elevator inspection, maintenance and repair or that are required for these tasks, and are not readily available through normal purchasing channels are defined as special tools.

2. Any “Special Tool/ equipment” that is required to troubleshoot, maintain, adjust, and test the system; the tool/equipment shall remain operational for the life of the equipment.

a. Provide all special tools and equipment necessary for making all system adjustments to the signal and speed controller and door equipment. A programming unit, approved by the Original Equipment Manufacturer (OEM) such as a laptop with 4GB memory, 15-inch display and DVD drive, with all software packages required to setup and program all equipment in the elevator system shall be provided, one per station or location. Software shall be provided for the display unit, DeviceNet, hoist motor drive, if applicable, and any other programmable devices, as well as for the controller PLC. Any hardware or software required for configuring, programming and or communicating to controller or any parts of the elevator shall be submitted to ELES engineering. Using the provided laptop, the contractor shall demonstrate loading, downloading (programming) any and all software that is required for the elevator for all operating needs. This includes display, PLC and any I/O controls. No special tools with decaying circuits or clocks are permitted. All application programs included in this escalator shall be the property of WMATA and shall not be considered proprietary to OEM.

3. Keys: Provide ten (10) sets of keys to operate all keyed switches and locks prior to completion of the first unit.

1.07 EXTRA MATERIALS

A. Storage Cabinet

1. The contractor shall install a lockable metal cabinet of suitable size with a key specified by the WMATA Engineering and Maintenance Dept. in each elevator machine room for the storage of special tools and necessary spare parts. The cabinet shall be mounted on legs or a pedestal, a minimum of 4 inches off the floor.

B. Spare Parts and Service Facility

1. At the expiration of the warranty requirements of the General Provisions, the Contractor is responsible to provide a source for spare parts and service facility in the United States which can be obtained for an additional five years. If product source is another vendor, Contractor shall include name and address of other vendor.

2. The Contractor shall propose and provide a spare parts inventory, to be approved by the Engineer and provided to the Authority not less than 90 days prior to scheduled completion, equal in value to seven percent of the cost of the each elevator.

3. This provision requires the furnishing of a Recommended Spare Parts and Special Tools List based on manufacturer's recommendations, defines criteria to be used by the Contractor in developing spare parts recommendations; defines the manner of identifying spare parts on the list and the labeling and identification of spare parts upon delivery; and the timing of delivery of spare parts.
4. Elevator parts list, grouped by system and subsystem for stocking identification and the list shall contain the following information for each item listed:
    a. Component name and Part number(s).
    b. Manufacturer's name.
    c. Model number(s).
    d. A blank column for WMATA's part number.
    e. Manufacturers recommended quantity.
    f. Anticipated annual usage.
    g. Unit price.
    h. Special storage and handling requirements.
5. The manufacturer's recommended quantities shall be based upon the following reliability, usage and lead time considerations:
    a. Wear: Components which may be expected to require replacement under normal maintenance schedule and operations, such as mechanical parts subject to continuous operation within projected mean time between failure levels.
    b. Consumables or Expendables: Components which are consumed, used up, destroyed, or upon failure, are otherwise made usable for their intended purpose and are economically unrecoverable except for inherent scrap value.
    c. Recoverable or Repairable: Components which, upon failure, are capable of being repaired or remanufactured to a serviceable, operational condition and maintained available for use within their initial intended purpose.
    d. Long Lead: Components that is not available from commercial distributors or within 48 hours from the manufacturers such as specifically made or selected components.
6. Cross referencing: Where replacement components are common to more than one system or subsystem, include a cross reference and indexing system in the replacement components list:
7. Non-Unique parts: In all components lists, items that are not unique to the system and have been manufactured by others shall be identified by the manufacturer's name and part number.
8. WMATA will provide the Elevator Contractor with shipping instructions, with WMATA part numbers for each item the Elevator Contractor is required to furnish.
9. The parts shall be shipped to the locations as directed by the Authority, at the same time as the counterpart equipment delivery or acceptance by the Authority of installed equipment. Shipping documents shall identify the Contract number, manufacturer's part number, quantity, unit price and WMATA part number.
10. Spare parts shall be properly packaged or crated so as to prevent damage during shipment and long-term storage.
11. Spare parts shall be the same in all respects as their counterparts furnished as a part of the assembled equipment to be delivered.
12. Parts furnished in accordance with this provision are WMATA spares, separate and distinct from any Contractor obligation to replace parts, components or assemblies under any warranty provision.

13. Parts lists contained in Operations and Maintenance Manuals provided under the Contract shall include assigned WMATA part numbers.
14. A Manufacturer's Recommended Spare Parts List shall be provided. Parts to be provided shall be based on the criteria described herein and require the Authority approval and shall be provided prior to Final Acceptance.
15. Any Special Tool(s) used including, but not limited to, troubleshooting, maintaining the elevator, software and/or hardware shall be provided as part of the spare parts to ELES Engineering Office. Any tools provided shall be the same as those issued to the Adjuster and equivalent members of the subcontractor's staff.

1.08 QUALITY ASSURANCE

A. Elevator Manufacturer and/or Installer's Qualifications:

1. Manufacturer Qualification: Shall provide documents stating that their firm has successfully produced elevators for transit system applications for a minimum of ten (10) years and regularly engaged for the past five (5) years in the manufacture of major components for gearless traction passenger elevators. As a standard of quality the elevator equipment design and installation shall comply with the Code.
2. Installer's Qualifications: Shall be the original manufacturer of elevator equipment or manufacturer's authorized agent who is trained and approved for installation of units required for this Project.
3. The Contractor shall obtain and pay for all permits and licenses and perform all required inspections.
4. The elevator contractor 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 carelessness, which may develop within two (2) years from date of completion of each elevator, inclusive of labor and traveling expenses. Defective work shall be repaired or replaced at no additional cost to the Authority.
5. 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.
6. Labeling Requirements: Every elevator shall be clearly marked with rated load and speed, manufacture serial number and the designated Authority identification.
    a. All elevators shall be permanently numbered with number designations corresponding to the indications on the kiosk annunciator panel. A station sketch showing the elevator numbers shall be submitted for WMATA ELES Engineering. The elevators shall be numbered in sequence, starting at the north entrance left to right facing to the elevator at each station and proceeding clockwise around the station. The numbering shall proceed into the station toward the end of the platform. Corresponding numerical identification shall be affixed to the equipment in the machine rooms. The elevator numbering shall be approved by the ELES Engineer.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Ship equipment and accessories securely packaged and labeled for safe handling and to prevent damage.

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. Store in clean, dry, secure areas and protect them from weather and damage.

1.10 WARRANT

A. Warranty: Two-year warranty of construction shall start at Final Contract completion.

B. The warranty shall include materials and labor necessary to correct defects.

C. The warranty does not begin until all of the following requirements have been met.

1. The Operations and Maintenance Manuals are accepted by WMATA.
2. The required training has been completed to the satisfaction of WMATA.
3. All field tests have been successfully completed.
4. The acceptance testing has been successfully completed.
5. The elevators are in service for passenger/public use.
6. The State and local jurisdictions have inspected the elevators and issued the respective certificates of Operation.
7. All spare parts have been delivered and received by WMATA.
8. Any discrepancy identified by the ELES representative shall be repaired or replaced by the Contractor at no additional cost to the Authority.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. The major elevator components shall be the products of one of the three manufacturers of established reputation, except they may be the products, either wholly or in part, of another manufacturer of established reputation provided such items are capably engineered and produced under coordinated specifications to ensure a high grade, safe reliable, and smooth operating system.

B. Major components to be furnished for this project shall be of a make or makes that have performed satisfactorily together under conditions of normal use for not less than one year in at least two other elevator installations of equal or greater capacity and speed.

2.02 DESIGN REQUIREMENTS

A. General:

1. Elevators furnished under the Contract shall be Gearless Traction elevators type elevators as shown. All parts shall be built to standard dimensions, tolerances, and clearances so that similar machines and devices supplied under contract are completely interchangeable. The mechanical fastening used throughout the equipment on parts subject to wear and requiring replacement shall be keyed and seat, nut, screw, or other removable and replaceable type not requiring physical deformation or field positioning. The use of rivets or similar devices will not be acceptable as mechanical fastenings for such parts.

2. Hours of Operation: Elevator shall be designed for continuous operation seven (7) days per week, 24 hours per day.
3. Elevators shall be designed, installed, and tested to operate with full-specified performance while exposed to the climatic and environmental conditions specified. In addition, during installation and until the beginning of scheduled maintenance service, the elevators will be subject to more extreme environmental conditions. The Contractor shall furnish protection necessary to prevent damage to or deterioration of the elevators during this period.
    a. Elevators shall be designed to operate in dry bulb temperature range of -10^0F to 140 ^{0}F and operate while exposed to the natural elements of weather, including sunlight, rain, snow, slush, salt; all condition of relative humidity, de-icing chemicals, debris, airborne dust, and corrosive elements.
    b. The elevators shall have a special winter operation. The elevators shall be designed to operate in the event the outside temperature falls below a pre-established minimum value. The elevator contractor shall furnish and install the necessary timers and thermostat to accommodate the desired function
4. Make provision for and provide a closed circuit television camera (CCTV), in the elevator car(s) with the ability to monitor the CCTV from the Kiosk annunciator panel. Submit drawings for approval before fabrication.
    a. Provide electrical connections, through shielded traveling cables, between camera and the communications terminal block in machine room or pit.
5. Painting: The pit, pit walls and machine room floor shall be painted. All machine room equipment shall be given two coats of approved machinery paint. All new iron work shall be given one coat of rust- inhibiting paint.

B. 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.
4. Fasteners securing removable sheet metal materials shall be operable with the aid of simple tools and concealed wherever possible. When the framework to which the metal is fastened is less than ¼ inch thick, steel backup plates ¼ inch thick shall be added with tapped holes and clearance holes where necessary.

C. Capacity, Speed, Travel, Platform Size

1. All parts of the elevator equipment shall be of such design, size, and material as to satisfactorily function under all conditions of loading and operation within its rated load and speed, all with a proper factor of safety, maximum mechanical and electrical efficiency, and minimum wear on parts. The elevators shall have sufficient capacity to lift the rated load at 350 feet per minute, minimum.
2. Elevator shall be of size, arrangement, capacity and shall comply with design criteria and as shown on the Contract Drawings, and in accordance with the requirements of the ASME A17.1
3. The top enclosure shall be reinforced to support two men and be capable of sustaining, without damage or permanent deformation, a load of three hundred pounds on any area two feet square and 100 pounds applied at any point. An emergency exit shall be installed in the car top in conformance with the Code.
4. Travel, location terminal floors, number of stops and openings, and overall car platform size shall be as shown on the Contract Drawings.

D. General Environmental Operation Conditions:

1. Operation Under Fire or Other Emergency Conditions: Elevator shall be equipped to function in accordance with the requirements of ASME A17.1 and applicable local codes.

2. Sound Level: No elevator car or elevator power unit shall generate noise in excess of NC45 sound level. Measurement of noise shall be made at a point 36 inches from the hoistway, machine room entrances, and ventilation openings.

E. Hoistway Movement:

1. Elevators shall be designed to sustain the load and operate with the following lateral movements of the hoistway structures:

   a. In any individual glazed area. ¼ inch.

   b. In total height of hoistway structure for aerial and surface structures: 5/8 inch.

F. Reliability:

1. Each elevator shall be capable of operating at full load under any of the normal modes of operation at a level of availability of not less than 98 percent over a period of 365 days.

2. Availability (A) is defined as the percent of normal operational time during which the equipment is available for use. Or

$$A = \frac{MTBF}{MTBF + MTTR}$$

Where:

MTBF = Mean time between failure in days

= Operating time, t (in days) /Number of failures in time t

MTTR = The average time in days required to restore an elevator to operation after a report . of a failure.

G. Workmanship:

1. Joints shall be welded their full length and dressed smooth and flush on exposed surfaces. Spot welding shall be sued where practicable in preference to screw or rivet fasteners.

2. Sheet metal materials shall be accurately rolled and leveled, and have smooth finish and uniform color. Joints shall be formed to a tight fit, with abutting edges flush, and shall be securely welded or riveted together in such a manner as to give strength equivalent to the solid sheet. Riveted construction shall have heavy reinforcement on the back, and no rivets shall show on exposed surfaces, Welds shall be solid and dressed flush, and holes for screws or bolts shall be drilled and countersunk.

3. Wrought work shall have joints milled to a tight even fit and, where possible, shall be made without screws. Square turns and comers shall be sharp, Curves and loops shall be true and without visible joints. Abutting members shall be welded, riveted or both. Similar bars shall be halved at intersections and wide bars shall be punched for the small bars to pass through.

4. The finished work shall be strong, rigid and neat in appearance. Plane surfaces shall be smooth and free from warp or buckle. Molded members shall be clean cut, straight, and true. Miters shall be well formed and in true alignment. Fastenings shall be concealed from face side of the material.

H. Corrosion Protection: The contractor shall design the elevator assembly in such a manner to avoid corrosion and galvanic action due to physical contact between dissimilar metals or due to other causes.

2.03 PRODUCTS AND MATERIALS

A. Elevator Car Characteristics

1. Rated load. Minimum rated load for the car will be as determined by the inside net platform area per ASME A17.1
2. Rated speed: as per Contract Drawings
3. Inside dimensions: As shown.
4. Landings served: As shown.
5. Number of openings: As shown.
6. Travel: As shown.
7. Operation: Selective/Collective. Drive Type: AC – VVVF
8. Car and landing operating buttons: Illuminated type, vandal resistant, in accordance with ADA requirements.
9. Car door and hoistway entrances: High-Speed, Heavy-Duty Master Door Operator GAL – MOVFR. Door Type: per Contract Drawings. Door Size: per Contract Drawings

B. Operation:

1. Operation shall be automatic. Automatic operation by means of car and landing buttons. Stops registered by momentary actuation of car buttons to be made irrespective of number of buttons actuated or of sequence in which buttons are actuated.
2. Operating station in car containing bank of buttons numbered to correspond to landing served position indicators. EMERGENCY CALL button, keyed EMERGENCY STOP button, DOOR OPEN/DOOR CLOSE buttons, independent maintenance key switch, and key-operated light and fan switches, with legends as specified. Identification as specified for emergency telephone. Emergency call button connected to bell that serves as emergency signal. Panel finish: Stainless Steel.
3. Landing: Single push button fixture at each terminal landing. Button fixture having push buttons with UP and DOWN legends at intermediate landing. Button identification as specified for Person with disabilities per latest ADA regulation (ADA rule 4.10.3).
4. Momentary pressure on car button or landing button illuminates that button, which remains illuminated until call is answered. Illuminated buttons serve as visual indication that call has been registered and that car will stop at that landing. The Push Buttons shall be round, have a Metalized Halo and center jewel. The metalized halo shall be from different color and approved by ELES Engineer.
5. Stops, registered by momentary actuation of landing buttons. All stops subject to respective car or landing button being actuated sufficiently in advance of arrival of car at that landing to enable stop to be made. Direction of travel for idle car established by first car or landing button actuated.
6. UP landing calls answered while car is traveling in up direction and DOWN landing calls answered while car is traveling down, car reversing after uppermost or lowermost car or landing call has been answered and proceed to answer car calls and landing calls registered in opposite direction of travel.
7. Elevators to park at the secure landing level selected by the Engineer.

8. Push button units to be PB-46 NEMA-4 Series or approved equal with button identification as specified by latest ADA regulation.
9. Emergency stop button shall be key operated rather than push-pull arrangement with key removal only in off position.
10. All elevator car control panel operating devices shall be designated by Braille and by raised standard alphabet characters for letters, Arabic characters for numerals, and standard symbols as required by the Code and ADAAG.
11. Lettering shall have a highly visible coloring, such as black, that is permanently affixed.
12. 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. Car door shall remain open unless closed fully by the door close button.
13. Two Stop Collective Simplex Automatic Operation
    a. The existing two stop collective simplex automatic operation shall be reused and checked for the following:
        1) System shall be designed so that when the car is standing at either terminal landing, pressure on car button for the other terminal shall automatically dispatch car to that landing. Pressure of landing button at either terminal landing shall call car automatically to that landing. If a landing call is registered while the car is making its trip that call shall remain registered until the car responds to that call. If no car calls are registered car shall start automatically and respond to hall calls. Provide time limit relay arranged to hold car at landing at which it has stopped for predetermined time after car stops. After all car landing calls have been answered, car shall remain parked at landing where last used with car and hoistway doors closed until another call is registered. Pressing the landing button at floor at which car is parked shall automatically open car and hoistway doors. In all normal operations, the starting of the car shall be contingent upon establishment of hoistway door interlock and car door circuits.
        2) Automatic dispatching operation: all two stop elevators shall include “Step-in-and-Go” feature. Calls for the opposite landing will be automatically set when the elevator opens its doors for a hall call. This feature shall be provided for all elevators that have public access for two stops (i.e., any elevators with key operated service landings will be included).

C. Position Indicators:

1. Car indicator: In accordance with ADA requirements. Mounted in vertical row in car-operating panel to show position of car in hoistway by illumination of indicators corresponding to landing at which the car is stopped or passing. Finish for exposed-to-view metal components: Stainless Steel.
2. Landing indicator: In accordance with ADA requirements. Two-element direction-of-travel indicator mounted above call station or hoistway entrance as shown, including one red and one white indicator. Direction of car's operation shown by illumination of red indicator for DOWN and white indicator for UP.
3. In car signals: Audible signal indicating car's direction of travel, signal sounding once for UP direction and twice for DOWN direction.
4. Landing signals: Audible signal at each hoistway entrance indicating car's direction of travel, signal sounding once for UP direction and twice for DOWN direction.

D. Lighting:

1. Machine Room Emergency Lighting: Maintained Emergency lighting fittings shall be provided in each elevator machine room.
    a. There shall be a minimum of one maintained lighting fixture.
2. Car interior: LED fixture, 120V operation, with clear prismatic glass diffuser, flush mounted in ceiling, cool white bulbs. Illumination level shall be 15-foot candles minimum at car operating panel.
3. Car top and underside of car floor: Medium base porcelain lamp receptacles, with wire lamp guards.
4. Car emergency lighting:
    a. Fixture: Recess mounted, with stainless steel frame, location as shown.
    b. Diffuser: Prismatic polycarbonate plastic.
    c. Lamps: Two, size 16 51.
    d. Remote power supply:
        1) Power pack: Sealed gel cell battery with integral regulating charger and an alarm bell.
        2) Capable of operating bell for one hour minimum and light at car-operating panel at 0.2 low candles minimum for four hours minimum.
        3) Location: on top of car or in COP with easy access provided.

E. Inspection Operation: Key switch in car to nullify car and landing buttons permitting operation of elevator from top of car for inspection purposes:

1. Top of Car Inspection Station: controls on roof of car containing continuous pressure UP and DOWN buttons, emergency stop button and toggle switch to activate inspection devices. The device shall also have an 110V AC outlet for extension cord and provided with a light and guard.

F. Leveling: Automatic leveling device to stop car within 1/8 inch of landing level regardless of load or direction of travel. Landing level maintained within leveling zone irrespective of hoistway doors being open or closed.

G. Emergency Service:

1. Controls to return elevator to designated floor by means of key-operated switch outside street or ground floor hoistway entrance in compliance with ASME A17.1.
2. In car control during emergency operation by means of key switch in compliance with ASME A17.1.
3. Terminals on elevators controllers for connection of circuit from heat and smoke sensing devices, with wiring from sensing devices to elevator controller.

H. Telephone Facilities:

1. Provide all audio/visual communication, signaling, and monitoring in accordance with ADA and ANSI 117.1- Accessibility. “Hands-free” phone integral with control panel, mounted in accordance with ADA requirements; having inscription EMERGENCY TELEPHONE as specified for Person with disabilities; finish exposed-to-view components to match stainless steel control panel; color of letters to contrast with panel.
    a. Provide emergency communicators in accordance with ADA requirements to include auxiliary push button to summon help and visual feedback indicating that the call has been responded to.

2. Provide wiring and jacks for a portable self-contained battery-powered maintenance telephone system. Jacks shall be located on car top, inside car, and in machine room. Furnish three telephone instruments for use of maintenance personnel.

I. Elevator Components:

1. Provide and install Gearless Traction elevators with machine unit, roping, governors, safeties, counterweight, and related equipment. Provide for locating and installing the machine units and associated control equipment in the machine rooms. Provide and install any and all necessary auxiliary beams, structural members or other such devices needed to assure proper and safe operation of all elevator equipment. Vibration isolating machine foundation shall be of approved type which shall effectively prevent transmission of machine vibration to the building structure.

2. Guide Rails:

   a. 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 Engineer.

   b. Guides shall be joined and installed in accordance with Section 2.23 of the Code.

   c. Rail bracket spacing and maximum horizontal forces and guide rails in accordance with ASME A17.1.

3. Roller Guides: Roller guides shall be mounted on top and bottom of the car and counterweight frames to engage the guide rails and provide a smooth ride.

4. Machine: Provide AC gearless machine, with permanent magnet synchronous motor, direct current electro-mechanical disc brakes and integral traction drive sheave.

   a. The motors shall be of the alternating current reversible asynchronous or synchronous type of a design adapted to the severe requirements of elevator service. Motor shall be capable of developing the torque required to meet or exceed an acceleration rate of 2 ft. /sec² for the elevator car.

   b. A means to protect the windings and bearings from airborne dust shall be provided.

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

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

   e. The motor shall be designed to stand the severe loads encountered in elevator service and the windings shall have a minimum insulation temperature rating two ratings higher than the actual temperature rise of the motor, with a minimum rating of NEMA class F.

   f. The motor shall be designed to the ASME A17.1 rated load requirements.

5. Brake: The brake(s) shall be of the self-adjusting fail-safe (spring applied and electrically released) type provided with an external manual brake release and designed to meet the service factor demand of its intended use. Dual brakes shall operate independent of each other for ascending car over speed and unintended car movement. Disc type brake shall be securely mounted to the shaft and shall run concentric to the shaft. Disc shall be machined to obtain a smooth and accurate face. The brake shall be spring actuated, direct current, electrically released, heavy construction with proper braking area for the load and speed specified. The brake shall be provided with sufficient power to stop and hold the car with full contract load.

6. Elevator Drive System: Variable Voltage Variable Frequency (VVVF) Drive: The drive shall be microprocessor and IGBT based using vector control algorithms. The algorithms shall incorporate a motor model to determine the electromagnetic state of the motor. The motor model shall also encompass a temperature compensation algorithm which is essential for speed accuracy.
    a. Velocity shall be controlled by a feedback loop to within +/- 2% of contract speed and speed shall be independently supervised.
    b. Position of floors in the building shall be learned during a slow speed setup run. Once learned, floor locations shall be stored in non-volatile memory. Power loss shall not require the floors to be re-learned. Stopping accuracy shall be +/- 5 mm or less. Re-leveling shall be automatic.
    c. Resistors shall be provided to absorb the power regenerated by the motor. They shall dissipate power only when the motor is regenerating. Control shall be by IGBT.
    d. Maximum total harmonic distortion shall not exceed IEEE Std. 519 to be measured at the elevator disconnect.
    e. For hoist motors 50Hp and above, the drive shall be regenerative feeding the three-phase power supply of the controller.
7. Hoistway Operating Devices: Normal terminal stopping devices. Emergency terminal stopping device as required, controller switches and circuitry arranged in accordance with ASME requirements. All switches to be compatible with control system.
8. Stop Switch: Emergency stop switch mounted in the pit of each elevator in accordance with Section 2.2.6 of the Code, shall prevent operation of elevator when switch is activated. Switch shall be of the type described in Section 2.2.6 of the Code.
9. Automatic Terminal Stopping Device: Terminal stopping devices shall be provided at the top and bottom of the elevator hoistway and shall be operated by a fixed cam attached to the elevator. The switches shall be independent of any other stopping device and shall cut off power from the driving machine motor and brake.
10. MOUNTING: Anti-vibration Mounts: For machines that are support beam mounted, an anti-vibration mounting pad is to be provided.
11. Car Safety. The car safety shall be Type B. as specified in the ANSI/ASME Code, mounted under the car platform and securely bolted to the car sling. It shall be sized for the capacity and speed noted on the Contract Drawings. The car safety shall be actuated by the speed governor upon a predetermined overspeed downward. When tripped, the safety mechanism shall engage the rails with sufficient force to stop a fully loaded car with an average rate of retardation within the limits given by the ASME A17.1 Code for the capacity. The safety shall stop the elevator whenever excessive descending speed is experienced and means shall be provided to cut off power from the motor and apply brake prior to application of the safety. The safety shall be modified and adjusted as necessary so that its operation complies with Code requirements and requirement of all authorities having jurisdiction.
12. Governor: Friction type over-speed governor rated for the duty of the elevator specified and to operate the car safety. The governors shall be located where the car or the counterweight in case of over travel cannot strike it, and where there is adequate space for full movement of governor parts and driven by a governor rope suitably connected to the governor rope-releasing carrier.
    a. An electrical governor over speed protective switch that, where operated, shall remove from the driving machine motor and brake before or at the time of application of the safety.
    b. The governor shall be sealed and tagged with the running speed, tripping speed, and date last tested as required by Code.
13. Tension Sheave: A tension sheave shall be provided in accordance with governor and car safety loading requirements.

14. Life Safety Provisions: Provide Life safety hooks and/or other life safety devices for fall protection in accordance with OSHA standards/guidelines. Life safety hooks and/or other life safety devices locations to be coordinated and installed by the Installer.

15. Counterweight: A counterweight shall be provided for the elevator equal to the weight of the complete car and 40 percent of the rated car. Tie rods shall pass through holes in each sub weight and through holes in frame members above and below sub weights in such a manner as to securely hold sub weights in place. The bottom of the counterweight shall have a buffer striking plate and means to attach knock-off blocks during rope stretch. Roller guides shall be mounted on top and bottom of the counterweight frames to engage the guide rails. Submit paint finish of counterweights for approval.

    a. Idler Sheave: To be located directly above the counterweight frame and integral with counterweight frame. The sheave material shall be accurately machined as per manufacturer's requirements.

    b. Counterweight guides shall be of the roller type; each guide shall consist of a set of at least three (3) large diameter polyurethane rollers equipped with sealed preloaded ball bearings. Each roller shall automatically adjust itself to guide rail misalignment and prevent excessive lateral car movement.

16. Compensation for the weight of hoisting ropes and unbalanced portion of traveling cables shall be provided where required to produce proper operation of elevator for car travel of 50 to 100 feet. All elevators requiring compensation shall have rope compensation.

    a. Rope compensation shall consist of an appropriate number and size of iron steel wire ropes attached to the underside of car frame and counterweight frame and passing under a weighted idler sheave in pit. A metal data tag giving the number, diameter, type, month and year installed, and names of manufacturer and installer of compensating ropes shall be securely attached to one of the compensating rope fastenings.

    b. The weighted idler shall be provided to equalize tension in the compensating rope. The idler sheave shall be provided with bearing of anti-friction bearing metal, ball or roller-type similar to those specified for hoisting machine. Suitable metal guards shall be provided for, or be incorporated in, the design of the equipment, to prevent rope jumping off sheave.

17. Buffers: Provide and install car and counterweight buffers of the oil type as indicated by Code with blocking and support, mounted on the supporting channel or block on the pit floor. Buffers shall comply with all applicable codes. Buffer anchorage at pit floor to be designed and installed without damage to pit floor.

18. Car Frame: A suitable car frame shall be provided with adequate bracing to support the platform and car enclosure. Provide welded or bolted type 316 stainless steel channel uprights affixed to crosshead and plank channels with welded or bolted bracing members and gusset plates which will remove strain from car enclosure.

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

20. Provide and install all necessary accessory beams, auxiliary beams or other devices needed for safe and normal operation and installation of all elevator equipment and devices. It is the elevators installer's responsibility to ensure provided elevator equipment will function as designed in the available space and with the steel beams, steel members or other such equipment in the machine rooms and hoistways in place at the time of installation.

J. Controller System:

1. An Allen Bradley PLC-based controller shall be provided, governing starting and stopping as well as preventing damage to the motor from overload or excessive current. It shall automatically cut off the motor current and bring the car to rest in the event any of the safety devices are activated.

a. System shall coordinate the functioning of elevator drive unit relative to actual location and status of elevator. It shall interface with door control and all required safety circuits, switches and devices. The controller shall be mounted in a NEMA 4X stainless steel air-conditioned cabinet within the controller room.

b. The diagnostic system shall be an integral part of the controller and provide user-friendly interaction between the service person and the controller system.

c. The supervisory logic shall be performed by a main controller or coordinated between the elevator controllers which will interface directly into the Allen Bradley DH485 protocol Remote Monitoring network, transmitting data from the elevator controller through a data concentrator to the Authority's AEMS RTU computer control and data system. The supervisory logic will coordinate dispatching assignments, interfacing operational demand data accumulated from car and corridor operating fixtures, selector and door control functions.

d. Controller shall be capable of operating with an operating temperature range of 32^0F to 140^0F with non-drip environment and no more than 90 percent relative humidity. However the air conditioner on controller cabinet shall maintain the operating temperature in range of 50^0F to 80^0F.

2. An Allen Bradley CompactLogix 1769-L32E based PLC control system shall be provided.

a. The exclusive Allen Bradley DH485 protocol data port will transmit data from the elevator controller to the station or facility data concentrator. The contractor shall provide a controller data interface to a DH 485 network. Contractor shall provide Data cables to connect from the PLC controller to data concentrator in the station and available for connection to the controller DH485 interface. The contractor shall pull Belden 9842, or ELES Engineering approved equal, cables to connect the controller into the monitoring DH485 network. The DH 485 controller interface shall be programmable for date rates up to 115 Kbps. The interface shall allow other nodes such as other elevators and escalators to be readily incorporated into the DH 485 network.

b. A data concentrator PLC shall be installed using an Allen Bradley CompactLogix 1769 L32E or SLC5/05 PLC per station to function as data concentrated or to consolidate data from all controllers in the station. The software for the data concentrator shall receive controller data over the local monitoring DH 485 network and provide formatted data to the AEMS RTU through an RS232 link. The data concentrator shall provide an Ethernet port for interfacing with the WMATA wide area network. A data concentrator connection to the WMATA wide area network shall be provided.

3. The PLC power shall come from 120V AC provided by the car lighting supply in the elevator controller.

4. The PLC shall accommodate the following Signal List, as Applicable, and provide data to the data concentrator as specified in specification.

5. The PLC CPU module shall store the last 99 faults, accessible via laptop connection, controller fault/status display and remote communications. The contractor shall provide WMATA with a programming and monitoring unit, such as a laptop computer with the newest version of Allen Bradley RS-Logix and any other software required to setup and program all electronic items in the control system, for each elevator that this system is installed, for the purpose of troubleshooting and remote monitoring modifications. The laptop should allow uploading, editing, and downloading any software that is being used on this elevator for any operation

6. An Allen Bradley PanelView Plus 6, EZAutomation or ELES Engineering approved equal, fault/status display/interface shall be provided in the controller cabinet. Control system timers and other setup criteria shall be programmable through this unit. All fault, status and setup data shall be stored in the controller CPU module.

7. In cases where the programming is done by the supplier, the supplier shall provide a copy of all working programs, including labels for all inputs and outputs, data tables and internal logic points,

on Flash Drives/CD-R disks as well as a printed program listing. The programs and setup data shall require a password for access and modification. The password shall be provided to ELES Engineering as part of the Submittal.

8. The main control of an elevator shall contain at least the following devices or electronic sensing: phase failure line voltage monitor, motor current and ground fault monitor.
9. The controller cabinet shall contain a permanently mounted fault indicator panel with LED indicator lights. Tripped safety devices, door position, door reversal, car running status, and control system status shall be indicated.
10. All terminals shall have identification markings and all wires, including field wires, shall be provided with permanent heat shrink sleeve cable markers. These wiring identifications shall be provided in the wiring diagram at each end of the circuit connections.
11. The controller shall be equipped with the AC vector drive installed in-line before the hoist motor contactor and the hoist motor.
12. The AC vector drive shall be capable of accelerating and decelerating the hoist motor smoothly and gradually.
13. Adjustable settings for acceleration and deceleration ramps shall be provided.
14. The controller shall have, at least, one dedicated serial port for interface to the DH485 monitoring network and programming access without disconnecting any other port.
15. The Programmable Controller shall have, at least, one dedicated port to support the controller fault/status display.
16. The controller PLC shall provide the following Remote Monitoring and diagnostic network support:
    a. All applicable faults, statuses and data listed in Table 1 shall be provided
    b. Fault indications shall remain until reset in the controller.
    c. Status and analog data shall be provided for the duration of the condition.
    d. Software in the controller PLC shall format monitoring data responses to data concentrator polling as specified in the specification.
    e. The monitoring data port in the controller shall be setup for DH485 protocol with the port network identification number programmed for the particular elevator identification. For instance, identification number 11 applies to elevator 1, 12 to elevator 2, etc.
    f. All faults, statuses and data shall be held by the controller CPU and sent from the CPU when polled by the data concentrator.
17. Provide sufficient non-volatile CPU memory, for non-volatile retention of program memory, system status and operating parameters.
18. Diagnostics
    a. 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 reset fire-service status signals 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 data concentrator provided the fault is not a catastrophic hardware failure where the processor is unable to power up.
    b. 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.
    c. 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 COMMUNICATION channels are active.

19. Input/Output Modules
    a. The Input/Output Modules shall be compatible with the PLC processor I/O structure. Each module shall be provided with a detachable terminal strip to connect wiring to the module. Each wire on the terminals shall be identified by the module terminal.
    b. Discrete Input Modules: Suitable for the input voltage and compatible with the Allen Bradley system.
    c. Discrete Output Modules: Suitable for the voltage and load and compatible with the Allen Bradley system.
    d. Analog Input Modules: Converts analog signals to operational twelve-bit binary values. The module shall accept 4 B four 20 Ma signals. Provide modules compatible with the Allen-Bradley system.
20. I/O Mounting and Power Supply
    a. The controller chassis shall have an additional three spare modules.
    b. Power supplies shall provide power to the PLC processors, I/O and other function modules. The power supply shall be suitable for operation of 120V AC, single phase power. Power supply capacity shall be a minimum of 150% of the connected load.
21. Air Conditioning:
    a. Provide an independent air conditioning unit for each new controller to maintain manufacturers recommended operating temperatures. Condensate from the air conditioning unit must be piped to a suitable drain.
22. Selective Collective Operating: As defined by ASME A17.1 and shall be the pressure upon one or more car buttons to correspond to 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
    a. Momentary pressure on car button or landing button illuminates that button, which remains illuminated until call is answered. Illuminated buttons serve as visual indication that call has been registered and that car will stop at that landing.
    b. 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.
    c. UP landing calls answered while car is traveling in up direction and DOWN landing calls answered while car is traveling down, car reversing after uppermost or lowermost car or landing call has been answered and proceed to answer car calls and landing calls registered in opposite direction of travel.
    d. Should both an up and a down call be registered at an intermediate landing, only the call responding to the direction in which the car is traveling shall be canceled upon the stopping of the car at the landing.
23. Supervisory Control: A processor based system to coordinate dispatching assignments, interfacing operational demand data accumulated from car and corridor operating fixtures and

other special feature commands issuing from computer processing, selector and door control functions. Incorporate in the system specific operational features as herein described.

a. Allocate service to demand, make decisions to prevent crowding, save energy, and provide efficient coverage throughout the building. Respond in real time to prevailing traffic conditions as well at historical traffic patterns.

b. Constantly compare passenger demand, car load, anticipated demand, car motion status, machine status and other prevailing conditions and evaluate this information in the context of the following dispatching approaches:

1) Give priority to contiguous calls, assigning calls on adjacent floor to the same car if other criteria are satisfied.

2) Give priority to coincident calls, having the same car let a riding passenger off and a waiting passenger on at the same floor.

3) Anticipate demand based on hall calls and car calls already registered and floors with a high possibility of demand.

4) Evaluate relative system response time for each car in the group, weighing all of the above factors.

5) Allocate calls and position cars to minimize waiting time, response time and travel time. The other elevator shall respond for hall calls without any delay after the first elevator leaved the door zone.

6) When there is a hall call registered and an elevator left the landing, the other elevator shall run toward opposite landing.

c. Provide the capability to make both car to call or call to car assignments.

d. During light traffic conditions, assign cars without demand to specific parking areas until requested for a hall call. Continuously evaluate dispatching assignment and immediately release a car from its assigned area to meet heavy demand elsewhere in the building.

e. In determining relative system response time for a car to answer a hall call, factor in round-trip calculations for each car as well as other system parameters before deciding which car shall respond to a hall call.

24. Other Features:

a. Independent Operation: Provide TWO position keyed switch (ChicagoLock 7500) marked Independent Service, OFF and ON in the lower portion of the car operating panel of all cars. The switch shall be spring loaded type. When placed in ON position, car will be removed from the automatic operating system and will not respond to demands registered at the hall push buttons. It will respond only to floor with doors open until another demand is registered in the car. Demands registered at the landing will remain registered until answered by another elevator. The car only responds to car calls and that the doors remain open after a stop until closed by continuous pressure on the door close button.

b. The controller shall be designed to operate automatically on standby power.

25. Machine Room Two Way Communication Device: Provide within each controller/machine room a two way communication device that will interface with any type of ADA compliant telephone. The device shall be mounted directly on or within hands distance proximity to the elevator controller.

26. Any junction boxes installed in the machine room or hoistway shall be accessible for Maintenance.

a. Drilling or opening top end of enclosure is not acceptable

b. Wire nuts or splicing without terminal strips is prohibited.

c. All openings shall be properly sized for the conduits.

K. Door Operator Equipment

1. Provide a water resistant heavy-duty GAL MOVFR or ELES Engineering approved equal door operator with encoderless 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:
   a. ½ hip motor and heavy duty sprocket, chain, belt, and sheaves.
   b. Closed loop regulated speed performance.
   c. Hand-held keypad programming.
   d. Adjustments can be stored in the keypad and downloaded to another operator.
   e. Adjustable door obstruction reversal.
   f. Optical cams with LED indicators.
   g. Test switches for open, close, nudging and speed zone set up.
   h. Universal inputs for open, close, and nudging.
   i. Reversing switch to back up the door reversal device.
   j. Designed for interior and exterior applications.
2. Provide a non-contact door reversal device with light immunity: The Door Reopening Device shall cause both the car and hoistway doors to reverse, should they detect an obstruction in the elevator entrance. The device electrical wiring shall be supplied with quick disconnects terminals to facilitate replacement. The infrared curtain detector shall include the following:
   a. A protective infrared detector field extending from 1 1/2” above the car sill to a height of 68”.
   b. A fail-safe control system to prevent the doors from closing in case of power loss to the detector.
   c. A one-piece full door height protective lens cover designed to be completely waterproof and to withstand impact, abrasion and vandalism.

L. Hoistway Entrances:

1. Doors of elevators shall be of the horizontal sliding type, single-speed, and center-opening. All elevator door openings shall be a minimum of 42-inches wide per the Americans with Disabilities Act.
2. Entrance frames shall be of welded or bolted construction for complete one-piece unit assembly. All frames shall be securely fastened to fixing angles mounted in the hoistway and shall be type 316 stainless steel. Provide an additional type 316 stainless steel sill angle support. The landing sills shall be extruded stainless steel with a mill finish.
3. All materials and finished surfaces exposed to public view shall be stainless steel with embossed finish and/or glass panels as indicated on Contract drawings. Glass panels (if provided) to be completely flush with door assembly. In a glass hoistway the struts or any brackets should not be visible to public.
4. Fascia and Dust Cover in the hoistway shall be galvanized or type 316 stainless steel and extend at least the full width of door opening on each side. Toe guard shall be fastened to the sill at the lowest landing.
5. Hoistway doors are to be stainless steel 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 stainless steel bottom guides that run in landing sill slots. Guides shall be replaceable without removing door panels. All doors shall have fixed fire gibs.

6. Interlocks and Contacts:

   a. The doors at each hoistway entrance shall be equipped with approved hoistway door interlocks of the hoistway unit system type tested as required by the Code. 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.

   b. Provide key-operated hoistway door unlocking devices. A device shall conform to the requirements of the Code and shall permit authorized persons to open the hoistway doors from the landing when car is away from landing. The key for emergency use shall be mounted in a receptacle with a breakable transparent cover clearly marked in letter at least 1/8 inch high ELEVATOR DOOR KEY FOR FIRE DEPARTMENT AND EMERGENCY USE ONLY. The location of the receptacle shall be as directed by the Engineer.

7. Provide raised floor/level designations in characters and Braille on each jamb at 60 inches from floor to centerline. Characters shall be two inches high and in accordance with ADA requirements.

M. Wiring and Cable: Division 16, except elevator traveling cable.

1. Elevator Traveling Cable.

   a. NEC Type ETT, size and number of conductors to suit service, 14AWG minimum, each conductor with different color insulation.

   b. Cable exceeding 100 feet in length to have steel supporting fillers, cable 100 feet or less with steel or nonmetallic fillers.

   c. Conductors for electrical, signal, control telephone and sensing devices.

   d. Ten feet of additional telephone, communications and sensing device conductors in elevator machine room for connection to future interface panel by others.

   e. Each traveling cable shall have a minimum of 10 percent spare conductors, but not less than 6 spare conductors in each traveling cable.

   f. A separate coax cable or a shielded twisted pair should be added to accommodate the security video cameras inside the elevator.

   g. Provide separate traveling cables for car lighting and fan control circuits and 14 AWG minimum sizes for elevator lighting circuit.

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

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

N. Conduit Raceways and Boxes: Division 16.

1. Rigid conduit and fittings shall be UL Listed rigid galvanized steel conforming to the requirements of UL 6 and NEMA C80.1. Minimum diameter shall be ¾ inch for power circuits, one inch for fire and intrusion circuits, and two inches for audio and control circuits. Liquid-tight flexible conduit shall conform to the requirements of UL 360 and consist of a flexible galvanized steel core containing a copper bonding conductor spiral-wound between convolutions and a neoprene or outer jacket overall. Fittings for liquid-tight flexible conduit shall be watertight and shall conform to the requirements of UL 514.

   a. All conduits 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.

b. The Contractor shall furnish all materials and completely wire all parts of the electrical equipment of the elevators including electrical devices on hatch doors.

2. Auxiliary gutters, wireways, and raceways shall be constructed of galvanized sheet steel conforming to the requirement of the NEC and shall be UL listed. Raceway, conduit and wireways within the hoistway exposed to public view shall be concealed within steel cladding.

3. Electrical boxes:

a. Outlet, junction and pull boxes shall be galvanized sheet steel or galvanized malleable iron, cast iron or ductile iron conforming to the requirement of UL 50, UL 514, and NEC 314. Pull boxes shall have screw cover with a liquid-tight gasket.

b. Junction boxes on car bottom and hoistway connecting the traveling cable shall contain approved terminal blocks for connection of traveling cable conductors. Terminal blocks shall have indelible identification numbers for each terminal connection.

c. All wire connection terminal blocks shall have the same identification number as labeled on the associated electrical wiring. All electrical wires shall use a labeling tube and heat shrink and match the terminal numbers.

d. During field installation of junction boxes or control boxes, the contractor/subcontractor shall not drill or cut into the top sides of the box for wiring.

e. All boxes in machine room or pit shall be mounted on strut channels in order to prevent future corrosion and water damage. The strut channels shall be mounted to the wall and has a minimum of 1-1/2 inches thickness and a minimum of 18 inches above the floor.

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

4. Disconnect Switches for Car Lights and Mainline Power

a. Disconnect switches shall be the following: UL 98, NEMA KS 1, heavy-duty, quick-make/quick-break switching mechanism with operating handle external to enclosure, with positions labeled ON and OFF, defeatable interlock to prevent opening of enclosure door when switch is ON. Enclosures shall be NEMA 250 Type 4 xs. Label disconnects switches in accordance with the NEC.

b. Mainline power disconnect switch shall be located in close proximity to the machine room entrance and shall be easily identifiable from other disconnect.

O. Metal Work:

1. Steel sheet and steel fabrications:

a. Stainless steel sheet for cladding shall be minimum 16 gauges, best grade cold-rolled furniture steel. Stainless steel sheet for top enclosure shall be minimum 12-gauge. Stainless steel sheet for hoistway door frame shall be minimum 12-gauge.

b. Steel sheet for corrugated floor decking shall be minimum 10-gauge.

c. Steel shed for subfloor shall be minimum 3/8 inch thick.

d. Stainless steel for screws bolts and nuts shall be AISI Alloy 303.

e. Galvanized steel material shall comply with ASTM A123, ASTM A153, ASTM A653 (G90 coating) and ASTM A568, as applicable. Steel sheet and steel fabrications, except stainless and lubricated machinery parts, which are not shown or specified to have other applied finishes, shall be galvanized.

2. Steel Finishes:

a. Provide protection for all metal parts, fittings, and accessories by painting or galvanizing, except for stainless steel or anodized aluminum.

1) Where visible to the public, cladding and related steel surfaces shall be 316 stainless steel satin finishes.

2) Paint finish, where shown, shall be aliphatic polyester polyurethane as follows:

a) Primer shall be high-build epoxy-polyamide type, Tnemec Series 66-1211 or equal.

b) Finish coat shall be aliphatic polyester polyurethane, Tnemec 71 Endura-shield or equal.

c) Total dry film thickness shall be not less than six mils.

P. Cab Enclosure:

1. The elevator car and car components shall conform to the requirements of the Code, and shall operate without squeaks or metallic sounds.
2. Entire car assembly, including car frame and platform, shall be free from warps, buckles, and squeaks and rattles. Joints shall be lightproof.
3. Handrails: Handrails shall be ½ inch by 6 inch stainless steel #4 satin finished tube suitably mounted.
4. Car threshold: Car threshold shall be stainless steel with non-slip surface.
5. Toe guard aprons:

a. The toe guard aprons (cladding) at entrance side of elevator car shall be not less than 16 U.S. Standard Gauge (USSG), galvanized or stainless steel and shall extend at least three inches beyond entrance jambs at each side. Toe guard shall have a straight vertical face, extending below the level of finished car floor, of not less than the depth of leveling zone plus three inches. The bottom of guard shall extend 3 inches below vertical face and be beveled at a 15-degree angle from the vertical. The toe guard shall be secured to car platform construction and be reinforced and braced to withstand a constant force of 150 pounds on its face without permanent deformation or deflection exceeding ¼ inch.

b. On glass elevators, the toe guard shall extend full width of cab.

6. Suspended Ceiling:

a. The suspended ceiling shall be faced and edged with solid stainless steel panels, 0.075-inch thick with a fully adhered ¾-inch thick core of noncombustible, sound-absorbent material and backed with galvanized sheet steel. ASTM A653M, G90 coating or better.

b. Mounting brackets and any necessary holes for the CCTV camera shall be provided on the top of the ceiling. The CCTV 360 degree camera shall be provided that will cover the entire car area. Coordinate bracket configuration and location with the CCTV subcontractor.

c. Mounting brackets and any necessary holes for the smoke and fire detection sensors shall be provided on the top of the ceiling, as further specified. Coordinate bracket configuration and location with the fire and intrusion system subcontractor.

7. Laminated tempered safety glass: Glass shall be laminated fully tempered safety glass conforming to ANSI Standard Z97.1 and the requirements of Specification Section 08800.

a. Glass shall be laminated. Heat-strengthened, safety glass conforming to requirements of ASTM C1048 and ANSI Standard Z97.I and shall consist of two pieces of ¼ inch thick glass and a 0.060 inch thick polyvinyl butyryl interlayer, laminated together.

b. Color: Tint by Globe-Amerada Co., used as a standard of quality, or comparable and approved equal.

c. Weatherproof tape for field installation of final edge seating shall be compatible with the interlayer.

8. Dry pressure glazing materials:

   a. The setting blocks, edge blocks, and face gaskets shall be ozone resistant, virgin neoprene.

   b. Setting blocks for installation at each quarter point of the sill shall be 90 durometer, shore A hardness approximately full channel width, 4 inches long, and high enough to afford correct cover and provide 3/8 inch edge clearance for the glass.

   c. Edge blocks, for vertical insulation at the bottom of each joint channel, shall be 50 durometer, shore A hardness approximately full channel width, three inches long, and provide 3/8 inch edge clearance for the glass.

   d. Face gaskets shall be continuous, 50 durometer hardness, and provide 3/16 inch face clearance both inside and outside.

9. Sub floor material to be nominal ¼" stainless steel to prevent water infiltration between finished floor, cab and platform base.

   a. Floor covering: Poured Acrylic Epoxy, polymer system or approved equal color selection and samples to be submitted to the Authority for approval by the Engineer, with slip-resistant surface, ¼ inch thickness, covering elevator car floor area. Flooring shall be non-shrinking, manufactured of prime quality compound, free of calendaring and curing defects, resistant to grease, oil, chemicals, aging, and ozone. Flooring shall be poured incorporating a full membrane system for the entire cab floor width and depth.

10. Emergency exit: Car shall have a top emergency exit conforming to requirements of the ASME Code, the applicable jurisdictional requirements. The door shall open toward the top of elevator and shall have a latching mechanism to keep it in place.

11. Ventilation: A 350 cfm exhaust fan for continuous car ventilation shall be provided. Connect continuous ventilation fan to emergency power system. The exhaust fan shall be controlled from the car operating panel with EPCO-1. Provide sixty (60) minute backup battery power for fan.

12. Lighting fixtures and plug receptacles:

   a. Car lighting shall provide a minimum of 15-foot candles measured at any point on the cab floor and shall of the LED type. 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.

   b. Exterior car lighting shall be as specified. On glass-enclosed elevators they shall be concealed under access panels flush with cab top or bottom surfaces, respectively. A duplex plug receptacle shall be provided in the pit and on top and bottom of each car. The lighting fixtures and receptacles on exterior of car shall be controlled by a switch adjacent to each fixture.

   c. Provide 115 volt ac plug receptacle (GFCI) within 12 inches of CCTV camera location. Coordinate the installation of CCTV equipment within the design of the elevator cab as the elevator contractor is responsible for the installation of the camera and wiring to the control room.

13. Car Doors and Door Equipment:

   a. Car doors and door frames shall be suitably reinforced and provided with a laminated stainless steel #4 finish on cab side and baked enamel finish on hoistway side. Doors shall protect the full width and height of car entrance opening when in the fully closed position. Car door frame shall be integral with front wall of cab.

b. Hanger cover plate sections above the door opening shall be removable from the hoistway. Doors shall be guided at the bottom by composition gibs engaging threshold grooves with minimum clearance.

c. 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.

d. Door operation automatic at each landing with door opening being initiated as car arrives at landing and closing taking place after expiration of specified time interval, with electric contact to prevent starting elevator away from landing unless car door is in its fully closed position.

1) Time door closing to start 5 seconds minimum from notification that car is answering landing call.

2) Time doors to remain open five seconds minimum.

3) Time shall be adjustable to 20 seconds.

4) The interval of time that the doors remain open at intermediate landings shall be less for a stop made in response to a landing call. Door open time at a dispatching terminal shall be longer than the time for a stop in response to an intermediate landing call.

5) All door timers shall be adjustable from the controller display panel.

14. Capacity plate: The car capacity plate shall be of plain stainless steel and contain the data required by the ASME Code but shall not bear the name of the elevator manufacturer.

15. Signal Devices and Fixtures:

a. Car Operating Station:

1) Provide one (1) main station in the front and one (1) auxiliary station. The COP shall be a vertical type.

2) 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.

3) 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.

4) Car Operating Station shall have a locked service cabinet for keyed switches of the car light; exhaust fan, independent operation, GFI duplex outlet as indicated on the Contract drawings. The service cabinet key shall be EPCO-1 security switch.

5) Provide Emergency Communication: “Hands-free” ADA compliant telephone/intercom.

b. Hall Station: Riser of hall stations of the push-button, call acknowledging, stainless steel, tamper resistant type shall be mounted at all elevator landings. Highest landing shall have a single DOWN button. Lowest landing shall have a single UP button. Incorporate ADA compliant telephone with each hall station. Braille Indicator Plate shall be provided. Faceplate finish shall be Type 316L stainless steel #4 finish. The Hall Station shall be flush to the surface and shall not be projected out.

c. Hall Lanterns:

1) Tamper resistant hall lanterns shall be equipped with illuminated (LED type) 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.

d. Bell Alarm System: Bell alarm system for each elevator shall be properly located within building and audible outside hoistway when activated by the EMERGENCY ALARM call button on each car control building/station. When emergency stop switch is activated inside fire service box, the bell alarm system should not be activated.

e. Firefighters' Service System: Firefighters' service system shall be provided in compliance with code requirements.

Q. Machine Room Equipment

1. Machine room for the single elevator shall be 224 sq. ft. minimum.
2. Machine Room Emergency Lighting:
   a. Emergency lighting fittings shall be provided in each elevator machine room.
      1) There shall be a minimum of one maintained lighting fixture.
3. Clearance around equipment in each machine room shall comply with provisions of all applicable codes. Clear distance for the maintenance purposes shall be at least 18”. In no case shall this clearance supersede minimum Code requirements.
4. Equipment in the elevator machine room and hoistway sheaves area shall be so arranged that replaceable items can be removed for repair or replacement either by overhead hoist and dolly, or other conventional means, without dismantling or removing other equipment components in the same machine room.
5. Machine rooms must be air conditioned and heated to maintain an ambient temperature of 50F to 80 degrees F and a relative humidity between 35% to 50%. The Air Conditioner shall be Split System. The heating system for the machine room is also a built in system. A forced removal should be done by moving the air from the room to the outside of the building to another part of the building to keep an air exchange through the equipment room. Intake and exhaust vent should not be located close to each other.
6. Any component attached to the controller shall have a minimum clearance of 18 inches from the side(s) of the component requiring access for maintenance and free air circulation.
7. Provide Mats of insulating rubber or other suitable floor insulation in the front of the Controllers.
   a. The Resistance range shall be 1x104<1x106 and shall meet ANSI/ESD requirements.
   b. The rubber mat shall be the width of the controller plus 12”.
   c. The length of rubber mat shall be a minimum of 24”.
   d. The rubber mat shall be a ¼” thickness and beveled at each end.

R. Emergency Power Operation

1. Provide control equipment and interlocks sufficient to operate at least one elevator for group of three at a time in the event of failure of normal building power supply.
2. Provide for sequential operation to return elevators to the main entrance floor. Upon transfer to generator power source as evidenced by signal generated by contact closure at elevator automatic transfer switch, start one elevator at a time and return that elevator to the main floor and park with the door open before starting next elevator.

3. Provide selector switch for automatic and manual selection of the elevator that is to operate on generator power source. Locate selector switch adjacent to elevator door key or as directed by the Engineer.
4. When normal building power is restored, as evidenced by signal generated by contact closure at elevator automatic transfer switch, return elevators to normal operation without disruption to normal operating circuits or electrical systems.
5. The key lock shall be EPCO-1.
6. The minimum requirements of the Code shall be met.

S. Kiosk Surveillance Control and Communication

1. Surveillance Camera Provisions (Surface Elevators). All requirements for CCTV shall comply with the WMATA SMNT Department.
    a. Space provisions and mounting holes shall be provided for closed-circuit television (CCTV) cameras to be furnished and install by CCTV subcontractor.
        1) The Contractor shall coordinate with the CCTV subcontractor and install wiring from the CCTV location within the elevator cab to an interface terminal and video transmitter located on the elevator car. Final equipment selection has not been performed and is subject to change. Coordinate model, configuration, and location with the CCTV subcontractor.
            a) Power will be required by the video transmitter and CCTV camera and shall be provided.
            b) Equipment: Fiber Optic Video Transmitters (Elevator Cameras)
        2) The Contractor shall work with the CCTV subcontractor to install CCTV subcontractor-provided fiber-optic cable and transmitter to a terminal location specified by the CCTV subcontractor. The Contractor shall tag the cables appropriately, indicating that they are for future use by others.
2. Supply the following status indication, control, and communication functions for each elevator car and landing at an annunciator panel in the kiosk: indication, control, and communication functions in each elevator and landing; and all interconnecting wiring required to provide a complete and operable system. Systems to be provided and installed include the following:
    a. Kiosk annunciator panel: Panel shall be a single panel approximately 7-½ by 19 inches. Coordinate design to ensure that the panel is compatible with the mounting provisions, previous designs, and human factors. The panels shall contain:
        1) Indicators:
            a) Visual display of elevator car status, to include landing stopped at or being approached and direction of travel:
                i. Designate elevator by functional name, e.g., Garage 1.
                ii. For garage elevators designate landing by garage floor level.
            b) Out of service because of malfunction.
            c) In-Car stop switch is actuated.
            d) Continuous audible alarm activated when emergency alarm switch in car is anitiated.
            e) Indicator lamps shall be LEDs, with life expectancy of 50,000 average rated hours.
        2) Controls:

a) Out of service.

b) Override control.

c) Door open.

d) Landing selection.

e) Push button switches shall have limited over-travel to prevent damage due to abuse and shall be equipped with lift-up covers to avoid inadvertent operation, have mechanical and electrical life of 25,000 cycles, with integral or isolated illumination circuit and be normally open with momentary action or alternate action circuitry.

f) When the override control switch is OFF, the kiosk controls shall function in parallel with the car and landing controls, i.e., the selective/collective control system shall respond to a kiosk-initiated landing selection with the normal priority afforded the remaining system landing selection and call buttons.

g) When the override control switch is ON, the following actions shall take place:

i. If the car is stationary at a landing, it shall remain at the landing and the doors, if open, shall close and remain closed.

ii. If the car is in motion, it shall stop at the first landing reached and the doors shall remain closed.

iii. The elevator control system shall then respond only to the kiosk controls and car station.

iv. The car shall park at the designate landing.

h) When the OUT OF SERVICE switch is actuated, the elevator shall return to the lowest landing before shutting off.

b. Elevator fire detection sensor: Provide space and mounting holes for smoke and fire detection sensors to be furnished and installed as required by building, electrical, elevator and local codes. Install wiring from the sensor location in the car to interface terminal cabinet in the machine room, for connection from the sensors to the smoke and fire detection system. Coordinate with installers to allow installation of sensors and operational checkout of the system.

c. Passenger - Kiosk communications (VOIP) system:

1) Communications signal button in elevator car momentary contact to illuminate back-lighted signal button in car and latch on a continuous audible signal and illuminated indicator in the kiosk.

2) Communications buttons at landings, momentary contact, to illuminate back lighted signal button at the landing and latch on a continuous audible signal and illuminated indicator in the kiosk.

3) Push button in kiosk to activate intercom system and reset indicator lamps and audible alarm.

4) Each passenger operated device shall have identification markings as specified for car operating devices.

5) The voice communication intercom system shall function as a master remote network. The master station shall be located in the kiosk annunciator panel and shall include a speaker-microphone, audio amplifier, on-off indicator lamp, audible signal device control and push button lamp for the operations. A remote station shall include a speaker-microphone and a communications signal button shall light the signal button and cause a continuous audible signal at the master station and light indicator lamp corresponding to the calling remote station. Communications between master

and remote station shall be established upon the actuation of the master station push-button control corresponding to the calling remote station with the master station push to talk control determining the direction of transmission.

6) If successive calls are received from other remote stations while communication is in progress with one remote station, the audible signal shall sound the indicator lamps corresponding to the calling remote stations shall light and both shall remain on the indicate waiting calls.

7) Means shall be provided to clear the indicating lamps independently. Communication initiated from the master station shall be established upon actuation of the push button control corresponding to the called remote station, with the master station push-to-talk control determining the direction of transmission.

8) The audio amplifier at the master station shall be all solid state in construction and shall control incoming and outgoing volumes for all of the remote stations. The volume levels shall be preset during installation and shall be adjustable to provide a maximum of five watts rms at the speaker-microphones.

9) The power supply shall supply all ac and dc voltages necessary for all circuitry associated with the voice communications intercom system, and shall operate from the 120V AC, 60 Hz emergency power supply located in the elevator machine room.

10) The audio amplifier and the speaker-microphones shall have a frequency response of plus or minus three dB from 300 Hz to 5,000 Hz. Power consumption shall be 5 watts maximum in standby and 50 watts maximum under load.

11) The Contractor shall be responsible for shielding, grounding and other measures necessary to protect the voice communications intercom system from interference from other electrical systems.

12) Speaker grilles shall have a minimum of 35 percent open area over the entire surface of the speaker cone.

13) Switches and relays used with this system shall have an operating life exceeding 5,000,000 cycles. Documentation shall be provided by the Contractor to the Engineer, for his approval, to substantiate this life cycle level.

14) The system shall perform adequately, as approved by the Engineer, with both the remote and the master station test personnel speaking from three feet away from the speaker-microphones.

15) Communication in the car shall also rollover to a 24-hour manned site (Rail Operations Control Center) in the event that the kiosk does not respond to the call.

16) Each passenger-operated device shall be identified in accordance with ADA/ADAAG requirements.

    a) ADA requirement for providing emergency two-way communications between an elevator and a point outside the hoist way (the Kiosk).

    b) Device mounting heights shall comply with:

        i. ADAAG requirements.

        ii. ASME A17.1. The highest operable part of the two-way communication system shall be a maximum of 48 inches from the floor.

    c) A Braille Instruction Plate shall be permanently affixed on each remote intercom unit.

        i. ADA Standards: Raised symbol and lettering (Signage) located adjacent to the device.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to beginning installation of elevator equipment, examine the following and verify that no irregularities exist that would affect quality or execution of work as specified. Notify the Authority if there are any non-conformances.

1. Hoistway size and plumbness.
2. Sill pockets.
3. Anchor brackets
4. Sill supports.
5. Spreader/Divided beams.
6. Machine beams and any other supplied by others.
7. Pit Depth
8. Overhead clearance

B. Do not proceed with installation until previous work conforms to project requirements.

3.02 PREPARATION

A. Elevator Protection

1. The finished elevator installations shall be completely barricaded and enclosed to preclude their use without permission of the Contractor until Final Acceptance and release by the Contractor for general use. The enclosure shall be fabricated to allow easy access for maintenance, testing and adjustment.
2. The Contractor shall be responsible for the security of the contents of each machine room. The Contractor shall control access to that room, and ensure that it shall remain secure at all times until the completion of the Contractor's interim maintenance obligation.
3. Protection: During installation and until all elevator systems are fully operational and accepted by WMATA, make all necessary provisions to protect all elevator components from damage, deterioration, and adverse environmental conditions. Do not use or allow the use of the elevator for construction purposes such as hauling materials or worker transport during construction.
4. Security of Machine Rooms: The Contractor shall be responsible for the security of the contents of each machine room. The Contractor shall control access to that room and ensure it shall remain locked and secure at all times.
5. Field Painting: Metal parts visible to the public shall be field painted.

3.03 INSTALLATION

A. Coordinate work in this section with all trades to ensure that the installation of the elevators is not in conflict with the work performed of other trades.

B. Make necessary wiring connections.

C. Paint metal surfaces in accordance with Section 09_91_99.

D. Install elevator equipment, materials and accessories in accordance with the OEM's installation procedures and approved Shop Drawings to make elevator fully operational.

E. Erect guides plumb and securely fasten to building structure.

F. Provide protective coverings for finished surfaces.

G. Upon completion, touch up and restore/ replace 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.

3.04 FIELD QUALITY CONTROL

A. Field Testing

1. Operating Adjustments and tests: At all times, until issued final acceptance by ELES representative, adjust equipment to operate satisfactorily, conduct performance tests and make necessary readjustments.
    a. Provide test instruments, materials, other necessary facilities, and all labor required for acceptance tests specified.
    b. All faults recorded during performance period will be turned over to the Authority for review. The review period should be not less than 20 working days. A fault such as, but not limited to:
        1) Door lock or car gate switch malfunction.
        2) Emergency stop switches and safety circuit malfunction.
        3) Door protection timer.
        4) Motor overload circuits
        5) Stuck button protection features.
        6) Low oil and oil pressure devices.
        7) Test emergency telephone in car
    c. Any deficiencies found during the performance period will be repaired by the contractor at no charge to the Authority.
    d. The warranty shall include materials and labor necessary to correct defects.
    e. Defects shall include, but not be limited to, noisy, rough, or substandard operation; loose, damaged, missing parts and fluid leaks.
    f. Arrange for tests and inspection by jurisdictional authorities to obtain certificate of acceptance.
    g. Coordinate with the Engineer to have the Authority personnel witness acceptance tests.
    h. When the elevator work included in this Contract is fully completed, demonstrate to the satisfaction of ELES representative that the proper operation of every part of the equipment complies with Contract requirements including compliance with all applicable requirements of ANSI/ASME A17.1. The inspection procedure outlined in ANSI/ASME A17.2 will form a part of the final inspection.
    i. Shop test of elevator motor and certified test sheets will be required. The heating, insulation and resistance of the motors will also be determined under actual conditions after installation.

B. Acceptance Tests

1. Notification Requirements: Notify the Project Manager and the Engineer a minimum of five (5) working days prior to each scheduled test.

2. Furnish all test instruments and materials, required at the time of final inspection, to determine compliance of the work with Contract requirements. Materials and instruments furnished shall include standard 50-pound test weights, megohmmeter, alternating current voltmeter and ammeter, centigrade calibrated thermometers, spirit level, and stop watch. At the time of final inspection, tests shall include the following:

   a. After installation, each elevator shall be tested without load by the Contractor. The elevator shall be subjected to a test for a period of eight—hours continuous run. During the test run, the car shall be stopped at top and bottom levels, in both directions of travel with a standing period of 10 seconds at each landing.

   b. Full-load run test: The elevator shall be subjected to a test for a period of one-hour continuous run, with full specified rated load in the car. During the test run, the car shall be stopped at top and bottom levels in both direction of travel with a standing period of 10 seconds at each landing.

   c. 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.

   d. Speed test: The actual speed of the elevator car shall be determined in both directions of travel, with full specified rated load and with no load in the elevator car. Speed tests shall be made before and after the full load run test. Speed shall be determined with a Tachometer. Car speed when ascending shall be not more than 10 percent above not more than 10 percent below the specified car speed.

   e. Temperature rise test: The temperature rise of the drive unit motor shall be determined during the full load test run. Temperatures shall be measured by the use of thermometers inserted into the windings and shielded by cotton waste. Under these conditions, the temperature rise of the motor shall not exceed NEMA specified temperature rise. Test shall be started only when all parts of equipment are within 5^0 C of the ambient temperature at the time of starting test.

   f. Insulation resistance test:

      1) The complete wiring system of elevator shall be free from short circuits and accidental grounds. The insulation resistance of the system shall be more than one megohm when tested by using a 500V megohmmeter.

      2) The elevator structure, equipment, and raceway shall be tested for continuity to ground.

3.05 MAINTENANCE SERVICE

A. The Contractor shall perform full maintenance service for a period of two years on each elevator in accordance with the manufacturer's maintenance manual and WMATA ELES maintenance program prior to WMATA providing permanent maintenance. The period of maintenance shall begin after test(s) and Provisional Acceptance of each elevator and shall extend to the scheduled date of Final Acceptance for all units in the same facility plus a period of two years. In no case shall the interval between inspections and testing be greater than one month. The maintenance service during the warranty period shall be provided by fully trained elevator mechanics. The maintenance tasks shall include, but not be limited to, the following:

1. Inspection of completed installation and periodic testing to maintain the elevators in completely operable condition.

2. Contractor shall provide support for periodic, accident and incident, PM compliance inspections.
3. Lubrication of parts, and the protection of the equipment.
4. Replacement of defective parts at no additional cost to the Authority.
5. Annual clean down of the elevator and hoistway enclosure is required. Make necessary arrangements with Authority in order to minimize any inconvenience.
6. Contractors performing maintenance are responsible for all service, repair work and emergency call. The contractors shall provide unlimited service during regular time and twenty-four (24) hour (including Holidays) emergency call back service at no additional cost.
    a. Provide twenty (24) hour (including Holidays) emergency service during the maintenance period consisting of a prompt response (within 1 hour) to emergency request by telephone or otherwise from Authority or designated representative if an elevator is inoperable or in case of injury, entrapment, or potential injury to persons.
    b. Unlimited service callbacks are included with a required response time of one (1) hour (including Holidays).
7. Periodic maintenance (based on WMATA schedule) shall be performed off peak hours to minimize service interruption as long as the other elevator serving the same platform is operational.
8. Reporting: Detailed monthly records of tasks performed including names of individuals performing the tasks, date and time performed, and other pertinent data. In addition, the reports are to be provided in an electronic format acceptable to WMATA's needs.
9. Contractor performed maintenance shall follow the WMATA Office of Elevator and Escalator Operations procedures, schedules and check charts.
10. Within three (3) months prior to the termination of this contract, the Authority or his designated representative(s) shall make a thorough maintenance inspection of all equipment covered under this contract. The contractor shall provide personnel to remove, test, and operate equipment as necessary. All deficiencies found as a result of this inspection shall be corrected by the Contractor as required in this agreement with no additional cost to the Authority.

3.06 REMOTE MONITORING SPECIFICATIONS

A. Allen Bradley DF1 or industry standard Modbus protocol shall be provided to transmit data from the Elevator/Escalator controller to the Authority's AEMS RTU computer control and data system. The Design-Builder shall provide a controller data interface to a DH-485 network located in the Elevator /Escalator machine room. The DH-485 controller interface shall be programmable for data rates up to 115Kbps. The interface shall allow other nodes such as other Elevator or Escalators to be readily incorporated into the DH-485 network. The controller data interface shall include one Allen Bradley SLC PLC per station to function as a data concentrator to consolidate data from all the controllers in the station. The software for the data concentrator shall be as specified by the Authority. The data concentrator shall receive controller data over the DH-485 data network and provide formatted data to the AEMS RTU through a RS 232 link. This data transmission may be accomplished by a separate PLC controller integrated into the control system.

B. The Elevator /Escalator control system shall automatically initiate the transmittal of data when data is requested by the Authority's AEMS system and continue until all data is received by the AEMS RTU in the station AC switchboard room. The Authority will perform final integration of the data in the AEMS system.

C. The Contractor shall also provide the required hardware to download data from any fault finding annunciator panel to a supplied laptop PC being utilized at the Elevator/Escalator location. The

provided software shall permit the downloading and storage of data on the supplied laptop PC from multiple fault finding annunciator panels.

D. The Contractor shall install an Allen Bradley network interface module, (model 1761-NET-AIC, or approved alternative) beside the PLC in the controller and provide 24V DC power to the module. The Allen Bradley PLC will be used for remote monitoring capabilities into WMATA established engineering monitoring network.

1. The Contractor shall provide all wiring and programming of the PLC to communicate with station data concentrators on the DH-485 network. Coordinate work with WMATA ELES Engineering.
2. The Contractor shall pull all remote monitoring cables to the interface in the elevator controller from the remote monitoring network going back to WMATA's Automated Energy Management System (AEMS) remote terminal unit (RTU).
3. Provide Ethernet communication between the elevator machine room and WMATA's communication room. The communication port shall be located less than 6' from the controller and shall have minimum of two ports for data communication.

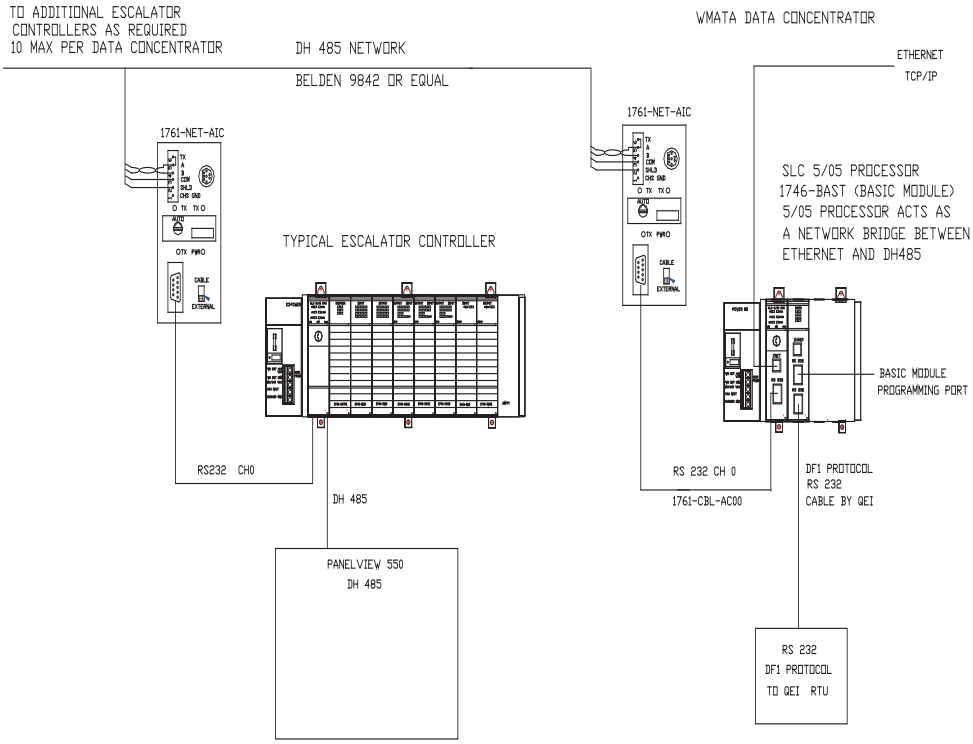
E. Terms and Definitions

1. Boolean - A single bit data type.
2. DF1 - A Rockwell Automation Company proprietary communications protocol.
3. DH485 - An industrial communications network used by Allen Bradley programmable controllers.
4. Integer - A data type 16 bit signed (range -32768 to 32767).
5. PLC - Programmable Logic Controller.
6. QEI - QEI Inc. Springfield NJ
7. RTU - Remote Terminal Unit

F. Elevator Remote Monitoring Data Specification

1. Overview

a. The design of the WMATA escalator & elevator monitoring system shall include a data concentrator PLC to gather data from the elevator control PLC's over an Allen Bradley DH 485 network. The QEI RTU shall read data from the WMATA data concentrator PLC via an RS 232 serial connection to a 1746-BAST module using Allen Bradley DF1 protocol. See figure 1.1 for reference. This specification defines data to be presented by the WMATA data concentrator PLC to the QEI RTU. The WMATA data concentrator PLC station shall pole the escalator & elevator controller(s) periodically for data and format the data into blocks within the WMATA data concentrator. An Ethernet TCP/IP connection is available at the Data concentrator PLC. The data concentrator PLC has been designed to collect data from up to (10) escalators and/or elevators. The data concentrator PLC is to be mounted into the existing QEI RTU enclosures and powered by a 120 VAC source from within the RTU. For Metro stations where more than (10) escalators and elevators are present additional data concentrator PLC's will be required.



2. Data Concentrator PLC Data File Assignments.

3. The WMATA data concentrator PLC shall store data for up to (10) escalators and/or elevators in any combination as defined in table 2.1.

Table 1

Escalator DH485 node #	Elevator H485 node #	Status bits File	Analog Data File	DC PLC MSG file#	DC PLC MSG buffer file#
1		N20	N21	N81	N101
2		N22	N23	N82	N102
3		N24	N25	N83	N103

4		N26	N27	N84	N104
5		N28	N29	N85	N105
6		N30	N31	N86	N106
7		N32	N33	N87	N107
8		N34	N35	N88	N108
9		N36	N37	N89	N109
10		N38	N39	N90	N110
	11	N40	N41	N121	N141
	12	N42	N43	N122	N142
	13	N44	N45	N123	N143
	14	N46	N47	N124	N144
	15	N48	N49	N125	N145
	16	N50	N51	N126	N146
17		N52	N53	N127	N147
18		N54	N55	N128	N148
19		N56	N57	N129	N149
20		N58	N59	N130	N150
Concentrator PLC (DC)	25	N80	N79		

4. Each data file shall begin with word 1 (example: escalator #1 status bits begin with N20:1 and end at N20:20)
5. The data concentrator PLC communication ports shall be configured as follows.

Channel 1

Driver: Ethernet

IP Address TBD

Subnet Mask TBD

Gateway Address: TBD

Channel 2

Driver: DH485

Baud Rate: 19.2K

Node Address 25

1756-BAST basic module communication ports shall be configured as follows.

Port 1: Programming port

Settings – 19,200 Baud, No parity, 8 bits, 1 stop bit, No handshaking

Port 2: DF1 port

Settings – 19,200 Baud, No parity, 8 bits, 1 stop bit, No handshaking

DF1 – Op Code 19 (Full Duplex, NHS, ER, Enable DPD, CRC error checking,

Timeout = 50

Retries = 3

RTS on delay = 20 msec

RTS off delay = 20 msec

Module address = 10

DH485 Port – Not Available

6. Data Format

Data Concentrator status in File N80 per table 3.0

Table 3.0 Data Concentrator Status Bits

WORD	BIT	DATA TYPE	DESCRIPTION	"0" STATE	"1" STATE
1	0	BOOLEAN	Spare		
	1	BOOLEAN	Data Concentrator PLC Battery Status	FAULT	NORMAL
	2	BOOLEAN	Data Concentrator Basic Module Battery Status	FAULT	NORMAL
	3	BOOLEAN			
	4	BOOLEAN			
	5	BOOLEAN			
	6	BOOLEAN			
	7	BOOLEAN			
	8	BOOLEAN			
	9	BOOLEAN			
	10	BOOLEAN			
	11	BOOLEAN			
	12	BOOLEAN			
	13	BOOLEAN			
	14	BOOLEAN			
	15	BOOLEAN			

WORD	BIT	DATA TYPE	DESCRIPTION	"0" STATE	"1" STATE
2		BYTE	Data Concentrator checksum byte1		
3		BYTE	Data Concentrator checksum byte2		

7. Words 4 through 20 of the Data Concentrator status file (N80) are unused.
8. The Data Concentrator Analog data file (N79) is unused.

Elevator data:

Two 20 word (40 BYTE) blocks of data shall be developed for each elevator one block for status bits and one block for analog data. Table 3.3 defines the format of data for status bits. Table 3.4 defines the format for analog data.

Table 3.3 Elevator Status Bits

WORD	BIT	FAULT TYPE	DESCRIPTION	"0" STATE	"1" STATE
1	0	FAULT	24 VDC POWER SUPPLY	FAULT	NORMAL
	1	FAULT	SAFETY CIRCUIT GOOD	FAULT	NORMAL
	2	FAULT	TOP FINAL LIMIT TRIPPED	FAULT	NORMAL
	3	FAULT	BOTTOM FINAL LIMIT TRIPPED	FAULT	NORMAL
	4	FAULT	DRIVE FAULTED	FAULT	NORMAL
	5	FAULT	OVERLOAD TRIPPED	FAULT	NORMAL
	6	FAULT	STOP BUTTON ACTIVATED	FAULT	NORMAL
	7	STATUS	IN-CAR ALARM BUTTON PRESSED	ALARM	NORMAL
	8	FAULT	OUT OF SERVICE BY DELAY	FAULT	NORMAL
	9	FAULT	MOTOR LIMIT TIMER TRIPPED	FAULT	NORMAL
	10	FAULT	VALVE LIMIT TIMER TRIPPED	FAULT	NORMAL
	11	STATUS	INSPECTION OPERATION ON	ON	OFF
	12	STATUS	INDEDENDANT SERVICE ON	ON	OFF
	13	STATUS	VISCOSITY CONTROL ON	ON	OFF
	14	STATUS	CONTROLLER TEST SWITCH ON	ON	OFF
	15	STATUS	FIRE SERVICE PHASE 1 ON	ON	OFF

WORD	BIT	FAULT TYPE	DESCRIPTION	"0" STATE	"1" STATE
2	0	STATUS	FIRE SERVICE PHASE 2 ON	ON	OFF
	1	FAULT	SMOKE SENSOR @ MAIN ON	ON	OFF
	2	FAULT	SMOKE SENSOR @ OTHERS ON	ON	OFF
	3	STATUS	EMERGENCY POWER OPERATION	ON	OFF

	4	STATUS	OVERRIDE ON	ON	OFF
	5	STATUS	CAR IS RUNNING UP	NOT-RUN	RUNNING
	6	STATUS	CAR IS RUNNING DOWN	NOT-RUN	RUNNING
	7	STATUS	BRAKE LIFTED	LIFTED	NORMAL
	8	STATUS	CAR IS IN DOOR ZONE	IOT IN ZONE	IN ZONE
	9	STATUS	INTERLOCKS ARE MADE	OPEN	NORMAL
	10	STATUS	FRONT DOOR GATE SWITCH MADE	OPEN	NORMAL
	11	STATUS	FRONT DOOR FULLY CLOSED	OPEN	CLOSED
	12	STATUS	FRONT DOOR FULLY OPEN	CLOSED	OPEN
	13	STATUS	FRONT DOOR REVERSAL ACTIVATED	OFF	ACTIVE
	14	STATUS	FRONT DOOR PROTECTION ACTIVATED	OFF	ACTIVE
	15	STATUS	REAR DOOR GATE SWITCH MADE	OPEN	NORMAL

WORD	BIT	FAULT TYPE	DESCRIPTION	“0” STATE	“1”STATE
3	0	STATUS	REAR DOOR FULLY CLOSED	OPEN	CLOSED
	1	STATUS	REAR DOOR FULLY OPEN	CLOSED	OPEN
	2	STATUS	REAR DOOR REVERSAL ACTIVATED	OFF	ACTIVE
	3	STATUS	REAR DOOR PROTECTION ACTIVATED	OFF	ACTIVE
	4	FAULT	DOOR REVERSAL DEVICE FAILURE	FAULT	NORMAL
	5	FAULT	ROPE BRAKE SET	FAULT	NORMAL
	6	FAULT	LEVELING SYSTEM FAILURE	FAULT	NORMAL
	7	FAULT	WATER INTRUSION ALARM ACTIVE	FAULT	NORMAL
	8	STATUS	ELEVATOR SLC 5/03 LOW BATTERY	FAULT	NORMAL
	9	STATUS	ELEVATOR SLC 5/03 COMM. ACTIVE	FAULT	NORMAL
	10	STATUS	ELEVATOR SLC 5/03 LOCAL/REMOTE	REMOTE	LOCAL
	11	STATUS	ELEVATOR SLC 5/03 RUN/PROG	PROG	RUN
	12	FAULT	FAULTED	FAULT	NORMAL
	13	STATUS	Out of Service	FAULT	NORMAL

	14		SPARE		
	15		SPARE		

WORD	BIT	FAULT TYPE	DESCRIPTION	"0" STATE	"1"STATE
4	0	STATUS	CAR POSITION 1	NOT AT POSITION	AT POSITION
	1	STATUS	CAR POSITION 2	NOT AT POSITION	AT POSITION
	2	STATUS	CAR POSITION 3	NOT AT POSITION	AT POSITION
	3	STATUS	CAR POSITION 4	NOT AT POSITION	AT POSITION
	4	STATUS	CAR POSITION 5	NOT AT POSITION	AT POSITION
	5	STATUS	CAR POSITION 6	NOT AT POSITION	AT POSITION
	6	STATUS	CAR POSITION 7	NOT AT POSITION	AT POSITION
	7	STATUS	CAR POSITION 8	NOT AT POSITION	AT POSITION
	8				
	9				
	10				
	11				
	12				
	13				
	14				
	15				

Words 5 through 20 are unused.

Table 3.4 Elevator Analog Data

WORD	DATA TYPE	MIN VALUE	MAX VALUE	UNITS	SCALE FACTOR	DESCRIPTION
1	INTEGER			AMPS	X10	DRIVE MOTOR AMPS

2	INTEGER			KWH	X1	PRE DAY KWH
3	INTEGER				X1	PRE DAY UP COUNT
4	INTEGER				X1	PRE DAY DOWN COUNT
5	INTEGER				X1	PRE DAY FRONT DOOR CYCLES
6	INTEGER				X1	FAULT CODE
7	INTEGER				X1	PRE DAY REAR DOOR CYCLES
8	INTEGER					
9	INTEGER					
10	INTEGER					
11	INTEGER					
12	INTEGER					
13	INTEGER					
14	INTEGER					
15	INTEGER					
16	INTEGER					
17	INTEGER					
18	INTEGER					
19	INTEGER					
20	INTEGER					

Note: All analog values are multiplied by 16 in the data concentrator to bit shift left 4 bits to align with QEI's 12 bit analog data types.

A note on communication loss

A 60 second watchdog timer is coded into each escalator file. If communications are lost between the data concentrator and the escalator controller for more than 60 seconds the watchdog timer will timeout. When the timer has timed out the communications loss bit will be reset (0) to indicate the communications loss condition.

Time and data sync

The QEI RTU shall provide clock synchronization to the WMATA data concentrator PLC every 5 minutes. Table 4.1 defines the address and data format of the clock registers in the WMATA data concentrator PLC. The data concentrator PLC shall set the escalator controller date and time every day at 3 AM.

Table 4.1

FUNCTION	ADDRESS	FORMAT
YEAR	N13:10	4 DIGITS
MONTH	N13:11	2 DIGITS
DAY	N13:12	2 DIGITS
HOUR	N13:13	2 DIGITS 24 HOUR
MINUTE	N13:14	2 DIGITS
SECOND	N13:15	2 DIGITS

Data Concentrator PLC Program

The data concentrator PLC includes code to monitor up to 10 escalators and 5 elevators. Each escalators and elevators has an independent code file and a configuration bit. If an elevator is to be monitored the configuration bit must be set corresponding to the DH485 station address of the elevator controller. If the configuration bit is reset (0), the status and analog data table values for the elevator or escalator will be set to 0.

The configuration bits are as follows:

Escalator Configuration Bit	DH485 Address of Escalator Controller	Elevator Configuration Bit	DH485 Address of Elevator Controller
B9:0/1	1	B9:1/1	11

B9:0/2	2	B9:1/2	12
B9:0/3	3	B9:1/3	13
B9:0/4	4	B9:1/4	14
B9:0/5	5	B9:1/5	15
B9:0/6	6	B9:1/6	16
B9:0/7	7	B9:1/7	17
B9:0/8	8	B9:1/8	18
B9:0/9	9	B9:1/9	19
B9:0/10	10	B9:1/10	20

Data Concentrator Gateway IP addresses

The Data concentrator PLC acts as a gateway between the Ethernet and DH485 networks. The PLC contains a list of IP addresses, known as the routing table which will be allowed access to the DH485 network. The routing table will contain 20 addresses.

Station	IP Address
1	TBD
2	
3	

4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	

END OF SECTION

SECTION 14300

HEAVY-DUTY ESCALATORS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General Supplementary Conditions and Division 01 Specifications, apply to this Section.

1.02 SUMMARY

A. This section specifies work pertaining to the design, fabrication, and installation of heavy-duty escalators, designed specifically for heavy rail transit system use.

B. The following sections include related requirements and are performed by other trades:

1. Section 02205 – Removal and Restoration of Existing Site Conditions
2. Section 05500 – Metal Fabrication
3. Section 07170 – Bentonite Waterproofing
4. Section 08800 – Glass and Glazing
5. Section 09920 – Field Painting
6. See Division 15 for heating, ventilation, air conditioning and/or fire suppression requirements for elevator machine room heating, ventilating and/or air conditioning of elevator machine room.
7. See Division 16 for operation and maintenance of electrical service to elevator or escalator equipment, fire alarm systems and communications systems.

C. Definitions

1. The WMATA escalators included in this Specification are classified as "Class A" or "Class B" which corresponds to the designations applied to the wellway structures. These are WMATA classifications, chosen for convenience to define machine installations having similar operating characteristics and ranges of vertical rise. The various classes and designation number of escalators are shown on the drawings.

a. Class A escalators shall have a vertical rise up to 24 feet nominal, three flat steps at the upper and lower landings, and rated speed of 90 to 100 feet per minute.

A1: Not exceeding 20 ft. vertical rise
A2: Over 20 to 24 feet vertical rise

b. Class B escalators shall have a vertical rise above 24 feet through 30 feet, and shall have four flat steps and a rated speed of 90 feet per minute.

B1: Over 24 to 30 feet vertical rise
B2: Over 30 to 40 feet vertical rise

B3: Escalators shall have a vertical rise above 40 feet through 60 feet, and shall have four flat steps and a rated speed of 90 feet per minute.

2. Heavy-Duty Escalators are defined as escalators designed specifically for heavily traveled, heavy rail transit system usage according to the structural and operational parameters defined herein and substantially more robust and superior to commercial units in the design of truss, machine, steps, step chain, and step chain tensioning device. Minimum design life shall be 30 years based on maximum loading conditions of (320 pounds per exposed step) for 75% of the operational hours.

3. The Working Point is the point of intersection of the step nosing line and the horizontal projection of the top of the landing plates. The landing plates shall be horizontal and shall be at the same elevation as the finish floor at the point of intersection with face of the truss bearing plate. This should not be confused with a working point internal to the escalator that is used by escalator installers to align the components, which is different from the previous building reference point.

4. Flat steps: The number of flat steps specified shall be measured from the point where the comb teeth join the comb plate in a horizontal direction to the first exposure of the riser of an adjacent step at the upper and lower landings.

5. Step width: The horizontal distance between skirt panels.

6. Escalator support: These are the upper, lower, and intermediate supports needed to support the total loads of the escalator.

7. Noncombustible materials are those materials that meet the requirements of the National Fire Protection Association (NFPA), Fire Protection Handbook, and for applicable plastics, Underwriters Laboratories (UL)-94HB.

8. Escalator Final Acceptance: The point at which the owner accepts the escalator project as being complete including all submittal requirements. This may be a different point in time than substantial completion.

9. Interim Maintenance: Maintenance from the point of substantial completion, but prior to Revenue Service.

10. Beneficial Use: When the escalator is placed into service, may be prior to the site being ready for public use.

11. Revenue Service: The station or facility opening date.

12. Notice to Proceed (NTP): within this document shall mean the date which the escalator installer is notified to proceed with the project.

13. MSDS - Material Safety Data Sheet.

14. BOM - Bill of Material

15. SMNT - Systems Maintenance (WMATA)

16. WMATA: Washington Metropolitan Area Transit Authority.

17. Escalators MCP – Maintenance Control Program as defined in the ASME A17.1 Code.

1.03 QUALITY ASSURANCE

D. Codes, Regulations, Reference Standards and Specifications.

1. Comply with codes and regulations of the Authority Having Jurisdiction. The American Public Transportation Association (APTA): Heavy Duty Transportation System Escalator Design Guidelines.
2. American Society of Mechanical Engineers (ASME) A17.1 Safety Code for Elevators & Escalators and A17.2 Guide for Inspection of Elevators, Escalators and Moving Walks.
3. WMATA Design Criteria requirements indicated in Section VI-Mechanical.
4. American Institute of Steel Construction (AISC).
5. American Iron and Steel Institute (AISI).
6. American National Standards Institute (ANSI): C80.1.
7. ASTM A36- Standard Specification for Carbon Structural Steel.
8. ASTM A123- Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
9. ASTM A240- Chromium and Chromium-Nickel Stainless Steel Plate.
10. ASTM A312- Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
11. ASTM A325- Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
12. ASTM A385- Standard Practice for Providing High-Quality Zinc Coatings (Hot Dip).
13. ASTM A490- Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength.
14. ASTM A500- Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
15. ASTM A653- Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
16. ASTM B3- Soft or Annealed Copper Wire.
17. ASTM B8-Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
18. ASTM B108- Aluminum-Alloy Permanent Mold Castings.
19. ASTM B221- Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
20. ASTM E84-Test Method for Surface Burning Characteristics of Building Materials
21. ASTM E136- . Test Method for Behavior of Materials in a Vertical Tube Furnace
22. American Wire Gauge (AWG).
23. Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG).
24. American Welding Society (AWS): D1.1.

25. Environmental Protection Agency (EPA).
26. Federal Transit Administration (FTA).
27. International Code Council (ICC) – International Building Code (IBC).
28. Institute of Electrical and Electronic Engineers (IEEE): 1202.
29. National Association of Architectural Metal Manufacturers (NAAMM): C54, C55.
30. National Institute of Standards and Technology (NIST).
31. National Electrical Code (NEC).
32. National Electrical Manufacturers' Association (NEMA): WC 70, KS 1, AB 1, 250, PB 1, MG 1.
33. National Electrical Safety Code (NESC).
34. National Fire Protection Association (NFPA): NFPA-130-2003.
35. Occupational Safety and Health Act (OSHA).
36. Society of the Plastics Industry (SPI).
37. Underwriters' Laboratories, Inc. (UL), UL-94HB.
38. UL 6- Standard for Safety Electrical Rigid Metal Conduit – Steel.
39. UL 50- Standard for Safety Enclosures for Electrical Equipment, Non-Environmental Considerations.
40. UL 62- Standard for Safety Flexible Cords and Cables.
41. UL 98- Standard for Safety Enclosed and Dead-Front Switches.
42. UL 360- Standard for Safety Liquid-Tight Flexible Metal Conduit.
43. UL 486A/486B- Standard for Safety Wire Connectors.
44. UL 489- Standard for Safety Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures.
45. UL 514 A, B.C.D- Standard for Safety Metallic Outlet Boxes.
46. UL 1591- Teflon Coated Wire.
47. United States Department of Transportation (DOT).

These specifications are not to be construed as supplanting any code requirements. Any additional requirements imposed by local agencies and/or codes having jurisdiction shall be incorporated into escalator installation. In the event of a conflict between codes, regulations, these specifications or standards, the most stringent requirement as determined by the Contractor and approved by the Authority shall take precedence unless specifically addressed herein.

E. In addition to the Design Submittal Requirements, the Contractor shall comply with the following:

1. Escalators shall be installed by the manufacturer.
2. The Escalator Contractor shall obtain all permits and licenses and perform all required inspections.

C. Quality Assurance:

1. The escalator contractor shall guarantee the materials and workmanship of the apparatus furnished under these specifications to be of the best quality and fully fit

for the purpose for which it is intended The Contractor shall unconditionally guarantee all equipment against defects or failures of any kind, including design, workmanship and materials for a period of two (2) years after the escalator has been commissioned into service. In the event of defects or failures in any component of the Work of this Section, then upon receipt of notice thereof from the Authority Representative, the Contractor shall correct such defects or failures by immediately reconstructing, repairing or making such alterations or replacement of said component in the Work of this Section as may be necessary or desirable, in the sole opinion of the Authority Representative, to comply with the above guarantee. Defective work shall be repaired or replaced at no additional cost to the Authority.

2. 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.

3. Labeling Requirements: Every escalator shall be clearly marked with rated load and speed, manufacture serial number and the Designated Authority identification.

   a. All escalators shall be permanently numbered with number designations corresponding to the indications on the kiosk annunciator panel. A station sketch showing the escalator numbers shall be submitted for WMATA ELES Engineering. The escalators shall be numbered in sequence, starting at the north entrance left to right facing to the escalator at each station and proceeding clockwise around the station. The numbering shall proceed into the station toward the end of the platform. Corresponding numerical identification shall be affixed to the equipment in the control rooms. The escalator numbering shall be approved by the ELES Engineering.

D. Certification:

1. Certificates of inspection and acceptance issued by jurisdictional authority.

2. The Acceptance Inspection (Specifications and Code) by the Office of Elevator and Escalator (ELES) Services shall take place prior to the Final Acceptance Inspection by the Jurisdictional Authority, and the escalators and associated equipment shall be free of defective material, imperfect work and faulty operation. All defective work shall be repaired or replaced at no additional cost to the Authority prior to the Final Acceptance Inspection by the Jurisdictional Authority.

1.04 SUBMITTALS

Submit the following for approval in accordance with the Contract Documents and with the additional requirements as specified.

A. Product information shall be submitted in both hard copy and electronic copy (compact disc) format, and shall include the following:

1. Manufacturer's design data, material specifications, drawings, installation and maintenance instructions, and other data pertinent to the components used in the escalator systems, including, but not limited to, detailed repair data for all components, including disassembly, inspection/gauging/torque requirements, reassembly, testing and other related information. Submittals shall cover all mechanical components, operating panels and indicators and electronic equipment to control and monitor escalator control functions. Exploded view drawings shall be included to facilitate repair and maintenance functions. Calculations for sizing motors, brakes, chains, etc. shall be included to document the designs conformance with the criteria.

2. Loads on supporting members, reaction points, and deflections under varying loads.

    a. Loads imposed on the structure shall be coordinated by the Contractor and not exceed limits established by the final structural design. This requirement shall be verified, documented, and stamped by a registered Professional Engineer in the Commonwealth of Virginia in accordance with the regulations of the Virginia Department of Professional and Occupational Regulation’s Board for Architects, Professional Engineers, Land Surveyors, Certified Interior Designers and Landscape Architects (APELSCIDLA Board). Supporting calculations shall be provided for record file.

3. Step chain details for material, configuration, arrangement, and lubrication requirements.

4. Lubricants, sealers, paints and any other potentially hazardous substances are subject to review and approval by the Authority. All necessary Material Safety Data Sheets shall be submitted.

5. Truss split detail drawings, associated design calculations and split torque settings.

6. Dimension of the truss including the top and bottom pit area.

B. The contractor to provide detailed drawings that shows the dimensions, tolerance and specification that may include the material specification, hardness or electrical rating for each component that is being used. In regards to assemblies they must provide a top level drawing with BOM and quantities with detailed material specifications and drawings with dimensional tolerances. The contractor also to provide as-built CAD models of all escalator components including CAD model Schematic diagram.

Shop drawings and samples shall be submitted in both hard copy and electronic copy (Flash Drive/CD) format, and shall include but not be limited to the following:

1. Drawings required interfacing the escalator installation with other work.

2. Provide fully dimensioned layout in plan and elevation indicating component locations, structural supports, access spaces, and points of entry.

3. Drawings and cut sheets covering drive motor, controller, and safety devices and switches including brakes.

4. Complete layout of electrical system including motor; control panel; disconnect switches; panel boards, truss lighting, light fixtures and light switches; receptacles; and safety, surveillance, and control devices. Schematic diagrams including single line power diagram of the escalator system, control wiring diagram and sequence of operation, interface connections with remote surveillance and control system.

5. Truss reaction loads with design calculations: Signed and sealed by a structural engineer licensed in the Commonwealth of Virginia.

6. Dimension of the truss including top and bottom pit area.

7. Other drawings, reports, and samples are specified in appropriate articles of this specification section.

C. Reports:

1. Five copies of a reliability and maintainability demonstration report. This report will document compliance with reliability and maintainability requirements specified herein by means of

   a. Inspection

   b. Verifiable engineering analysis

   c. Static and dynamic testing

   d. Analysis of field operational data

   The Contractor has the option to conduct test as a part of the factory "type" testing if certification of equivalent performance of the completed installation is provided by the Contractor. Prior notice shall be provided (two weeks minimum) to allow Authority representatives to witness testing and demonstrations. Submit the report no later than 90 calendar days prior to Final Acceptance. All reliability and maintainability documentation is subject to approval by the Authority.

2. Test results from tests specified in Section 2.09.

3. Failure Mode and Effects Analysis: Provide five copies of a Failure Mode and Effects Analysis for all escalator safety circuits and components, including but not limited to steps, axles, brakes and step and axle rollers and any other components which could affect rider safety.

D. Samples

1. Three of each of the following samples shall be submitted for approval in accordance with the Design Submittal Requirements.

   a. Stainless steel cladding: 12 inches square of thickness and finish specified.

   b. Landing Plate: 12 inches square in the color and finish to be supplied.

   c. Handrails: 12 inches long exposing non-separating stainless steel mesh core laminated within the handrail structure.

   d. Comb Plate: 42 inches long.

2. One of the following samples shall be submitted for approval in accordance with the Design Submittal Requirements.

   a. Step: Sample size adequate to show tread, riser, cleats, nosing, and black powder based baked on enamel paint.

E. Operation & Maintenance (O&M) Manuals.

Manuals and Catalogs:

The O&M Manual shall be submitted to the WMATA/ELES Engineering group. The electronic copy of the manual shall be submitted after installation and at least 90 days prior to the final acceptance for review and approval.

1. The maintenance and repair manuals, hardbound and indexed, shall be furnished, in a minimum of four volumes as follows:
    a. Wiring Diagram Manual with page size of 11 inches by 17 inches.
    b. Maintenance and Renewal Parts Catalog with page size of 8-1/2 inches by 11 inches.
    c. Six sets of the approved manuals, escalator installation, operation instuctions, troubleshooting techniues and related equipment drawings and software (all publication must be ONLY in English) – two copies of which to be delivered to the WMATA/ELES Engineering representive of the Authority 60 days prior to final acceptance. Each binder shall has the Binder Cover and Spine Insert which contain the Station Name and Unit ID.
    d. Submit an additional electronic copy on Flash Drive(s)/CD(s). The Information shall be saved/presented as follows:
        1) Text in Microsoft Word“.doc”, ".pdf", or approved alternative formats.
        2) Graphic images in "pdf" and "dwg" - AutoCAD formats. All revisions shall be made by using computer software. Hand written changes are not acceptable.
2. All publications shall be in loose-leaf form, on 30-pound paper with 3-hole punched reinforced with plastic, cloth or metallic material.
3. All covers shall be resistant to oil, moisture, and wear commensurate with their intended use. Diagrams and illustrations shall not be loose or in pockets. All printed material shall be capable of being reproduced on dry copying machines.
4. Each escalator shall be treated as a whole and not as a grouping of disassociated parts. The material in the Wiring Diagram Manual shall be organized and indexed by the escalator classifications included in this Specification. All manual sections shall be sub-divided, to the extent required by the subject matter, and shall include, but not necessarily limited to the following topics:
    a. General system or sub-system description and operation.
    b. Block diagrams.
    c. Functional schematics.
    d. Replacement and step by step adjustment procedure for all components and systems.
    e. Recommended measurement values such as torque and pressure.
    f. Functional wiring diagram.
    g. Lubrication and cleaning, including frequency, methods, and trade identifications of recommended materials.
    h. Component location and description.
    i. Inspection and maintenance standards including wear limits, settings, and tolerances.
    j. Installation and removal sequence.

k. Test and evaluation procedures.

l. Spare parts lists and special tools.

5. The O&M manual shall only contain information related to equipment installed under this contract. Generic information that does not pertain to the equipment installed shall not be included. Scanned documents are not allowed. The fonts should be standard format. The manuals shall be prepared to help WMATA/ELES personnel who perform maintenance, service and repair on the equipment's installed under this contract.

6. The detailed contents of sealed assemblies need not be displayed but their functions must be explained and the appropriate operational specification characteristics listed as well as procedures for test and replacement.

   a. Maintenance and Renewal Catalog and Wiring Diagram Manual shall contain all the information needed to sustain optimum operation. It shall include general familiarization material; location, function, and operation of all controls, gauges, indicators, and switches; emergency procedures; and trouble diagnosis methods.

   b. The manual shall be logically organized with systems and elements considered in descending order of importance.

   c. The Catalog and Manual shall provide, in convenient form, all the information needed for servicing, including lubrication, inspection, running, maintenance and adjustment, and on-line trouble diagnosis.

7. Repair and Maintenance Section shall contain a complete functional description of each component of the escalator likely to require repair and complete procedures and step-by-step guide for the repair and overhaul of the escalator and all components.

   a. The manuals shall include all measurements for clearance, gap, and torque readings.

8. Four copies of the complete draft copy of each publication shall be submitted for approval at least 60 days prior to the date of acceptance testing of the first escalator.

9. Each year, for a period of five years, on the anniversary of the Final Acceptance date, the Authority shall be provided with the revised catalog and manual pages encompassing all changes to the appropriate escalator models, including modifications of all parts. If no changes occur, the Authority shall be informed in writing on each date the pages are due for submittal.

10. Manuals shall include the following data:

    a. Table of Contents.

    b. Contractor's name, address and telephone number with similar data for his 24-hour service organization.

    c. Manufacturer's name, address and telephone number, with similar data for his local representative, distributor and service agency.

    d. Catalog, model and serial number of equipment installed. Include WMATA unit numbers where applicable.

    e. Description of equipment.

    f. Statement of warranty as specified.

    g. Description of modification, service and repairs performed prior to start of warranty.

h. Dates warranty begins and expires

i. Standard starting, stopping and operating procedures for escalator sequence of operation.

j. Emergency and special operating procedures.

k. Routine maintenance procedures.

l. Servicing and lubrication schedule.

m. Manufacturer's printed operating and maintenance instructions, manufacturer's parts list, illustrations and diagrams.

n. One copy of each wiring diagram.

o. List of spare parts, prices and recommended stock quantities for routine maintenance of the equipment for one year and list of spare parts that are considered critical and for which extended time frames for acquisition would create undesirable down-time for the equipment.

p. List of special tools required to perform inspection, adjustment, maintenance and repair. Special tools are those developed to perform a unique function related to the particular equipment and are not available from commercial sources. One set of all special tools shall be provided for each escalator. No special tools with decaying circuits or disabling clocks are permitted.

q. Copy of each approved shop drawing of the equipment and system. Include drawings which show outline dimensions, weights and assembly data: do not include drawings which show manufacturing details.

11. Four sets of full-size laminated electrical wiring drawings shall be provided for each escalator.

F. 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 escalator. During a ten (10) years period, In case of any items are obsolete or no longer available from the manufacturer the Escalator Contractor shall provide the alternative products.

G. Manufacturers recommended spare parts list.

H. Escalator Maintenance Control Program (MCP).

1. Provide a separate Maintenance Control Program (MCP) for each unit as required by A17.1 Code.
   a. Submit an electronic copy of the MCP to ELES Engineering for the review and approval.

   b. Provide one copy of the the approved MCP at each escalator control room/space.

   b. Three (3) sets of hard copies and electronic version of the approved MCP shall be submitted to the WMATA/ELES Engineer representative.

2. The MCP shall include, but not be limited to, the Code required maintenance tasks, maintenance procedures, examination and tests.

3. The MCP shall specify examinations, tests, cleaning, lubrication, and adjustments to applicable components at regular intervals.

4. The MCP shall only contain information related to equipment installed under this contract. Generic information that does not pertain to the equipment installed shall not be included. Scanned documents are not allowed.
5. The instructions shall be permanently legible with characters a minimum of 0.125 in. (3 mm) in height.
6. All covers shall be resistant to oil, moisture, and wear commensurate with their intended use. Diagrams and illustrations shall not be loose or in pockets. All printed material shall be capable of being reproduced on dry copying machines.
7. Each unit shall be treated as a whole and not as a grouping of disassociated parts. The material in the MCP shall be organized and indexed by the escalator classifications. Each binder shall has the Binder Cover and Spine Insert which contain the Station Name and Unit ID.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials to site in original unopened moisture proof containers clearly labeled with manufacturer's name, type, grade and color.

B. Provide setting compound and sealant materials with labels certifying compliance with specifications and they are the types recommended by manufacturer for this application.

C. Store materials on pallets to prevent damage and moisture penetration. Materials shall be stored in a clean, dry area.

D. Handle materials so as to prevent breakage of containers and damage to materials.

E. Do not work with flammable materials such as polyurethane adhesive components or keep such materials on the WMATA property during revenue hours. Deliver quantities of such materials as are needed for the day's work, and remove any excess from the WMATA property before revenue hours begin. Acquire permits for the use of flammable materials as required by jurisdictional Fire Marshal.

F. Protect setting compound and sealants from freezing or excessive heat. If necessary, provide heated, dry storage facility.

1.06 SYSTEM DESCRIPTION AND PERFORMANCE REQUIREMENTS

A. Design Requirements:

1. Escalators shall be heavy-duty type, designed specifically for the operating; loading and environmental conditions encountered in extensively used, heavy-rail transit systems and shall have a minimum design life as previously defined.
2. Each escalator shall be of a 48-inch nominal width (40-inch step width) and be designed for an incline of 30 degrees from the horizontal.
3. In all design, fabrication, and purchasing, the interchangeability of equipment shall be given maximum consideration.
4. The drive mechanism, step drive unit assembly, motor, steps, step chains, comb plates, handrails, handrail drive units, and any parts subjected to wear or frequent removal shall be readily and easily removable and replaceable without requiring any rigging, modification or alteration of escalator structure, station structure, or equipment.
    a. Access for all maintenance actions must be available from the step area between the balustrade panels, from the machine room and through the landing plates.

b. Standard items such as, but not limited to, steps, comb plates, axles, safety devices, controllers, locks and keys, rollers, handrails shall be interchangeable within each class and may be interchangeable between classes within a single manufacturer to the greatest extent possible.

5. On parts of equipment subject to wear and requiring periodic replacement, provide key and seat, nut, screws, or other removable and replaceable type mechanical fasteners.

a. Such replacements shall not diminish original structural integrity.

b. Use of rivets or similar type fasteners requiring physical deformation during field positioning will not be permitted.

c. All gaps and running openings within structural design tolerances where the escalator structure meets the surface of the finished openings shall be properly closed by the use of polyurethane sealant as specified or other approved means installed in accordance with the manufacturers' instructions.

6. Components and materials, except for handrails and step wheels, shall be noncombustible and shall meet the requirements UL-94HB. The equipment shall be quiet and smooth running and be capable of withstanding the operating conditions hereinafter described.

7. Surface irregularities, sharp edges, or protrusions in public and maintenance areas will not be permitted.

8. There shall be a work area on top and bottom landing pit. This area should be a minimum of 42” X 30” starting from end of the steps.

B. Structure Dimensions:

1. Escalators design shall be coordinated with the final architectural and structural design, and escalators shall be fabricated to fit within the structures as dimensioned on the drawings.

NOTE: That the dimensions given on the drawings are designed dimensions. The contractor shall verify all dimensional after construction of decks prior to final shop drawings, fabrication, delivery and installation of trusses.

a. All field-verified structural dimensions which do not conform to the drawings shall be identified to the Authority so that contractor’s corrective action can be reviewed and approved.

b. If the well ways are not available at this time for dimensional survey, the escalators shall be designed and fabricated in accordance with approved structural shop drawings.

2. Refer to the drawings showing the location of the working point placement. Note the station construction drawings have placed the working point of all the escalators on the finished floor line, thus causing the upper and lower landing areas to slope away from the escalators.

3. The escalators shall be installed under canopies. The Escalator Contractor shall verify the size and location of each canopy prior to the delivery of truss to insure that the fabricated escalator can be installed and also removed for future maintenance or replacement.

4. In the event of a discrepancy, Contractor shall notify the Authority immediately, and shall not proceed with installation in the areas of discrepancy, until the discrepancy has been fully resolved, and the Authority has instructed Contractor to proceed. Failure of

Contractor to report discrepancies shall constitute an acceptance of existing work as fit and proper for the execution and completion of Contractor's work.

C. Truss Supports:

1. The station structures shall have supports of adequate strength for the truss installation at the upper and lower landings of the wellway. The supports are to be provided with I-beams or bearing plates of steel eight inches wide for the full length of the support surface, for attachment of escalator truss mounting angles by the Contractor. All angles or support bearing plates shall be galvanized paint.

2. The loads shown on the drawings were computed for heavy-duty, transit system type escalators as specified. The escalators will have the drive motor assembly mounted within the truss or truss width dimension in the flat step and pit area, cage or wellway.

3. The total live and dead load reactions imposed by the escalator assembly, the remote machine loads, and the drive assembly reactions shown on the drawings shall be verified by the Contractor. The Contractor shall prepare calculations for the escalators and submit to the Authority for approval.

D. Truss:

1. Verify field dimensions when possible of wellways prior to fabricating trusses. Structural trusses shall be designed and fabricated in accordance with the requirements of the most stringent applicable code, and as specified. The width of trusses shall be sufficient to afford a width of the finished escalator of not less than a nominal 40 inches between the skirt panels as defined in ASME A17.1. Deflection under full load, including 320 pounds live load per exposed step, shall not exceed 1/1000 of the inter-support distance.

2. The truss shall be of sufficient total length to allow for the track radii between the 30 degree angle and the horizontal portion of the truss and the minimum number of flat steps. Provisions shall be made for the thermal expansion and contraction of the complete escalator assembly due to changing ambient conditions. The truss shall be fabricated by welding.

3. Field splices, where necessary, shall be made with drive fit bolts in reamed holes. Punched holes of proper size shall be provided for attaching the balustrade securing brackets. Field modification of these holes by burning will not be permitted.

4. The truss shall rest on the top and bottom support beams and the intermediate support recesses provided in the wellway structure.

    a. Trusses shall be of ample strength to rigidly maintain the alignment of tracks and moving parts and shall be so designed that they will safely retain the steps and running gear, and in case of failure of the track system, retain the step mechanism within the guides and envelope of the individual truss.

    b. Intermediate supports shall be of the stub column and beam type bolted or welded to the wellway structure. The stub columns may be welded to the truss. All intermediate supports shall be galvanized paint.

    c. The trusses shall be supported using these supports, to suit the installation. No other attachments to the structure will be allowed.

    d. All trusses mounts, including bolts, angles, shims, bearing pads, and spring supports shall be provided and installed to properly install and align the escalator.

e. All support points shall be shop coated with galvanized paint prior to truss installation and touched up, if required, after the truss installation.

E. Drip Pans:

1. Galvanized steel, welded, oil tight drip pans shall be provided in the truss, for the entire length and width and shall be of sufficient strength to support a concentrated load of 500 pounds on any portion of the drip pan. Material of pan shall be 0.125 inch minimum thickness.

2. Drip pans shall be of a sufficient size to collect and maintain, within the truss area, all oil, water and grease droppings from the step chain and all forms of loose debris that may be deposited in the drip pans from the steps at the turn-around point at the upper and lower portions of the truss.

3. An access shall be provided to the drip pans at the lower landings of all escalators for cleaning the drain catch basin.

4. The drip pans in the upper landings of escalator wellways shall be removable for cleaning, or be otherwise accessible for easy cleaning.

5. Drip pans on exterior escalators shall be designed to collect and drain off all water which may enter through the exposed portions of the escalator, including landing and floor plates. The drip pan in the upper truss section shall be sloped to drain water down the sloping portion of the drip pan to the lower pit. The upper portion of the drip pan shall not be provided with a drain outlet.

6. No transverse bracing shall be placed on the interior surface of the drip pan. Supporting elements impeding drip flow and clean down shall not be permitted.

7. A manual or mechanical method for clearing/cleaning the drip pan shall be provided. Cleaning requirements also apply to longitudinal drains pans (if used).

8. At truss splits, appropriate sealing of drip pans shall be performed.

9. Any screws at splices that protrude below the pan shall be cut flush if the area below is accessible.

F. Tracks:

1. Tracks shall be designed and fabricated to safely support, and retain the steps, step rollers and running gear under the maximum load requirements at the highest design speeds specified and under any lateral movement. Sections of track shall be assembled and secured together in a manner that permits easy removal and replacement of defective sections. The design shall permit easy installation and removal of mechanical components without dismantling any part of the truss or building structure.

2. The rolling surface of the track shall be a minimum of 0.12 inch (3mm) thick or of a thickness to provide equivalent strength, safety and rigidity relative to the complete track assembly.

3. Tracks shall be properly supported on trusses to provide correct alignment and smooth, even operation of the running gear. Track shall be fitted with guides to insure proper alignment of steps through the turn around.

4. The radius of the upper transitional tracks shall be determined in conformance with the following constraints:

a. A minimum radius of 8 feet- 6 inches for vertical rise less than 10 meters, and a minimum radius of 8 feet-10 inches for vertical rise greater than 10 meters.

b. The requirement for the number of flat steps is met in all cases.

c. Verify that track loading and wheel size is such that interaction force between each wheel and track shall permit escalator to meet the reliability and maintainability requirements specified herein.

5. The radius of the lower transitional tracks shall be a minimum of 6 feet-6 3/4 inches for Class B units and 4 feet-11 inches for Class A units.

6. It is the intent of these provisions to limit the maximum effect of acceleration on passengers due to radius of curvature of track, consistent with a design for good longevity of wheels and tracks.

7. The step roller/wheel tracks shall be sectional elements of structural steel throughout the truss, incline and transition curves at the upper and lower landings in order to restrain the lateral displacement of the steps, ensure rollers/wheels are retained in their proper position on the track and to provide a smooth ride without discernible vibration.

8. The tracks shall be constructed of drawn steel or other alloy of proper rigidity and strengths and shall be installed and supported to ensure correct alignment and smooth operation of the running gear. All tracks shall have a smooth finished track surface. Means shall be provided to positively ensure the forming of steps before the 30 degree run and flattening of the steps. The unit design shall be such that vibration levels are less than 0.4 inches per second as measured by Bruel and Kjaer model 2516 integrating vibration meter. Readings shall be taken throughout the exposed travel of steps.

G. Escalator Enclosure:

1. On completion of all work, the finished escalator installations shall be completely barricaded and enclosed to preclude their use without permission until Final Acceptance and release for general use by the jurisdictional inspector and the Authority inspector. The enclosure shall be fabricated in a manner to allow easy access by authorized persons for maintenance, testing, and adjustment, and shall be removed when directed by the Engineer.

H. Step Chains:

1. Two-step chains of the endless type shall be used, one on each side of the steps.

2. Each pair of step chains shall be exactly the same length. Only precision roller fish plate chains of high grade, heat treated steel shall be used as step chains. The pins, axles, bushings and rollers shall be hardened and ground.

3. The breaking factor of safety of a step chain defined as a ratio of chain breaking load to chain traction force, must be a minimum factor of safety of six based on a load of 320 pounds per step.

4. Pins:

a. Pin diameter shall be 5/8 inches (15.875 millimeters) minimum.

b. Pin shall be case hardened, with tensile strength suitable for the application.

c. Pin pressure shall not exceed 4351 psi (30 N/mm^2) for standard escalator step chain bushings or 2320 psi (16 N/mm^2) for polymer non-lube bushings.

5. Each lot/load of step chain shall be certified by the manufacturer that the step chain meets the requirements of this Contract by design, function and materials.

6. Provisions shall be made to prevent sagging or buckling of the step chains, to prevent steps from coming in physical contact with one another, and to maintain a constant distance between the step axles.

a. Automatic tension devices shall be provided to maintain tension under load and to compensate for wear.

b. Each step chain shall have a provision for individual fine adjustment of tension.

c. The step chains shall be designed and constructed in a manner that permits the removal of a segment, as may be required for replacement purposes.

d. Step chains shall be positively guided at the lower and upper landing turnarounds to prevent chordal action and resultant vibration and wear.

e. Material, configuration, arrangement, and lubrication requirements shall be submitted for approval.

f. Support wheels shall be spaced to distribute the load and to guide the step chain throughout the run, and shall be constructed of a polyurethane material, or equivalent, with a diameter sufficient to provide the reliability, maintainability, and smoothness of motion and noise level specifications contained herein.

1) 4 inch nominal (100 mm) diameter wheels shall be affixed in a manner that ensures positive wheel retention but allows for replacement without dismantling chain link assemblies.

2) Wheel foot print width shall equal wheel width at the hub.

I. Steps:

1. Step assemblies shall be cast aluminum. .

2. The design of the steps and their various attachments shall be such as to permit ready removal of the steps at the upper and lower landings without disturbing the balustrades or dismantling any part of the step drive system.

3. The design shall permit running the drive without steps or with a minimum of number of steps for convenience in cleaning and inspection.

4. Color:

a. Steps shall be aluminum color on the tread and riser surfaces on both raised and recessed portion of the surface; black riser surfaces are acceptable if approved.

b. On the step nose, a strip 2 inches wide on the tread and one inch wide on the riser shall be black powder based baked on enamel paint on the recessed portions only of the surfaces.

c. Per ASME A17.1, there shall be demarcation lines on the step tread along the back of the step to delineate the division between steps. These lines shall be marked by a yellow strip a minimum of 1.5 in. and a maximum of 2 in. in width.

d. Per ASME A17.1, there shall be demarcation lines on the step tread along the sides of the step. These side lines shall be marked by a yellow strip a minimum of 0.5 in. and a maximum of 2 inches in width.

5. Steps shall be constructed to be driven by step chains in a manner that will not transmit any of the strain in the step chain to the step.

6. Lock washers shall be used on all tap bolts, and lock washers and lock nuts or an approved alternative shall be on all through bolts.

7. Step guides and skirt panels shall be designed to be sufficiently adjustable to meet and hold maintenance adjustment requirements for the life of the unit. The design goal for skirt panel adjustment shall be 3/32-inch clearance between both side of step and its adjacent skirt, with a maximum allowable not to exceed 3/16-inch.

J. Risers:

1. Risers shall be slotted and designed to interlock and mesh with adjacent step treads to minimize seizure of articles between the riser of one step and the tread of the following step.

K. Treads:

1. Step treads shall be die-cast aluminum, cleat type, with sound deadening coating at the underside of tread, designed to assure a secure foothold and a comfortable tread surface and shall be an integral part of the step assembly.

2. Step treads shall have 1/8 inch wide cleats on 3/8 inch centers, not less than 3/8 inch in-depth and shall be designed to mesh with the comb plates.

3. Step treads shall have a chamfered or radius nosing of 1/8 inch at the riser edge of the tread.

4. Casting drafts shall be eliminated by machining, grinding or other mechanical means.

L. Wheels:

1. Step wheels shall have 100 percent pure virgin polyurethane tires on a sealed hub and bearing. Step wheel bearings shall be of the ball or roller-type, factory-sealed and self-aligning. Bearings shall be rated for severe heavy-duty service, be of the best quality available, and shall be subject to the Authority approval. Four-inch nominal (100mm) diameter wheels shall be located and arranged so as to prevent tilting and rocking of the steps.

M. Comb Plate Assembly:

1. The comb teeth assemblies of the comb plate shall be of a highly wear-resistant, noncorrosive material, with an anti-slip surface.

2. Comb teeth assemblies of the comb plate shall be bright yellow in color and shall clearly contrast with any step demarcations required by code. Finish shall be baked enamel. No plastic comb plates shall be permitted.

3. Comb teeth shall be designed as removable sections, to permit easy replacement without the aid of special tools or equipment. Each assembly shall have a minimum of three and no more than seven comb teeth sections.

4. A method of fine lateral and vertical adjustment of the comb teeth sections shall be provided so that the cleats of the step treads will pass between the comb teeth with minimum clearance. The teeth shall be designed to engage the treads on the escalator steps in such a manner as to reduce to a minimum the dangers of injury to passengers, and prevent breakage and wear of comb teeth caused by interference with step treads.

5. The comb teeth shall be adjusted according to ASME A17.1, but in no case shall the penetration be less than 3/16- inch into the step tread.

6. Two individual safety switches shall be employed for comb impact device assembly on each side of the comb plate landing. One switch and a spring are for vertical force activating device adjustment and the other switch for horizontal force activating device adjustment. These two switches should have a separate spring for adjustment. The vertical tripping force and the horizontal tripping force should be able to adjust independently to maximum allowable force.

N. Landing Plates:

1. Landing and floor plates shall be furnished and installed by the Contractor to cover the entire areas of the upper and lower landings. A frame around the floor openings shall be provided to receive the landing and floor plates. The upper edge of the frame shall enclose the open pit space, be at the elevation of the finish floor and be contiguous with the finish floor.

2. Landing and floor plates shall be reinforced to be rigid. Exposed portions of the landing and floor plates shall be of a material and finish to harmonize with the steps and comb plates. All landing plates shall be sufficiently lightweight and removable, or hinged, for easy access to the machinery and maintenance areas below, and designed in sections of a size and weight capable of being handled by an average person. Landing plate fasteners shall be readily removable by maintenance personnel.

3. The landing plates and floor plates shall be of a wear-resistant, noncorrosive material with an anti-slip surface. The anti-slip surface shall be American Safety Technologies Inc. AS-250 or equivalent and shall be designed for a live load of 250 pounds per square foot. The landing plate shall be installed flush with the adjacent floor area. Deflection with maximum load shall not exceed applicable code. The landing and floor plates of all escalators shall be coated with AS-250, applied per written manufacturer's recommendation, black in color stopping 2 inches from the comb plate.

4. Upper and lower landing plates of each escalator installed in Class A escalator shall have access provided as an integral part of the plate. The supplier shall demonstrate the adequacy of the proposed access to the satisfaction of the Authority.

5. In cases where two or more escalators are installed side-by-side, landing plates shall be designed to allow adjacent escalators to remain operational while work is being performed on an escalator.

O. Metal Balustrades, Newel Panels, Skirt Panels and Decking:

1. Surface panels shall be type 316 stainless steel and at least 0.075-inch (2 mm) thick. The panels shall be reinforced to withstand the specified loads/forces as specified in ASME 17.1. Skirt panels shall match the balustrade panels.

2. Decking shall be reinforced metal with material and finish to match the balustrade and skirt panels. The finish of the face side shall be as specified in the escalator materials legend.

3. Moldings, trim, baggage stops and other miscellaneous metal items shall match the surface to which they are attached.

4. Edges of the balustrade and newel panels shall be sealed against moisture and shall then be framed within a welded aluminum "U" channel except for the facing section. Sections shall be made in equal lengths for interchangeability where practical.

5. The panels shall be designed and fabricated to permit easy removal for inspection, lubrication, and adjustment of safety devices located behind the panels. Panels shall be designed to be individually removable, without the need to remove any other panel.

6. Panels shall be fully engaged and seated in place properly. The top and bottom of each panel shall be covered a minimum of ½ inch to secure the panels and shall be free of rattles.

7. Removal or replacement of the panels shall not affect the escalator mechanical operation in any way. The panels shall be removable without the use of special handling equipment, and by not more than two persons. All panels shall be securely fastened to their respective supports or mating portions to ensure a secure installation resulting in flush surface.

8. Removal of the fasteners shall be with the aid of simple tools. When the framework to which the panels are fastened is less than 1/4-inch (6.35 mm) thick, steel backup plate's 1/4-inch (6.35 mm) thick shall be added with tapped holes and clearance holes where necessary.

9. All paneling, decking, and other enclosures shall be supported on the steel framework. Wood or wood products will not be permitted for use in any part of the escalator.

10. The decking between escalators and deck extensions shall be free draining and shall be designed to support a live load of 100 pounds per square foot (489.3 kilograms per square meter), without "oil canning" of the surface or a deflection of greater than 1/200 of the span.

11. Details for the fabrication and application of baggage stops shall be as shown on the drawings and shall match current system design.

    a. Baggage stops are used only at Double Escalator applications.

    b. The baggage stop is a stainless steel disk, 2 inches in diameter and 2 inches high, fastened to the stainless cladding between escalators by machine screws.

    c. Baggage stops are placed every 24 inches along the plate.

12. The balustrades and decking shall be designed and installed so that the interface to the adjacent well way surfaces does not leave openings which would be in violation of applicable codes, or offer areas of potential entrapment or infiltration of foreign substances.

13. Shear guards of material matching the decking or clear Lexan shall be provided in the intersecting angle of the outside balustrades and the ceiling or soffit where required in order to comply with applicable codes.

14. Provisions for mounting information signs at the upper and lower landings of all escalators shall be made.

P. Neoprene Joint Filler:

1. Lubricant-adhesive: One-part polyurethane, non-staining to adjacent surfaces, as recommended by joint filler manufacturer.

2. Joint filler: Preformed polychloroprene or neoprene joint filler, sized for joint as required; ASTM D2628.

3. Application: Prime and lubricate both sides of joint for adhesion of filler as recommended by manufacturer. Fill joint continuously with joint filler bonded together to form continuous strip.

Q. Cladding and Base Plates:

1. Stainless steel cladding shall be solid as specified in Section 1.05 O, with a fully adhered 3/4-inch thick core of noncombustible, sound-absorbent material and backed with galvanized sheet steel, ASTM A525M, G90 coating or better.

2. Base plates shall be finished to match the cladding and shall be laminated to reinforced, galvanized sheet steel backing 16-gauge minimum. Where sufficient rigidity is achieved and sound decibels are met, design may omit core of sound insulation and backing.

3. Finish panels shall be as specified on the escalator materials legend.

4. All panels shall be secured with concealed screws and shall be of such size and weight (less than 30 pound) that one mechanic can easily remove or replace a panel with the aid of simple tools.

5. All sections shall be made in equal length for interchangeability where practical and for removal independently of the adjacent panels.

6. All necessary steel framework and attachments shall be included for a complete installation.

   a. All openings shall be provided in the above panels as shown on the Contract Drawings and coordinated with the trades.

   b. The cladding shall be designed and installed so that the interface to the adjacent well way surfaces does not leave any openings that would be in violation of applicable codes.

R. Sealant and Accessories:

1. Primer: As recommended by sealant manufacturer; tested for non-staining and durability characteristics on samples of actual surfaces to be sealed.

2. Solvents, cleaning agents and similar materials: As recommended by sealant manufacturer.

3. Backup material: Non-staining, compatible with sealant and primer; and resilient, closed-cell foam sponge rubber, tube or rod stock, ASTM D1056, Class SC-E, Grade SCE 41 for general use, Grade SCE 44 where sealant is subject to traffic.

4. Sealant: Polyurethane; single-component, FS TT-S-227, or two-component, FS TT-S-230; Type I, self-leveling for joints in horizontal surfaces; Type II, non-sag for joints in overhead and vertical surfaces. Color shall match color of surfaces being sealed.

5. Application: Apply products in accordance with manufacturer's printed instructions.

S. Handrails:

1. Handrails shall be of the traction-drive type, and have a return of 180 degrees minimum around the newel. Handrails shall receive their motion from the main escalator drive through direct gearing and drive shaft, auxiliary drive or drive chains designed so that the handrail and steps operate at substantially the same speed in either direction of travel. Handrail speeds shall be synchronized with step speed so that there is no more that plus or minus 4-inch displacement of the handrail with respect to the step in a full run in either direction. Separate or independent handrail drives are acceptable so long as the function specified and the applicable code requirements are met. Handrail lead or trail speed shall not exceed the tolerance defined in ASME A17.1.

2. Provide methods within escalator and approved by the engineer (1) to adjust the slack and tension in the handrail and (2) for releasing tension for repair or removal of handrails. Pre-tensioning of handrail to create traction on drive is not acceptable. Driving and guiding wheels shall be compatible with the design of the underside of the handrail.

3. The handrail drive mechanism shall be designed to operate without slippage under full load condition and, at minimum, maintain no less than 30 square inches of contact with the underside of the handrails at any time.

4. The surface of the newel base adjacent to where the handrail enters or leaves shall be at an angle of 90 degrees with the surface of the handrail. The newel shall be of an extended type designed and constructed in such a manner that the handrail will enter the newel end at a point inconspicuous and difficult for the passengers to reach.

5. Handrails, handrail drive systems and guides shall be so designed and installed that the handrail cannot be physically thrown off or disengaged while running and special design attention shall be given to the area where the handrail passes from the drive system to the guides.

6. Handrail wheels, where used, shall have a bearing material or bearings that have provision for retention of lubricant to insure satisfactory lubrication and operation.

7. Friction drive wheels and idlers, where used, shall be designed and positioned in such a manner that lubricant cannot reach the surface of the handrail. Marking and spotting of the handrail by the drive equipment will not be permitted.

8. The handrails shall be constructed with non-separating stainless steel mesh core laminated with the handrail structure so as to be resistant to the environmental conditions set forth herein and the materials vulcanized into an integral, non-separating, seamless, smooth handrail.

    a. A specially coated finish to minimize the frictional wear to the underside of the handrail shall be provided.

    b. Hand rails shall contain no cotton and shall comply with Fire Protection guidelines specified in Section 1.05 X. 4.

9. The handrail guides shall be continuous on the exposed portion of handrail and shall be constructed of 316 stainless steel which shall not subject to corrosion or pitting, and shall have a polished or specially coated permanent finish to minimize the frictional wear to the under surface of the handrail.

10. Anti-static rollers to prevent static electricity shocks shall be provided at both top and bottom of the escalator. The color of the handrail material shall be black. The material selected for the handrail shall not be subject to swelling or other deformation when exposed to the environmental conditions given in Section 1.05 X. 7.

T. Drive Units:

1. Mount motors and drive mechanisms within truss envelope and/or truss width if positioned below on the floor of the upper machine room. Use single-stage worm gear or planetary gear type drive machine designed especially for moving stair service, with means for determining oil level inside the case and for draining oil, driven by an electric motor, the speed of which shall not exceed 1800 rpm.

    a. The drive machine shall be readily accessible without use of special tools.

    b. The design of movable carriages shall be such that freedom of movement is maintained over the life of the escalator with proper maintenance.

    c. Provisions to access the drive motor and gear boxes individually and also to replace them individually for maintenance and repair without any special equipment are required. The motor should have a bed plate or equivalent method for easy removal during maintenance.

2. Design shafts, where possible, for ease of assembly or disassembly, without use of keyways.

3. If chain drive is used between motors, reduction gears, or other drive mechanism:

    a. Design shall have provisions for tensioning chain.

    b. Drive chain must run in safety housing.

    c. Manual tensioning with automatic lubrication shall be provided.

    d. Chain drive systems, where used, shall use double or triple strand roller chains for transmitting power from the step chain sprockets.

    e. Step chains shall be driven by sprockets connected to the drive machine with a double- or triple-strand roller chain.

4. Drive sprockets shall directly engage the step chain. Intermediate linkages or belt drives are not permitted in the power transmission members.

5. If carriages are required for step chain tensioning, they shall be designed for continued free movement of the carriage under varying chain tensions and with a guide system which prevents skewing or crabbing as the step chain tension is modified. Provide mechanical adjustment and spring-operated device to aid in adjustment of tension. Provide carriages with scale and pointer on accessible section of carriage frame to indicate movement and amount of adjustment available.

6. Position scale and pointer to indicate zero for initial position of carriage, prior to placing in service.

7. The use of timing belts is prohibited.

8. Provide rotating parts with means for lubrication and retention of lubricants. Use sealed bearings in those environmental conditions where entry of water or dust may adversely affect bearing performance. Bearings shall be rated for severe heavy-duty service, shall be the best quality available and shall be subject to the Authority's approval. Protect exposed moving drive elements by removable sheet metal or wire mesh guard or shield assemblies designed to allow for free air circulation.

9. Means shall be install to detect excessive movement/worn on bearings for main drive shaft and carriage. The signals to controller should not affect the operation of the escalator, but just for alarm purpose.

U. Brakes and Sequence of Operations:

1. Each drive motor shall be equipped with one motor shaft brake, which is sufficient to dynamically stop (320 pounds per exposed step) and statically hold a fully loaded escalator (674 pounds per exposed step). This load shall not include any loads imposed by an operating escalator.

    a. The deceleration rate shall be no greater than 3 feet per second squared in accordance with the ASME A17.1 code requirement.

    b. Deceleration rate shall be adjustable to the maximum allowed by the Code.

    c. The stopping distance shall be at least four inches less than the distance between the first skirt panel safety switch and the comb plate.

    d. Under no load conditions, the escalator shall stop in a nominal 10-20 inches with a unit-to-unit variation of no more than 4 inches.

    e. Brakes shall comply with the requirements of ASME A17.1.

2. Each escalator shall have the following brakes for the stopping and locking of the moveable drive components:

   a. A motor brake shall be provided on the motor shaft for shutting down and holding the escalator with the full specified loads upon activation of either

      1) Normal stop control,

      2) Emergency stop button,

      3) Any safety device switch or

      4) Loss of power.

   b. An emergency brake shall be provided on the main drive shaft to stop and hold the fully loaded escalator if the drive chain parts.

      1) The emergency brake shall be electrically interlocked so that when actuated it shall disconnect the motor from the line.

      2) When actuated, the emergency brake shall be reset by means of a separate key actuated switch.

   c. If the main drive unit is directly connected by gearing to the main drive shaft, without a chain or other means of transmitting power that is susceptible to breakage, the emergency brake will not be required. The gearing shall maintain at least 2 teeth in contact at all times.

   d. An apparatus shall be provided to mechanically lock the step chains and prevent movement at such times as repair work is performed within the truss or upon the other brakes.

      1) This apparatus shall be a positive mechanical device that shall be manually engaged to prevent movement of the step chains.

      2) An electrical interlock shall prevent the escalator drive motors from starting while the apparatus is engaged.

   e. Both the motor brake and the emergency brake shall be mechanically or magnetically applied and electrically released. Brakes shall be of a fail-safe design. The Hydraulic brake is not recommended due to the hydraulic fluid entering to friction surface may affect the escalator stopping and holding capability.

   f. The design of the brakes shall provide for easy access to the brake equipment for inspection and maintenance.

      1) The operating temperatures of the brakes shall not exceed 195 degrees Fahrenheit (90 degrees Celsius) above ambient.

      2) Brake torque requirements shall be permanently marked on the brake. The procedure for measuring torque shall be included in the O&M manual.

      3) The brake assembly shall be designed to provide an audible warning indication of brake pad wear (at the 80-percent level of wear) and to prevent restart of the escalator unit on the brake pad reaching an unacceptable wear level as identified by the manufacturer. (Refer to Section 1.05 V. 6. d)

4) The manufacturer shall provide written instructions describing field testing and field measurement of brake torque.

5) Friction surfaces shall be protected from oil, grease, dirt and other substances which would reduce brake friction.

V. Safety Devices:

1. Specific switches and safety devices are required to insure safety during maintenance and to shut down the escalator in an emergency.

2. A disconnect switch capable of being locked in the OFF position shall be provided in the upper pit of each escalator to prevent the starting of the escalator from any other location.

3. All safety devices shall be clearly identified and accessible for maintenance within the escalator. These devices shall be designed for easy adjustment or reset without dismantling the escalator.

4. If an escalator stops because of a malfunction or actuation of a safety device, it shall be impossible to operate the escalator until the safety hazard or malfunction has been corrected. A manual start shall be necessary if the escalator stops for any reason.

5. An EMERGENCY STOP button shall be located according to ASME A17.1 and the Code.

   a. The emergency button shall be a momentary contact-type push button.

   b. This emergency button shall be housed under a clear, high impact-resistant plastic cover, which shall be self-closing by means of a gravity/positive closure cover.

   c. The cover shall have clearly printed upon it, EMERGENCY STOP, in white Helvetica medium-typeface letters, 3/8-inch minimum height.

   d. The cover shall be hinged at the top and lift from the bottom.

   e. The emergency button shall be red in color and visible through the cover.

   f. The cover shall be provided with a switch to set off an alarm when lifted, but it shall be necessary to press the STOP button to stop the escalator. The cover alarm switch shall be a proximity device not requiring mechanical contact to operate.

   g. The alarm shall be continuous for five minutes while the cover is lifted or until manually silenced by the key on/off switch at the operating controls.

6. Each escalator shall be equipped with safety devices in accordance with the Code, any other safety devices appropriate to the specific design; and shall include but not be limited to the following:

   a. Over/Under Speed Device - A device which detects operating speeds of less than 80 percent or more than 110 percent of the rated speed. The device shall operate in both directions.

   b. Step Sag Device - A device that can detect a 0.2 inch (5 mm) out-of-level condition on any step. This step sag device or a separate device shall detect step or axle/chain rollers with diameter reduced 0.2 inch (5mm) or more before steps enter a turnaround or comb plate area.

   c. Skirt Obstruction Device

1) These devices shall be installed behind the skirt panels at the upper and lower landings and intermittently along the 30 incline at distances not to exceed 20 feet.

2) At both the upper and lower landings, these devices shall be located such that the escalator will stop in a distance at least four inches less than the distance between the first skirt panel safety switch and the comb plate.

d. Brake Lining Wear Device - A device which detects a condition when degree of brake wear is such that the brake function cannot meet the requirements of this specification. Activation of this device shall prevent escalator start until the brake has been serviced.

e. Motor Over-Temperature Device – A PTC shall be embedded in the motor windings to detect a motor over temperature condition.

1) When the PTC detects a motor over temperature, the escalator shall shut down and not be able to be restarted until the temperature of the motor has cooled to within design specifications of the motor.

2) Motor Over-Temperature device shall be manually reset type to facilitate investigation of over temperature condition.

f. Motor Temperature Monitor - A device which shall indicate on fault-finding annunciator panel the date and time operational parameters for the motor were exceeded.

g. Provide a monitor/alarm to ensure notification of a disengaged brake during maintenance.

h. A manual locking mechanism shall be provided to secure the step chain during maintenance. This device shall be interlocked such to prevent escalator operation while engaged and may be an integral part of 1.05.V.6.

i. Step Up thrust – A device which detects a condition in which an article becomes wedged between the step tread of one step and the riser of another step while forming a landing. This device shall be provided at both landings.

j. Install skirt deflector devices using threaded steel inserts in the skirt to allow repeated removal and reinstallation.

1) The length shall be the same as skirt panel sections for the straight segments to allow the skirt panel to be removed without disassembling the entire brush.

2) Top and bottom radial segments with end caps and all fittings for a complete installation shall be provided.

3) Fasteners for attaching the strips to the skirt panels shall be selected to be appropriate for the skirt panel construction.

7. After activation, devices as defined in Sections 1.05 V. 6. a through e., inclusive, shall interrupt electric power to the individual escalator motor, automatically apply the brakes and bring the escalator to a stop.

W. Operating Controls:

1. Each escalator shall have a control station (operating controls) at each landing. The control stations shall be mounted on the newels.

2. Interlock shall be provided to require that the escalator be brought to a stop before a direction change is made.

3. Escalators shall have key operated switches, accessible at both upper and lower landings, located on the exterior deck above the newel base. (A separate switch must be provided for direction (UP and DOWN) and stop switch; the stop key switch should be below the direction switch). Alternate locations may be used subject to approval by the Authority. The key shall be Allen-Bradley #D018, Cylinder Model #800T-J631KC1, with 30mm switches. Each keyed switch shall be clearly and permanently labeled, including starting, stopping and direction selection.

   a. Cylinder locks having not less than five disc combinations may be used provided keyway, tumblers, and springs are of stainless steel.

   b. Five (5) keys shall be provided for each station.

   c. Locks and keys shall be provided.

4. Provided no safety devices are activated, manual escalator start from a key switch shall be possible from both landings upon restoration of power following an outage or after the emergency stop button has been inadvertently activated. In the event of escalator shut-down resulting from activation of a safety switch, a start shall be possible from either landing only upon completion of the appropriate corrective action and a manual reset at the controller.

X. Performance Requirements:

1. Escalators shall not generate noise levels in excess of 65 dB measured five feet above the floor or stair level at the entrance comb at either end and along the incline with escalator operating under rated load and no load.

   a. Background noise without the escalator operating shall not exceed 49 dB at the measurement point at the time test measurements are taken.

   b. For multiple escalator installations the noise measurements at each installation shall be made with only the escalator under evaluation operating.

2. All escalators shall be designed using tamper proof fastenings to the maximum degree practicable.

3. Corrosion Protection

   a. The escalator assembly shall be designed and enveloped in a manner to avoid corrosion and galvanic action due to physical contact between metals or other causes. Trusses shall be hot dipped galvanized.

   b. Where the use of adjoining dissimilar metals is required, the descriptions of protective measures to be employed shall be provided to avoid corrosive damage.

4. Materials of construction shall be noncombustible (as defined in ASTM E136) and the design shall produce a fire-resistant installation. Handrails shall have a flame spread rating of 76 to 200 when tested in accordance with ASTM E84. Lubricants shall be selected to obtain the highest practicable flashpoint, consistent with other requirements. Fire control means shall be non-hazardous to human life and shall be approved by the Authority.

5. In addition to the minimum requirements given in the Codes, the Contractor shall design the steps for a minimum load of 320 pounds load with an ultimate strength safety factor of eight. The steps shall carry the load under maximum, concentric and eccentric loading conditions without distortion.

6. Step Testing

   a. Step assemblies shall be tested in accordance with ASME A17.1 STEP FATIGUE TEST requirements, Sections 8.3.11.1 through 8.3.11.6, as a minimum. The Contractor shall furnish a certification by a Professional Engineer an actual copy of the test report. The step assemblies shall be a sample test for each lot so that the manufacturer guarantees compliance with the fatigue requirements. Step castings will be permanently marked to identify casting source, casting date, assembly and installation.

   b. Perform dynamic testing, witnessed by the WMATA representatives and, to verify the structural strength and serviceability requirements and submit certified test results. Testing shall include the tests necessary to verify the structural capacity of the step.

7. All escalators shall be designed to operate at full specified performance in temperature ranging from minus 10 degrees Fahrenheit to 140 degrees Fahrenheit dry bulb while exposed to sunlight, rain, snow, slush, debris, airborne dust, tracked on deicing substances, and maximum patron loading.

8. Controllers shall be designed to operate in a temperature range of 32 degrees Fahrenheit to 140 degrees Fahrenheit dry bulb.

9. Unintentional abuse by patrons and vandalism shall be a consideration in the design of the escalator.

Y. Maintenance Pendant Control Station

1. The escalator shall be equipped with the inspection mode to be operated by using the hand held pendant control. Contractor shall provide Plug-in connection points for the pendant handset at both ends of the escalator within the truss enclosure beneath the landing plates. When plugged into the receptacle, there should be no means of operating or permitting the escalator to run other than through the use of the hand held control. The hand held pendant control shall be used for any service procedure and inspection of the escalator with slower speed.

2. Safety switches shall not be bypassed on inspection mode except missing step sensor, handrail monitoring device, and degradation switches. When safety switch tripped during the inspection mode, the control circuit shall be interrupted and unit must stop immediately. When the switches are released, the unit should be able to move using a hand held pendant control without requiring a reset at the controller. The hand held pendant shall be equipped with:

   a. One “STOP” Push/pull button (RED)
   b. Two continuous pressure pushbuttons “UP” and “DOWN”
   c. One continuous pressure pushbutton “ENABLE”.
   d. Buttons shall be flush-mounted with the enclosure to reduce accidental operation
   e. The contact Blocks for buttons shall be mounted securely in pendant control enclosure.
   f. The hand held pendant control shall have 10 ft. cable.
   g. Maintenance plug shall be equipped with:
      a) Single locking lever.
      b) 80mm width by 28.9mm height

c) Shall have a total of 6 poles with three of the poles used for direction command by handheld station as follows.
   i. Pin “1” shall be the supply voltage for control station
   ii. Pin “2” shall be to initiate UP direction and
   iii. Pin “3” shall be to initiate DOWN direction
d) The female insert shall be Han E 06 Pos. F Insert Screw with Harting part number 09 33 006 2701.
e) The opening of the inspection station cover shall disable automatic operation of the escalator.

1.07 SITE CONDITIONS

A. General:

1. During installation and until the Final Acceptance, the escalators may be subjected to more extreme environmental conditions. Furnish the amount of protection necessary, and to the satisfaction of the WMATA to prevent any damage or deterioration to the escalators during this period.

1.08 WARRANTY

A. Warranty: Two (2) year warranty of construction shall start at Final Contract completion.

B. The OEM shall warrant in writing that all equipment manufactured and installed under this specification, for a period of twenty four (24) months from the date of Final Acceptance by the Authority, be free of defects in design, materials, and workmanship, under normal use and service. Defective work shall be repaired or replaced at no additional cost to the Owner.

C. The warranty shall include materials and labor necessary to correct defects.

D. The warranty does not begin until all of the following requirements have been met;
   1. The Operations and Maintenance Manuals are accepted by WMATA.
   2. The required training has been completed to the satisfaction of WMATA.
   3. All field tests have been successfully completed.
   4. The acceptance testing has been successfully completed.
   5. The escalators are in service for passenger/public use.
   6. The State and local jurisdictions have inspected the escalators and issued the respective certificates of Operation.
   7. All spare parts have been delivered and received by WMATA.
   8. Any discrepancy identified by the ELES representative shall be repaired or replaced by the Contractor at no additional cost to the Authority.

1.09 OPERATION AND MAINTENANCE TRAINING

A. A classroom training program shall be developed to instruct WMATA Operations and Maintenance personnel in the operation and maintenance of escalator equipment. The following training requirements shall be met:

1. Three days of classroom plus two days hands on training on the field shall be provided for 10 students per class. Six training session for a total of 60 students is required.
2. Time and place of training will be determined by the Authority, but must be completed no later than 30 days prior to the Final Completion.
3. Training shall be organized to make optimum use of the required maintenance and operation manuals including training for replacement of all parts contained in the Parts Inventory list.
4. Training materials reflecting the final installed equipment configuration shall be submitted to support continued in-house WMATA training. Photos of actual equipment shall be included to support training materials.
5. On-site training may be included and/or supplemented with mock-up equipment, as appropriate.

B. Scope of Work:

1. All training, as described below, shall take place prior to Final Acceptance of equipment or materials. Operations and maintenance training may take place as a combined class by agreement of the Office of Elevators and Escalators (ELES). The minimum number of ELES employees to be trained will be 60 total with a maximum of 10 in each class. Those persons will be identified by WMATA. The contractor shall video tape all training sessions and provide WMATA/ELES with edited copy of the recording. The video shall be edited for the purpose to be used as a training guide for other WMATA/ELES mechanics.
2. At the completion of the first training session, a narrated and properly edited training video shall be submitted for the Authority on DVD or flash drive. The video shall be taken by the professional camera operator with quality image and sound track and will be used for the future trainings. The video shall cover operation of the Escalator function of the devices, maintenance, adjustment procedures and troubleshooting. The following items shall be included as minimum requirements:
    1) Step by step adjustment procedure on the followings:
        1.1 Handrail system including drive chain
        1.2 Comb Impact device
        1.3 Escalator Brake
        1.4 Bottom Carriage ...
        1.5 Drive and motor alignment
        1.6 Safety switch adjustment and clearance
    2) General overview of major items:
        2.1 Motor:
        2.2 Gearbox:
        2.3 Bull gear and Carriage system
        2.4 Controller:
        2.5 Controller display:
        2.6 Brake mechanism
        2.7 Escalator pit
        2.8 Handrail system
        2.9 Guide rails
        2.10 Automatic oiler

3) Daily operation and sequence of operation
4) Replacement and Installation of components:
   4.1 Brake
   4.2 Balustrade panels
   4.3 Escalator steps
   4.4 Handrail Drive chain
   4.5 sensors
5) Proper step and chain guide adjustment
6) Verification of safety circuit
7) Maintenance procedure and Frequency of maintenance
8) Proper access of pit and step band
9) Proper test of over/under speed operation
10) Proper lubrication of components
11) Troubleshooting techniques
12) Proper clearance check between the skirt and balustrade panels.

3. Operations training shall be tailored specifically to the furnished and installed equipment, and designed to teach the day-to-day operation of all equipment. The training shall be sufficient to bring personnel to a level of operating proficiency such that routine vendor support is not needed.

4. Maintenance Training shall be tailored specifically to the furnished and installed equipment, and designed to develop the knowledge and skills required to maintain all item(s) delivered. Maintenance training shall be subdivided into two major levels as follows:

   a. System Level Maintenance Training, covering:

      1) Theory of operation of the system and its major components.

      2) System configuration.

      3) Preventative maintenance, consisting of written procedures and schedules for the periodic maintenance of all equipment.

      4) Written and validated inspection procedures and a system-level trouble-shooting guide (to the lowest field-replaceable unit).

   b. Shop Level Maintenance Training, covering:

      1) Detailed theory of operation to module, board, and/or device level.

      2) Component level troubleshooting and component replacement.

      3) Testing and alignment procedures of repaired units.

C. Deliverables:

1. The following course materials shall be delivered by the Contractor, according to the following specifications:

a. An Instructor's Guide containing all the information and direction necessary for the instructor to make an effective presentation. It shall include adequate guidelines to conduct a comprehensive training program. Individual lessons within the course shall be organized as separable blocks (or modules) which may be taught as a unit. In some instances, the same module may be used in more than one course. The Instructor's Guide shall contain, as a minimum:

1) Discussion of student prerequisites (if any).

2) Program overview.

3) A statement of overall program goals.

4) Lesson plans (a session-by-session outline containing the following):

a) Student learning objectives, stated in measurable terms.

b) Overview of each lesson.

c) Suggested instructional methods/learning activities.

d) Required equipment and resources. Special training equipment, test equipment or special tools required for maintenance training shall be supplied by the Contractor and delivered to the Authority's representative after completion of the course.

e) Evaluation Device(s), (written and/or practical tests) designed to measure the extent to which students have met the learning objectives with an answer key for each of the tests developed.

b. A Student Manual including all materials for the student to interact in the learning situation. It shall contain, as a minimum:

1) Program overview and introduction.

2) Statement of overall program goals.

3) Learning objectives, stated in measurable terms that specifically describe desired behaviors or knowledge to be gained.

4) A fully developed prose treatment (not outline format) of content presentation, developed in the same modular format as the Instructor's Guide.

5) Illustrations, charts, photos or other graphics of actual system components, as needed to enhance content presentation.

6) The training manuals shall be prepared and submitted for approval prior to training. The training manuals shall include procedures for adjustment and replacement of all electrical and mechanical components, and a troubleshooting guide.

c. Audio-visual Aids consisting of:

1) A narrated video of not less than 90 minutes duration to include, but not limited, to the following:

a) General overview of major features.

b) Daily operations.

c) Maintenance procedures (lubrication, adjustments, critical measurements, etc.).

d) Frequency of maintenance procedures.

e) Parts replacement, safety device, lighting, etc.

f) Verification of safety circuits methods of accessing and preserving computerized functional data if required.

g) Handouts, transparencies and/or slides as necessary to ensure clear and comprehensive presentations.

h) The training video shall be taken from actual equipment installed under this contract by the professional camera operator.

d. Supplemental Materials consisting of a functional mock-up or a functional representation is required of any equipment which requires theoretical discussion. This may be in the form of an animated schematic, a model of the equipment, an actual device, an interactive video training device, or an Engineer approved substitute. All mock-ups shall become the property of the WMATA.

D. The final copies shall be delivered to the Airports Authority as follows:

1. One complete set of training materials that is completely camera-ready. Camera-ready copy is defined as typewritten or typeset originals or high-quality copies such that further copies can be made from them with no noticeable decrease in copy quality.

2. Five copies of all student and instructor materials, to be used for archival purposes in the WMATA Technical Library.

3. A set of complete student materials such as O&M manuals, Training manuals, and training guide for each participant enrolled in training classes.

E. The following specifications shall be met in instructional delivery:

1. Instructor Qualifications. A description of instructor qualifications, a resume, curriculum vitae, or other description of instruction qualifications must be submitted at least 60 days prior to the presentation of training. The ELES Engineering Office will review and approve the Instructor candidacy.

2. The description shall document a thorough knowledge of the equipment being taught, an understanding of the adult learning process, and demonstrated experience in vocational instructional.

3. Course length. The length of the course shall be 5 working days with 3 days classroom training and 2 days hands-on training on the field.

4. Student qualifications. For the purposes of course development and presentation, vendors shall assume all WMATA students are high school graduates (or equivalent), and that maintenance personnel will possess the ability to use basic hand tools and electronic test equipment.

5. Testing. Instructors must give written and/or practical tests as a measuring device to determine knowledge transference. Tests shall use a multiple-choice or short answer format, and have been validated in a pilot course or by some other means agreed to by the Authority. Whenever possible, a practical hands-on test shall be developed to demonstrate the transference of operational/ mechanical skills.

1.10 SPARE PARTS AND SERVICE FACILITY

A. At the expiration of the warranty requirements of the General Provisions, the Contractor shall provide a spare parts and service facility in the United States at no additional cost to the Authority from which all manufactured parts and components of the equipment furnished and installed under this Contract can be obtained for an additional five years. If product source is another vendor, Contractor shall include name and address of other vendor.

B. Spare Parts and Special Tools:

1. This provision requires the furnishing of a Recommended Spare Parts and Special Tools List based on manufacturer's recommendations; defines criteria to be used in developing spare parts recommendations; defines the manner of identifying spare parts on the list and the labeling and identification of spare parts upon delivery; and the timing of delivery of spare parts.

2. Escalator parts list shall be grouped by system and subsystem for stocking identification and the list shall contain the following information for each item listed:

   a. Component name and Part number(s)

   b. Manufacturer's name

   c. Model number(s)

   d. A blank column for WMATA's part number

   e. Manufacturer's recommended quantity (see Section 1.09 3, below)

   f. Anticipated annual usage

   g. Unit price

   h. Available packaging

   i. Special storage and handling requirements

3. The manufacturer's recommended quantities shall be based upon the following reliability, usage and lead time considerations:

   a. Wear: Components which may be expected to require replacement under normal maintenance schedule and operations, such as mechanical parts subject to continuous operation within the projected mean time between failure levels.

   b. Consumables or Expendables: Components which are consumed, used up, destroyed, or upon failure, are otherwise made unusable for their intended purpose and are economically unrecoverable except for inherent scrap value.

   c. Recoverable or Repairable: Components which, upon failure, are capable of being repaired or remanufactured to a serviceable, operational condition and maintained available for use within their initial intended purpose.

   d. Long Lead: Components which are not available at short notice from commercial distributors or within 48 hours from the manufacturers, such as specifically made or selected components.

4. Cross referencing: Where replacement components are common to more than one system or subsystem, include a cross reference and indexing system in the replacement components list:

5. Non-Unique parts: In all components lists, items which are not unique to the system and have been manufactured by others shall be identified by the manufacturer's name and part number.

6. The Contractor shall propose and provide a spare parts inventory to be approved by the Engineer and provided to the Authority not less than 90 days prior to scheduled completion, equal in value to seven percent of the cost of each Escalator.

B. The Authority will provide shipping instructions, with WMATA part numbers for each item. The parts shall be shipped to the locations as directed by the Authority. Shipping documents shall identify the Contract number, manufacturer's part number, quantity, unit price and WMATA part number.

1. Spare parts shall be properly packaged or crated so as to prevent damage during shipment and long-term storage. An individual packing slip shall be included inside the package or crate.

2. Spare parts shall be the same in all respects as their counterparts furnished as a part of the assembled equipment to be delivered.

3. Parts furnished in accordance with this provision are WMATA spares, separate and distinct from any Contractor obligation to replace parts, components or assemblies under any warranty provision.

4. Parts lists contained in Operations and Maintenance Manuals provided under the Contract shall include assigned WMATA part numbers.

5. A Manufacturer’s Recommended Spare Parts List shall be provided. Parts to be provided shall be based on the criteria described herein and require Authority approval and shall be provided prior to Final Acceptance.

6. Any Special Tool(s) used including, but not limited to, troubleshooting, maintaining the Escalator, software and/or hardware shall be provided as part of the spare parts to the Authority. Any tools provided shall be the same as those issued to the Adjuster and equivalent members of the subcontractor’s staff.

C. Security of Machine/Control Rooms:

1. The Contractor shall be responsible for the security of the contents of each machine/control room. The Contractor shall control access to that room, and ensure that it shall remain secure at all times until the completion of the Contractor’s interim maintenance obligation.

1.10 SPECIAL TOOLS

A. A complete set of special tools and instruments necessary for troubleshooting, maintenance, repair and making all adjustments on every part of the Escalator installation, including software and hardware shall be furnished for each escalator and delivered to the Engineer as part of the spare parts inventory. Tools that are designed specifically for tasks associated with Escalator inspection, maintenance and repair or that are required for these tasks, and are not readily available through normal purchasing channels are defined as special tools.

B. Any “Special Tool/ equipment” that is required to troubleshoot, maintain, adjust, and test the system; the tool/equipment shall remain operational for the life of the equipment.

a. Provide all special tools and equipment necessary for making all system adjustments to the controller and other equipment. A programming unit, approved by equipment manufacturer (OEM) such as a new laptop with 4GB memory, 15-inch display and DVD drive, with all software packages required to setup and program all equipment in the Escalator system shall be provided, one per station or location. Software shall be provided for the display unit, Device Net, motor drive, if applicable, and any other programmable devices, as well as for the controller PLC. Any hardware or software required for configuring, programming and or communicating to controller or any parts of the escalator shall be submitted to ELES engineering. Using the provided laptop, the contractor shall demonstrate loading, downloading (programming) any and all software that is required for the escalator for all operating needs. This includes display, PLC and any I/O controls. All special tools shall be new and to be provide with casing. No special tools with decaying circuits or clocks are permitted. All application programs included in this escalator shall be the property of WMATA and shall not be considered proprietary to OEM.

C. Keys: Provide ten (10) sets of keys per escalator to operate all keyed switches and locks prior to completion of the first unit.

1.11 AUTHORITY COORDINATION:

A. The escalators shall not be in service for passenger/public use until all of the following requirements have been met.
1) The Operations and Maintenance Manuals have been approved and received by WMATA.
2) The Training and Student Manuals as well as video record of all training sessions have been approved and received by WMATA
3) The required training has been completed in accordance with this specification.
4) All field tests have been successfully completed.
5) The acceptance testing has been successfully completed.
6) All spare parts have been delivered and received by WMATA.
7) All Special Tools/Equipment and Software have been delivered and received by WMATA.
8) All discrepancies identified by the WMATA's CEI (Certified Elevator Inspector) representative shall be completed.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. All escalators shall be the product of a single of three manufacturers.
1. KONE
2. Schindler
3. ThyssenKrupp
4. Approved Equal

2.02 MATERIALS

A. Except where product conformance to specific standards is indicated, and in ASME A17.1, manufacturer's standard materials and equipment may be used in escalator construction, subject to approval by the Authority. Materials cited below are intended to establish the standard of quality for comparable materials if used by the manufacturer. Noncombustible materials shall meet the requirements of the National Fire Protection Association (NFPA), Fire Protection Handbook.

B. Structural Steel:

1. Rolled Steel Sections, Shapes, and Rods: ASTM A36.

2. Tubing:

a. Cold formed: ASTM A500.

b. Hot formed: ASTM A501.

3. Sheet Steel: ASTM A653, Grade B, zinc coated.

C. Stainless Steel:

1. Shapes and Bars:

a. ASTM A276, Type 304 or 301 for non-exposed components and Type 316 for all finish panels and exposed components.

2. Plate, Sheet, and Strip:

a. Over 1/8 inch, ASTM A264 with ASTM A240, Type 316 on ASTM A36 base

b. Less than 1/8 inch, ASTM A167, Type 304, or Type 316 for all finishes panels and exposed components.

3. Pipes and Tubes: ASTM A312, Type 304, in accordance with the following:

a. Welded connections: Schedule 10 minimum.

b. Screwed connections: Schedule 40S minimum.

c. Press fits: Schedule 5S minimum.

D. Cast Aluminum: ASTM B108, Alloy ANSI 356.0, T6 or comparable materials meeting the strength and performance requirements specified.

E. Extruded Aluminum: ASTM B221, Alloy 6061, and T6.

F. Fasteners:

1. Provide bolts, nuts, washers, screws, rivets, and other fastenings necessary for proper erection and assembly of work in accordance with ASTM A325 or ASTM A490. Fasteners shall be compatible with materials being fastened, comply with buy America requirements, and shall be tested and certified based on appropriate sampling.

2. For exposed fasteners, ensure that fasteners match adjacent material in appearance, finish, and color, and are countersunk to achieve a smooth, uniform surface, unless otherwise indicated. In any case, surfaces exposed to passengers shall be snag free. If screws are used in an exposed location, use tamperproof screws to the maximum extent possible, otherwise use Phillips flathead type.

a. Fasteners shall be compatible with materials being fastened.

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

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

G. Welding Material: AWS D1.1, type required for structural steel materials being welded.

H. Welder's qualifications shall be certified in accordance with AWS D1.1 or equivalent, internationally recognized standard.

I. Neoprene joint filler: As specified in paragraph 1.05.P.

J. Handrail material: As specified in paragraph 1.05.S.

K. Sealers, Paints, Coatings, Lubricants and Other Similar Materials:

1. The least hazardous material or substance that will effectively perform the required function shall be selected. Submit MSDS information for all potentially hazardous materials, for approval.

L. Balustrade shall be made of the following materials:

1. All locations shall be used Stainless Steel

M. Decking, Newel and Skirt Panels:

1. Stainless Steel

N. Outer Cladding Panels:

1. All locations shall be use Stainless Steel

2.03 EQUIPMENT

A. Electrical:

1. Electric equipment for all escalators shall be designed, selected, and fabricated in accordance with NEC, NEMA, IEEE, and ANSI standards as applicable, and as specified herein. All equipment including motors, controllers, switches, indicators, circuit breakers, panelboards, lighting, heating, wiring, conduit, boxes and other appurtenances for proper installation and operation of the escalators shall be furnished and installed.

a. One 480/277-volt, 3-phase, 4-wire, or 480-volt, 3-phase, 3-wire, 60-Hertz power feeder will be provided in each Escalator control room by others. Power feeder will be sized to include the total load of combined escalator drive systems, controls, and heating. The Contractor shall provide necessary power distribution from the junction box to the individual escalators, including all disconnect switches, wiring, and electrical equipment necessary to make complete and operable escalator systems.

b. One auxiliary 208/120-volt, 3-phase, 4-wire, or 120-volt, 1-phase, 2-wire 60-Hertz feeder for lighting and receptacles will be provided in each control room/space by others. The feeder is used for escalator balustrade lights except as noted below for the emergency feeder.

c. One 120-volt, single-phase 2-wire, or 208/120-volt, 3-phase, 4-wire, or 208/120-volt, 1-phase, 3-wire 60-Hertz emergency feeder will be provided by others. Emergency feeder shall be used as necessary for maintenance service lights, comb lights, and step demarcation lights, and 20 percent of the other escalator lights.

d. Equipment grounding conductors with each of the three escalator feeders will be provided by others and terminated in the junction box. The equipment grounding conductors shall be provided from the junction boxes for all feeders and branch circuits as shown and required. Electrical equipment shall be provided with a minimum of two ground paths. One path shall be a green, insulated equipment-grounding conductor. The second path shall be a connection, to grounded metallic items using metallic fasteners, metallic conduit and/or bonding jumper. Provide a #6 AWG insulated grounding conductor attached to each truss and running back to the main feeder junction or tap box and spliced to the equipment grounding conductor run with the feeder wires. On escalator, bond exposed metallic items, ac equipment enclosures and lighting fixtures to grounded escalator metallic structure with metallic fasteners as shown. Only escalator parts shall be used the ground bond or ground bar located inside the escalator truss.

e. All necessary steps shall be taken to ensure the flow to ground of accumulated static electricity, by means of metallic rollers or other appropriate means installed at appropriate locations to prevent potential at all times at all points along the handrails.

f. Grounding and bonding all parts of the escalator metallic structure, truss, equipment and raceway shall be in accordance with the applicable requirements of the NEC and the codes and regulations of the jurisdictional authorities.

g. All wires in controller or junction boxes shall be identified and a permanent label shall be placed to match with terminals number. The terminals shall have permanent labels. Wires to relays or connected any other devices must be marked and identified. Wires shall have inserted labeling and heat shrank to match with terminal labeling and schematic diagram.

2. Temporary Power Supply

a. The Contractor will provide temporary power for Contractor’s use.

3. Conduit Boxes and Fittings:

a. All wiring for escalator equipment and control devices is in GRS conduit or liquid-tight flexible conduit.

b. Rigid conduit and fittings shall be UL-approved galvanized steel conforming to the requirements of UL 6 and ANSI C80.1. The minimum size shall be 3/4-inch for power circuits and one-inch for control circuits. Power and control circuits shall be in separate conduits.

c. Liquid-tight flexible conduit shall conform to the requirements of UL 360 and consist of a flexible hot dip galvanized steel core spiral wound with continuous copper ground built in the core for sizes up to 1-1/4 inch and a neoprene jacket overall. Sizes 1-1/2 inches and above shall be installed using a separate ground wire. Fittings for flexible conduit shall be watertight and shall conform to the requirements of UL 514B.

d. Outlet boxes shall be watertight, stainless steel for exterior units and galvanized malleable iron, cast iron or ductile iron for interior units conforming to the requirements of UL 514A. Wiring device cover plates shall have weatherproof construction. Junction and pull boxes shall be non-metallic NEMA 250 Type 4X conforming to the requirements of UL 50 and UL 514A and having screw covers with liquid-tight gaskets.

e. Provide NEMA 250 Type 4X waterproof fittings, watertight hubs and appurtenances as required by the installation to preclude the entry of water or moisture into the system.

f. Junction Boxes with electrical circuit boards and/or terminal blocks shall not be installed inside the step band. All junction boxes shall be NEMA 4X and shall have easy access for maintenance.

g. All boxes shall be accessible without removal of steps and installed behind removable balustrade panels as recommended.

h. All non-metallic boxes shall have a reinforcement plate on sides where conduits enter.

4. Cable and Wire:

a. Cable and wire for external circuits between various items of escalator equipment shall be sized for their respective duties, shall be installed in galvanized rigid steel or liquid-tight flexible conduit, shall be continuous with no splices between electrical boxes and electrical equipment and shall have the following requirements:

b. All conduits (rigid steel and liquid tight flexible) shall be permanently secured with metallic clamps. Zip ties are not acceptable for permanent use.

c. General Requirements for Single-Conductor and Multiple-Conductors Cable:

1) All wires shall run inside conduits. Wires and cables shall not be spliced inside or outside of conduit. Wire and cable shall only be connected at terminal strips or devices inside boxes or approved enclosures.

2) Type and size: As shown or as required by code, #12 AWG minimum size.

3) Rated voltage: 600 volts.

4) Conductors:

a) ASTM B3 or ASTM B8 annealed copper.

b) Size 10 AWG and smaller: Solid or Class B or Class C stranded.

c) Size 8 AWG and larger: Class B stranded.

5) Standards: Except as modified, wire and cable complying with the following standards:

a) Cross-linked polyethylene (XLPE) insulated cable: NEMA WC 70.

b) Other Cable: NEMA WC 70.

c) Nonmetallic jacket for single-conductor cable and individual conductors of multiple-conductor cable and as overall covering on multiple-conductor cable.

d) Chlorosulfanated polyethylene or cross-linked polyolefin.

i) Tensile strength, minimum pounds per square inch: 1,800.Tensile strength, minimum percentage of unaged value: 100.

ii) Elongation at rupture, minimum percent: 150. Elongation at rupture, minimum percentage of unaged value: 80.

iii) Aging requirements: After 168 hours in air oven test at 100C, plus or minus one degree Celsius.

iv) Oil immersion: 18 hours at 121C, plus or minus one degree Celsius, ASTM D471, Table 1, No. 2 oil:

(a) Tensile strength, minimum percentage of unaged value: 80.

(b) Elongation at rupture, minimum percentage of unaged value: 80.

e) Jacket materials other than cross-linked polyolefin complying with NEMA WC 70. Jacket material free of PVC and PVC-based compounds.

6) Flame retardancy: Single-conductor and multiple-conductor cable demonstrating flame retardancy in accordance with the following:

i) Single-conductor cable and individual conductors of multiple-conductor cable passing vertical flame test in accordance with UL 1581 and/or NEMA WC 70. Cable size for testing: 14 AWG.

ii) Single-conductor cable and individual conductors of multiple-conductor cable, passing vertical tray flame test, using ribbon gas burner in accordance with IEEE 1202. Multiple-conductor cable passing vertical tray flame test using ribbon gas burner in accordance with IEEE 1202.

7) Applied voltage testing:

a) Single-conductor cable and individual conductors of multiple-conductor cable to be given applied ac voltage dielectric strength test, after six-hour water-immersion test.

b) For single-conductors of multiple-conductor cable, conduct tests prior to assembly as multiple-conductor cable.

c) Test procedures:

i) Polyethylene insulated conductors: In accordance with NEMA WC 70.

ii) Other conductors: In accordance with NEMA WC 70.

d. Single-Conductor Cable:

1) Insulated with ethylene-propylene-rubber with non-metallic jacket or unjacketed filled cross-linked polyethylene. UL-labeled Type RHW or XHHW.

2) Color coding: In accordance with paragraphs 200-6, 200-7 and 210-5 of the NEC.

e. Multiple-Conductor Cable:

1) Individual conductors:

a) Number of conductors: As required.

b) Construction: Complying with one of the following:

i) Insulated with ethylene-propylene- rubber, with or without nonmetallic jacket.

ii) Insulated with composite compound of ethylene-propylene-rubboard polyethylene, UL Class EPCV, without outer jacket.

iii) Insulated with filled cross-linked polyethylene without jacket.

c) Phase and neutral conductors: Individually insulated.

d) Neutral conductors: Same size as phase conductors.

e) Bare ground conductors: Sized in accordance with the NEC, unless otherwise shown.

f) UL-listed as Type RHW or XHHW.

2) Conductors assembled with non-wicking, flame-retardant filler to form cable of circular cross section.

3) Metallic-sheath: Provide one of the following:

a) Size 1AWG and larger:

i) Interlocked aluminum tape armor.

ii) Continuous corrugated aluminum sheath conforming to NEMA WC 70.

b) Size 2AWG and smaller: As specified for 1AWG and larger or continuous smooth aluminum sheath conforming to NEMA WC 70.

f. Multiple-conductor cable provided with overall nonmetallic jacket as specified.

g. Cable UL-listed as follows: Metallic-sheathed cable: Type MC, suitable for wet and dry locations.

h. Color coding:

1) Power cables: In accordance with paragraphs 200-6, 200-7 and 210-5 of the NEC.

2) Control cables: In accordance with NEMA WC 70.

5. Fixture Wire: UL 62, with the following additional requirements:

a. Type: To suit temperature rating of lighting fixture, minimum 90C

b. Conductor: Stranded copper conductor 16AWG or larger.

6. Bare Conductor: ASTM B3 or B8 annealed copper conductor; 8AWG and larger, Class B stranded.

7. Connectors, Terminal Lugs and Fittings:

a. In accordance with UL 486A.

b. For 10 AWG and smaller conductor cable: Tin-plated copper pressure connectors with nonflammable, self-extinguishing insulation grip with temperature rating equal to that of conductor insulation.

c. For 8 AWG to 4/0 AWG conductor cable: Tin-plated copper compression connectors and terminal lugs with insulating sleeve or heat shrinkable insulator for insulation grip.

d. For 250 KCMIL and larger conductor cable: Long barrel double-compression tin-plated copper connectors and terminal lugs with two-hole pad.

e. For multiple-conductor cable: Watertight aluminum fittings with stainless steel pressure ring and set screws or compression cone for grounding of aluminum sheath of Type MC Cable.

f. Terminal lugs used for bonding connections to metallic structures shall be installed on bare/uncoated metallic surfaces to assure minimum contact resistance.

8. AC Drive Motors: Motors shall have TEFC enclosures and be rated for inverter use on 480 VAC, three-phase, 60-Hertz power. The follow characteristics shall also be provided:

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

b. Motor characteristics shall include: heavy gauge steel and cast iron frames, ball bearings, inverter spike resistant windings, low-loss electrical grade lamination steel, dynamic balancing for vibration no greater than half the NEMA vibration standard, continuous duty rating, service factor of 1.15 and have a rated efficiency at full load of greater than 91%.

c. Motor leads in the conduit box shall have the same insulation class as the windings. Motor lead wire shall be rated 125 C and shall be sized for 105 C at the motor nameplate amperes at 1.0 Sf per EASA recommendations. Leads shall be securely labeled.

d. The motor shall be provided with a ring or other suitable lifting means. A sliding base shall be provided for motors other than direct coupled.

e. Motors shall be provided with a compression type grounding lug, the same size as motor leads, mounted in the conduit box by drilling and tapping into the motor frame or by a double ended silicon bronze cap.

9. Controller:

The controller shall utilize an Allen Bradley PLC incorporating the Compact Logix 1769 L32E based PLC module, or higher. The controller, the variable-voltage variable frequency (VVVF) motor drive as well as any brake controller shall be located in a readily accessible Escalator control room. The controller shall be mounted in a NEMA 4X stainless steel air-conditioned cabinet within the controller room, and include all surfaces being painted, drip-proof venting, and lockable doors. The door of the cabinet shall have a sealed window placed over the fault indicator board within. Controllers shall include the PLC components, control relays, fault indicator, and all other functions of escalator controls.

a. Variable-Voltage Variable-Frequency Drive: The escalator shall be started and continue to run with drive motor power provided by an appropriately sized variable voltage, variable frequency AC motor drive with regenerative drive. Motor contactors shall be installed to meet code requirements when running off a solid state drive. Accommodation shall be made to set a second maintenance-operation speed in the solid state drive. The VVVF drive and drive motor shall be capable of over speeding the escalators by 40% for test purposes. There shall be no bypassing of the solid state motor drive for normal operation or maintenance operation. The drive and associated components can be housed in a separate NEMA 4 enclosure.

b. PLC Escalator Control: The Allen Bradley Compact Logix 1769 L32E controller shall provide logic for all required operation of the escalator including control of the VVVF drive, braking control, safety device responses, maintenance operation and control inputs from key switches.

c. All controller enclosures shall be NEMA 4X rated. All enclosures shall be provided with strip heaters controlled by a humidistat mounted within the enclosure.

d. The top side of the controller enclosure shall not be drilled for any reason; liquid tight and any other connectors to the controller shall be installed half way below the controller or at the bottom side of the controller.

e. The controller room/space shall have adequate lighting. Lighting shall be a minimum of 19fc measured at the floor level.

f. Specific capabilities shall include:

1. The CPU module must provide DH-485 and/or RS-232 Communication ports. In addition, the contractor shall install an Allen Bradley network interface module, (Model 1761-NET-AIC, or approved equal) beside the PLC in the controller and provide 24 VDC power to the Module. The Allen Bradley PLC will be used for Remote monitoring capabilities into WMATA Established engineering monitoring network. All required coordination for wiring and programming on the PLC and the DH-485 network shall be made with WMATA ELES Engineering. Contractor shall pull all Remote Monitoring cables to the interface in the escalator controller from the pull box in the upper or lower pit area.

2. The Programmable Controller shall have one serial port open to support accessibility to ladder logic and provide data to the remote monitoring network.

3. The exclusive Allen Bradley DH485 protocol data port will transmit data from the escalator controller to the station or facility data concentrator. The contractor shall provide a controller data interface to a DH 485 network located in the escalator controller room. Data cables in an existing controller or in the escalator controller room shall be retained and connected into the new controller and available for connection to the controller DH485 interface. If DH485 cabling is not available, the contractor shall run

run Belden 9842 cable or approved equal, to connect the controller into the monitoring DH485 network as directed by WMATA . The DH 485 controller interface shall be programmable for data rates up to 115 Kbps. The interface shall allow other nodes such as other elevator and escalator to be readily incorporated into the DH 485 network.

If not already installed in the station or facility, a data concentrator PLC shall be installed using an Allen Bradley Compact Logix 1769 L32E or SLC5/05 PLC per station to Logix 1769 L32E or SLC5/05 PLC per station to function as data concentrator to consolidate data concentrator to consolidate data from all controllers in the station.

The software for the data concentrator shall receive controller data over the local monitoring DH 485 network and provide formatted data to the AEMS RTU through an RS232 link. The data concentrator shall provide an Ethernet port for interfacing with connection to the WMATA wide area network. A data concentrator connection to the WMATA wide area network shall be provided.

1) The controller PLC shall use integrated programming, error checking, communications setup, ladder-type software package that shall be supplied by the Contractor.

a) Five copies of the annotated ladder listing with flowchart of the PLC software shall be provided in electronic format and in hardcopy.

b) One programming/monitoring device, such as an appropriately setup laptop, with necessary software and cables shall be provided for each station.

2) Provide battery backup – 2 year minimum.

a) PLC memory and programs shall be retained in non-volatile memory such as an Allen Bradley 1747-M13 module or approved alternative.

3) Modules, such as input, output, communication and analog, shall be slot type and compatible with the PLC processor I/O structure.

a) Each module shall be provided with a removable wiring terminal strip so that modules may be changed without removing associated wiring.

4) The power supply shall be suitable for operation on 120 VAC, single phase power.

a) Power supply capacity shall be a minimum of 150 percent of the connected load.

5) As a minimum, status, faults and analog data as listed in the tables for the remote monitoring interface shall be available from the serial port. Some of this data may be available in the tables of data for the two fault displays.

6) When on Inspection, the control system, variable frequency drive and drive components shall be capable of being set to various running speeds including over speeding the escalator by 40%.

7) No circuit boards, other than those incorporated in the lower balustrade display or in transducers for speed monitoring, shall be located in the truss or balustrade areas of the escalator.

a) All circuit boards and terminals for escalator safety, indicator and control devices shall be located in the controller area.

8) Screw type compression terminal blocks rated for 20 amperes minimum shall be used for all power circuits and 10 Amp minimum terminal blocks for control and indicating lights.

a) All wiring shall be stranded conductors of sufficient current carrying rating, color coded and permanently identified at all terminations.

b) A maximum of three wires shall be terminated at any terminal.

c) All wiring jumpers, taps or multiple wire connections shall be located on a terminal; tee taps, wire nuts or conductor splices shall not be utilized.

d) All controls shall operate at 120 volts or lower, AC or DC.

e) Control power shall be obtained from integral dry type control transformers.

9) All wiring internal or external to the controller shall be stranded copper, matching existing AWG size or size 18 AWG minimum, moisture resistant, flameproof, and oil resistant insulated conductors.

a) All terminations at devices and terminals shall utilize insulated type crimp connectors, terminal strip, phoenix or similar devices.

b) All terminals shall be identified with wire numbers which correspond to wiring diagrams.

c) Wiring shall be laced and tied or contained in wiring trough at terminal blocks.

d) All conductors shall be identified with embossed tubing sleeves at each terminal and heat shrink.

e) All terminations shall be made within boxes at terminal strips.

10. Air Conditioning:

Provide an independent air conditioning unit for each new controller to maintain manufacturers recommended operating temperatures. Condensate from the air conditioning unit must be piped to a suitable drain.

11. Fault and Status Display:

    a. One fault and status displays shall be provided for each escalator to visually indicate the activation of specified safety devices.

        1) The panel shall be constantly active.

        2) The panel should be located in the controller enclosure visible with controller door closed.

        3) The controller display shall indicate operating status when no fault is displayed.

        4) An Allen Bradley PanelView Plus 6, EZAutomation or ELES Engineering approved equal, fault/status display/interface shall be provided in the controller cabinet. Control system timers and other setup criteria shall be programmable through this unit. All fault, status and setup data shall be stored in the controller CPU module.

    b. The fault and status display shall provide the capability to store:

        1) 99 activations of any and all safety devices

        2) 99 events of a minimum of 125 different error or event codes

        3) 99 entries of the escalator travel distances in inches or millimeters after application of the brake(s)

        4) 99 entries of motor current draw in five minute increments.

        5) The display shall have the capability to download faults to a flash drive and upload the program from a flash drive or other memory device without the need for a laptop. All data points shall be date and time stamped.

    c. Stack memory shall be used so that, when full, the oldest data point is overwritten as new data is accumulated.

    d. Events to be stored include, but are not limited to, internally detected error codes, operational mode selection, start up, power down, and run direction including items listed in the table above.

        1) The fault displays shall use definitive word descriptions at the controller panel.

        2) The display shall only display the root cause of the shutdown when it occurs.

    e. The Contractor shall provide test plans for approval and shall satisfactorily demonstrate all local and remote functions of the fault and status displays and the remote monitoring data retrieval system prior to Final Acceptance.

12. Disconnect switches shall be provided and installed in the space where the controller is located as required by code.

    a. Disconnect switches shall be the following: UL 98, NEMA KS 1, heavy-duty, quick-make/quick-break switching mechanism with operating

handle external to enclosure, with positions labeled ON and OFF, defeat able interlock to prevent opening of enclosure door when switch is ON. The disconnect and any other boxes shall have a permanent label to identify specific unit.

b. Enclosures shall be NEMA 250 Type 4X stainless steel for all escalators.

c. Controllers shall be interlocked so that all drives shall be disconnected in the off position and cannot be inadvertently started.

d. A disconnect switch shall be provided to disconnect all ungrounded power feeders for each motor in accordance with NEC paragraphs 620-51 and 620-91.

e. Labels disconnect switches in accordance with the NEC.

f. The main line disconnect shall be located inside the machine/control room near the machine/control room access door and easily reachable.

13. Circuit Breakers and Panel Boards

a. Circuit breakers shall be the following: NEMA AB 1, UL 489, molded-case, bolt-on quick-make/quick-break, mechanically trip-free switching mechanism, with thermal trip for inverse time delay overcurrent protection and magnetic trip for instantaneous short-circuit protection. Designed to carry continuous rating in ambient temperature of 40 degrees Celsius.

b. Panelboards shall be the following: UL 50, NEMA PB 1, latch and handle in accordance with UL 50, minimum side gutter size of four inches, bus bar of 98-percent-conductivity copper with contact surfaces silver-plated or tin-plated, rating of neutral and ground buses equal to phase bus rating, neutral bus mounted on insulated block, neutral and ground buses equipped with integral mechanical connectors, one-inch high engraved plastic nameplate with 1/2-inch high letters on black and attached with stainless steel fasteners.

c. Enclosures shall be NEMA 250 Type 3R for mezzanine to platform escalators in underground stations and panelboards in NEMA 250 Type 4X box for all other escalators.

14. Switches, Indicators and Controls

a. All switches, indicators, and controls and their respective housings and fittings shall be suited for the operations and environmental conditions specified in Section 1.05 of these Specifications. Those components and fittings that may come in contact with water or dust environment, and in other ways are not protected, shall be in NEMA 250 Type 4X enclosures.

b. Indicator lights, two with red lenses, two-inch diameter Plexiglas 2423 or approved alternative, and two with two-inch diameter green lenses, Plexiglas 2092 or approved alternative, shall be provided at the upper and lower landings of each escalator to indicate to approaching passengers the direction of travel of the escalators.

c. One red and one green light shall be located on the right hand side of each escalator landing. A green light shall indicate that the escalator is moving away from the landing being approached. A red light shall indicate that the escalator is moving toward the landing being approached. Each green and red pair may be a single fixture with dual lamps. Red light lens shall be equipped with the international no entry symbol silhouetted over the red lens.

d. Indicator lights shall be vandal-resistant with easily replaceable long-life LED lamps. Lens shall be held secure and resist external pressure.

e. Shop drawings showing complete details shall be submitted to the Authority for approval.

15. A protective rubber mat shall be installed for the main and AC drive controller cabinets.

a. Floor mat of solid construction, ¼ inch thick with beveled edges shall be place in front of the permanently mounted electric equipment in escalator control room/control spaces and escalator pits. Rubber mats shall be noncombustible.

16. Electric power receptacles shall be furnished and installed in the upper and lower pits and along the escalator trusses as well as escalator machine room. .

a. Each receptacle shall be duplex, of specification grade, ground fault circuit interrupter type, resettable at the receptacle; waterproof; grounded; and rated for 120 volts at 20 amperes.

b. The receptacles in the pits shall be surface-mounted on the walls, not less than 30 inches from the floor.

c. The receptacles mounted along the escalators shall be mounted directly on a truss member at the location at minimum 15-foot intervals.

d. A receptacle shall be mounted near the remote control panel.

17. All maintenance lighting shall be furnished and installed with quick start type PL LED type and LED strip lighting as required for complete illumination of working spaces and specified areas within the escalator control room, the interior of the escalator and its immediate surroundings.

a. The escalator control room shall have illumination of 19-foot candles minimum. The light switch shall be on the lock-jamb side of the access door.

b. Upper and lower pits shall have internal lighting of 15-foot candles minimum.

c. Separate panel circuits shall be provided for pit lights and stair and truss lights.

d. A separate vapor-tight service light with quick start type PL LED compact fluorescent lamp shall be furnished, installed, and connected to the emergency lighting circuit to illuminate the entry.

e. A main light switch of specification grade shall be located at the entry to the pit.

f. Provide maintenance lighting for the remote control panel.

18. Electric Heating

a. Electric heaters shall be provided where required to permit sustained performance and maintenance of all escalators exposed to the outside environment.

b. Wellways shall be equipped with thermostatically controlled heaters to maintain a wellway temperature of 50F.

c. Heaters shall be provided to maintain the handrail steps, comb plates, landing plates and floor plates free of ice and snow while the escalators are running or idle. Heaters and mounting devices shall be of corrosion resistant materials.

d. Boxes associated with the heater shall be installed so that their covers are easily accessible and unobstructed by other components. No boxes shall be installed inside the step band. Boxes may be installed behind the removable balustrade panels.

19. Escalator Lighting Fixtures

a. The built-in escalator lighting fixtures shall be furnished and installed complete with all conduit, wiring, and accessories.

b. Fixtures/light box assemblies shall be UL-listed and labeled and shall be as shown and specified. LEDs lightings and associated parts shall be replaceable without a requirement to disassemble the balustrade or other parts of the escalator.

c. Type CST, Continuous Strip balustrade and cladding lighting fixture shall be enclosed and recessed and shall deliver a minimum of five foot candles on any portion of the step tread.

a) The fixtures shall be suitable for wet locations.

b) Individual lighting fixtures along the length of the balustrade may be acceptable so long as specified foot candles are provided on the steps.

c) Lamps/ LED stripe shall be compatible with the fixtures.

2) The housings shall be fabricated of steel, welded all around.

a) The housings shall have a lens opening width of 4 inches.

b) The housings in the balustrade must slip over the skirt, be mounted securely to the escalator truss and provide structural reinforcing of the skirt.

c) The interior finish shall be baked aluminum enamel (BAE) with curved, interior reflectors for maximum light distribution.

d) The bezel plate trim shall be attached to the escalator with tamper proof screws, and designed to fit securely against the balustrade and cladding with suitable gasketing to prevent light leakages and the intrusion of dust or moisture into the fixture.

e) Bezel trim finish plates shall match the adjacent material and finish.

3) The lenses shall be white polycarbonate.

4) LED strip light shall be enclosed, the lights shall be UL listed and waterproof. Contractor shall submit the manufacture of the light and detail information to WMATA-ELES engineering for approval. The lighting shall have minimum life of 50,000 hours.

a) The ballast shall be electronic, instant start; high frequency type rated 0 to 300EF and shall be installed under/within the housing, under the lamp, for easy removal and installation, and to maintain the continuity of the lighting strip.

b) All fixtures shall be hardwired to the branch circuits, protected by GFCI in the panel.

c) Wiring outside of the light boxes shall be in galvanized rigid conduit or liquid-tight flexible metallic conduit.

d) Wiring inside shall be in rigid pipe or liquid-tight flexible metallic conduit.

e) Each light box shall be electrically grounded by means of the equipment grounding conductor from the branch circuit. Additionally, each light box is to be electrically bonded to adjacent light boxes by means of a green jumper wire sized per overcurrent protection.

f) Light box assemblies shall be grounded and personal protected against shock hazard by means of a ground fault circuit interrupter which has a sensitivity of not more than 5 mA.

g) The fixtures shall be configured with gasketed hand holes at each end.

h) The balustrade lighting must be electrically independent of the operation of the escalator.

5) Wiring shall be configured to insure that each step has lighting from at least one side at all times. Ground escalator lighting fixtures to equipment grounding bar associated with ac power feeder by using separate insulated annealed copper grounding conductor, size governed by NEC paragraph 250-95.

d. Step demarcation lights (located below the steps at both landings) shall be in accordance with ASME A17.1.

e. No joints or splices shall be permitted in wiring except at outlets. Tap connectors may not be used. All terminations shall be made within boxes at terminal strips or devices. All wiring shall be run in conduit.

20. Fixtures, Bodies, Reflector Plates, Channels. End Caps and Castings.

a. Except as shown otherwise, materials for fixture bodies, reflector plates, channels, end caps, and castings shall be as follows:

1) Steel for Type CST fixtures shall be precision die-formed of not less than 16-gauge prime cold-rolled steel with anti-rust primer and baked enamel finish all over or painted surface of equivalent durability.

2) Fixture bodies, reflectors, channels, end caps, and castings shall be so formed as to prevent buckling or distortion. Reflector plates shall conceal all wiring and be easily removable by one man without special tools. Reflector plate fastening device shall be of rugged construction and provided with an approved grounding bond to the fixture. At least two wire clips shall be provided in the wiring channel for support of wiring. Wiring channel shall be UL-listed.

3) All construction seams and joints shall be continuous-welded and ground smooth before finishing. Fixtures shall have mechanically self-retaining neoprene gaskets where shown or specified.

4) Dissimilar metals shall be jointed in a manner to preclude electrolytic corrosion.

21. Ballasts shall be hybrid electronic, high frequency or electronic, instant start, high frequency type rated 0E to 300EF.

22. The lamps shall be furnished and installed by the Contractor as specified.

a. All lamps shall be guaranteed for 90 days after Final Acceptance and the Contractor shall replace those lamps which fail during this guarantee period within eight hours after request by the Authority.

23. Lenses and Diffusers:

a. All lenses and diffusers shall be of one-piece construction made of polycarbonate plastic, 0.125-inch minimum thickness.

1) The plastic shall be non-flammable as determined by ASTM D635, "Flammability of Self-Supporting Plastics".

2) The plastic shall not change color materially when lighted by 4500 degree Kelvin fluorescent lamps.

3) The plastic shall show no yellowing apparent to the naked eye after 500 hour exposure to lamp source under conditions identical with those existing in the fixture in which it is to be used.

b. The light transmission range for the clear polycarbonate sheet shall be from 82 to 89 percent.

c. The plastic shall be non-electrostatic or the finished parts shall be treated with an anti-static wax. The wax shall not affect or alter the optical properties of the fixture.

24. All lamp holders shall have a glazed porcelain body-type with nonferrous metal components and be of heavy-duty design. Incandescent lamp holders shall have a mechanical self-retaining neoprene jacket to provide a dustproof seal between bulb and socket.

25. Latch and release mechanism, hinges, pins and other operating parts of the fixtures, screws, or other assembly and mounting parts shall be manufactured of stainless steel, precision quality, positive in operation and rugged in construction.

a. All exposed hardware to be same material and finish as adjacent balustrades or cladding.

b. All springs shall be heavy-duty stainless steel.

c. All operating hardware shall be self-retaining.

26. Seismic Loads

In accordance with VA-USBC 2006, all structures shall be designed to resist the effects of earthquake motions.

2.04 ACCESSORIES

A. Smoke Detection

1. Fire and smoke detection devices which will shut off all entering escalators will be furnished and installed by other trades. An interface terminal box shall be furnished and installed. A 4-inch by 4-inch electrical box and flex conduit into the control panel shall be furnished and installed. The ¾-inch conduit into the 4-inch by 4-inch electrical box will be provided by other trades.

2. Location of terminal box to be coordinated with applicable trades. Interconnecting wiring between the fire and smoke alarm panel and terminal box will be furnished and installed by other trades.

3. Coordination shall be done with all applicable trades to allow installation of the equipment as required and make operational checkout within the wellway.

4. The fire and smoke alarm system shall be interfaced with the escalator controller in such a way that upon activation of the fire or smoke alarm, only entering escalators shall be stopped. Once stopped, escalators shall be capable of being reversed and started in an exiting direction only. Non-running escalators shall be capable of being started only in the exiting mode.

B. Smoke Detection Control Relays

1. Relays energized from the fire detection system shall be ordinary acting relays enclosed in polycarbonate dust covers. The relays will be provided by other trades.

2. Contacts interfacing the escalator control equipment shall be electrically compatible with the equipment they are serving.

C. Kiosk Escalator Remote Surveillance and Control

1. The kiosk contains an annunciator panel provided by trade communications which displays escalator status. An interface terminal box shall be furnished and installed by the Contractor in the upper or lower pit. Location of terminal box to be coordinated with the appropriate trades. Interconnecting wiring between the kiosk annunciator panel and terminal box will be furnished and installed by other trades. Coordination by the Contractor among trades is required to ensure the kiosk panel reports escalator functions correctly.

2. The following status indications and control functions shall be furnished for inclusion on the annunciator panel:

a. Indication of direction of travel (two modes).

b. "Out of Service" indication.

c. A provision for flashing the "Out of Service" indication to indicate that the escalator has stopped due to the activation of any safety device.

3. Coordination of design shall be done with the Contractor, and the specified devices necessary to provide a complete electrical installation shall be furnished and installed. All necessary wire and conduit runs from the escalator control circuits to the interface box shall be furnished and installed, and final connection to the appropriately identified terminals shall be made. All work shall be in accordance with all applicable codes and regulations.

D. Kiosk Status Interface Contacts: All contacts wired to the interface terminal box shall be metal-to-metal dry contacts and shall be capable of carrying and breaking a maximum resistive load of one ampere at 24 volts DC. Contacts shall be hermetically sealed or otherwise protected from deleterious effects from the environment in which they are installed.

E. Comb Plate Lighting Fixture

1. Each escalator shall be equipped with LEDs light fixture.

2. Fixture housings may be constructed of die cast aluminum alloy and be equipped with two cable entries to facilitate through wiring. Fixtures shall be UL listed as suitable for wet locations. A polycarbonate high density, UV stabilized; impact resistant diffuser shall be sealed to the housing with extruded closed cell ethylene propylene diene terpolymer (EPDM) gasketing and held in position by the housing frame. The housing frame shall be secured by tamper proof set screws. A full opal lens shall be provided. An electrically applied baked enamel finish shall be provided on aluminum surfaces. Finish shall meet or exceed all AAMA requirements for 5,000-hour salt exposure. The interior of the housing body shall be white enameled.

3. Fixture shall be "Quality Lighting" ST-9-0 or approved alternative. Each fixture shall be hardwired to the branch circuit. Separate aluminum from dissimilar metals and ground fixtures.

F. Signs and Illuminated Indicators

1. The signs, including escalator cautions signs at the upper and lower landings, both illuminated and unilluminated, which attach to the escalator, as required for the proper and safe unattended operation of the escalators, shall be furnished and installed.

2. One portable sign shall be provided for each landing for all escalators. The signs shall be reversible with both sides finished in brown porcelain conforming to Federal Standard 595A, Color 20040.

3. Camera-ready artwork will be furnished by others for application in porcelain; one side of each sign shall bear the words PLEASE USE OTHER ESCALATOR in white letters. Signs shall be durable, easily stored, and designed for attachment to support means provided in all escalator balustrades.

4. Signs and illuminated indicators shall conform to all applicable ADAAG requirements.

5. All escalators shall be permanently numbered at the top and bottom right hand newels with number designations corresponding to the indications on the kiosk annunciator panel. A station sketch showing the escalator numbers shall be submitted for WMATA ELES Engineering. Number escalators in sequence, starting at the north entrance (left to right, looking UP from bottom) of each station and proceeding clockwise around the station. The numbering shall proceed into the station toward the end of the plate form. Corresponding numerical identification shall be affixed to the equipment in the machine spaces. Markers for newels shall be constructed of 15 MIL, transparent, non-glares General Electric Lexan or approved alternative. Adhesive shall be 3M hi-performance #468 double thick adhesive or approved alternative, heat-laminated to the marker. Numbers shall be

sub-surface screen printed and vandal resistant. Markers shall be laser die cut with rounded corners for increased durability and vandal resistance.

G. Locks and Keys:

1. All key switches shall be of the tumbler or cylinder type.

2. An Allen Bradley 30 mm key switch with D018 key, Cylinder Model #800T-J631KC1 shall be used.

3. Keys shall be stamped with the inscription "TRANSIT AUTHORITY - DO NOT DUPLICATE" and with visual key control data.

4. Five keys shall be supplied with each escalator.

H. Drain System

1. Floor type drains will be provided in all outside entrance escalator machine rooms and/or pits or both by other trades. Drain pans to the floor drains shall be connected and suitable grease traps provided per applicable EPA regulations. Access for cleaning grease traps and floor drains shall be provided.

2. Provisions shall be made for the capture and containment of oil/grease from the escalator. The oil/grease shall be captured either by a longitudinal drain pan under the length of each escalator drive chain or by the escalator drain pan itself. A method of cleaning both the longitudinal drain pan (if used) and the escalator drain pan itself shall be provided. A method of accessing and emptying the interceptor(s) shall be provided. The interceptor(s) shall be constructed of stainless steel equal to the gauge and strength of the escalator drain pan. The interceptor(s) shall consist of a 2 inch elevated drain, outer container, and internal gate(s). The oil/grease storage capacity of the interceptor shall be 2 fluid quarts per escalator drive chain handled. The interceptor(s) shall fit into the escalator pit without modification to the pit.

3. Retractable or non-retractable ladder shall be installed in the pit of each escalator, where the pit extends more than 35 in. below the sill.

I. Electrical Interlock

1. Where indicated on the contract drawings, the Contractor shall provide gate limit switches and the necessary wiring to prevent escalator operation in the direction leading toward the gate if the gates are not fully open. The interlock shall not preclude escalator operation in a direction moving away from the gate. The required connections to the escalator circuits shall be made.

2.05 FINISHES

A. Stainless steel: For cladding finish exposed to view, use manufacturer's Standard No. 4 satin polished finish. Stainless steel shall be finished to match adjacent escalator surface.

B. Aluminum castings and extrusions: Manufacturer's standard commercial mill finish.

C. Galvanized: For sheet steel, use ASTM A653 as applicable with coating designation of G185. For other galvanizing, use ASTM A385 and ASTM A123. For touch-up galvanizing, use zinc dust coating conforming to MIL PRF 26915. Galvanizing process shall not result in a loss of metal ductility.

2.06 PREPARATION

A. General

1. The Contractor shall become thoroughly familiar with the related work and shall coordinate and schedule escalator delivery and installation with the work of others and the site availability schedule. The Authority shall be notified of intended delivery dates no less than 30 days prior to the dates. No deliveries shall be made without prior approval of the WMATA.

2. The dimensional survey of wellways shall be conducted prior to fabrication, delivery and installation of trusses. The Authority shall be notified immediately of all field-verified structural dimensions which do not conform to the drawings so that the Contractor can take corrective action. If the wellways are not available at this time for dimensional survey, the escalators shall be designed and fabricated in accordance with approved structural shop drawings.

B. Structure

1. The structural elements required supporting the escalators and to withstand the forces and loads resulting from use of the escalators will be provided in accordance with the requirements shown on the drawings. The escalators shall be designed, fabricated, and installed to be compatible with the structures and equipment room spaces as designed, and in accordance with the current version of ASME A17.1 except as modified by these specifications.

C. Alterations

1. Alterations of any structures or systems necessary to accommodate the escalator installation and maintenance such as cutting of walls, floors, and repairs as required, shall be submitted to the Authority for approval and such work performed at no additional cost to the Authority.

2.07 INSTALLATION

A. General

1. Entrance escalators shall be installed under canopies. The size and location of each canopy shall be verified prior to the delivery of truss to insure that the fabricated escalator can be installed.

2. The station construction drawings have placed the working point of all the escalators on the finished floor line, thus causing the upper and lower landing areas to slope away from the escalators. The drawings shall be referred to showing the location of the working point placement.

B. Controller Room Equipment:

Escalator control room shall be 168 sq. minimum.

1. Clearance around equipment in each control room shall comply with provisions of all applicable codes. The ASME A17.1 code requirements for the machine room clearances shall be applied in addition to the code specified clearances for escalator machine room/control room.

2. Equipment in escalator control room shall be arranged so that replaceable items can be removed for repair or replacement without the need to dismantle or remove other equipment components in the same control room.

3. Drive controller and main controller enclosures shall be right-or left-hand as required to provide necessary work space around the equipment in machine room.

4. Any component attached to the controller shall have a minimum clearance of 18 inches from the side(s) of the component requiring access for maintenance and free air circulation.

5. Layout shall be designed to allow safe access to controllers and minimize piping bends and provide ease of access for service and repair.

6. Upon approval, one set of plastic or laminated electrical diagrams of each escalator shall be provided. The diagrams shall be mounted in an aluminum channel frame with Lucite cover and waterproof fiberglass backing and installed adjacent to the appropriate controller.

7. A permanent rubber floor mat of solid construction, 1/4-inch thick, shall be provided with beveled edges in front of the permanently mounted electric equipment in escalator control room/control spaces and escalator pits. Rubber mats shall be noncombustible as defined in 0. Rubber mats shall be inches wider than the controller on all sides

    a. The Resistance range shall be $1x10^4<1x10^6$ and shall meet ANSI/ESD requirements.
    b. The rubber mat shall be the width of the controller plus 12”.
    c. The length of rubber mat shall be a minimum of 24”.
    d. The rubber mat shall be a ¼” thickness and beveled at each end.

8. Controller rooms must be air conditioned and heated to maintain an ambient temperature of 50^0F to 80^0F degrees and a relative humidity of 35% to 50%. The Air Conditioner shall be Split System. The heating system for the control room is also a built in system. The temperature control shall have the ability to auto reset to 50^0 F after 1 to 8 hours. A forced removal should be done by moving the air from the room to the outside of the building to keep an air exchange through the equipment room. Intake and exhaust vent should not be located close to each other.

9. Control room lighting shall provide an illumination level of 19fc minimum at the floor when measured at any location in the room.

10. Room Emergency Lighting: Maintained Emergency lighting fittings shall be provided in each Escalator Control room.
    a. There shall be a minimum of one maintained lighting fixture.

11. Provide two Ethernet data drop in each control room.

C. Install controllers and electrical panels outside the pit or truss area in environmentally protected areas such as a control room which meets the requirements, and ensure that these components are protected from water and de-icing salts.

1. All controllers and electrical panels shall be mounted on strut channels to hold the enclosures away from the wall. The strut legs should be at least 1 ¼” deep.

D. A metal cabinet of suitable size shall be provided in each control room for the storage of special tools and necessary spare parts. The cabinet shall be mounted on legs or a pedestal, a minimum of 4 inches off the floor. A Mobile Tool Storage Cabinet with wheels is not allowed.

E. Miscellaneous Work by Other Trades

1. The furnishing and installing of electrical and non-electrical signs for escalators, which are not a part of the escalator.

2.08 FIELD QUALITY CONTROL

A. Provide a quality control program for approval by the Authority.

2.09 DEMONSTRATION

A. General

1. Before an escalator is put into interim service, that escalator, or one of the same rated load and type shall be tested with full design load in accordance with ASME A17.1 and ASME A17.2. These design loads shall include all above rated loads including, but not limited to, a static load of 674 pounds per exposed step, a live load of 320 pounds per exposed step in the downward direction and 300 pounds live load in the upward direction. The tests shall be conducted either in the Contractor's plant or after installation in the presence of the Authority or their designated representative after the installation is completed. The tests shall demonstrate to the satisfaction of the Authority that all the requirements of this Contract have been complied with. Applicable provisions of the Code Practices for Inspections of Escalators, ASME A17.2, Part III (and supplements) shall apply. Additional testing shall not be required if the supplier has previously provided WMATA with an escalator of the same rated load and type, and successfully passed the required testing.

2. The testing shall satisfy the requirements of the local jurisdiction and this specification.

3. Every escalator shall be marked with the rated load and speed for which that size and type has been tested and approved. Such markings will be accepted in lieu of actual tests at the installation.

4. After installation, each escalator shall be tested without load by the Contractor in the presence of the WMATA shall include tests as follows:

   a. The over speed protection device shall be tested by operating the escalator at the speed which trips the over speed device. Verify compliance with Code requirements.

   b. The handrail tension malfunction device shall be tested manually.

   c. The broken chain protection shall be tested by operating the escalator at rated speed and tripping the broken chain device by hand.

   d. The device providing against sudden and unusual strains on the step chains shall be tested by operating the device by hand.

   e. All push buttons, starting switches, relays, interlocks, and controls required in connection with the work shall be inspected and tested to prove that the complete escalator functions properly under any and all conditions of operation within the limits specified.

   f. Brakes and driving machinery shall be tested for operating efficiency, ease of adjustment and temperature limits. Test and record brake torque.

   g. The device which removes power and stops the escalator in the event an article becomes wedged between the comb plate and a step tread.

   h. The device which removes power and stops the escalator in the event an object is carried into the handrail entries.

   i. The device which removes power and stops the escalator in the event either handrail breaks, stops, fails to travel on escalator start-up or the handrail tensioning device fails.

   j. The devices installed behind the upper and lower landing skirt panels which remove power and stop the escalator in the event the skirt panels are forced away from the steps.

k. All AC conductors before being connected shall withstand a 1,000 volt D.C. megger test, the voltage being applied between each conductor and ground for a minimum of 1 minute. Each conductor shall show an insulation resistance to ground of not less than 2 megohms.

l. Instruments, electric power, other necessary facilities and all labor required for the tests specified herein shall be furnished by the Contractor at no additional expense to the Authority. All test data shall be certified.

m. Noise level as specified in paragraph 1.05.

n. Vibration level as specified in paragraph 1.05.

5. Inspections: A Final Acceptance inspection shall be conducted by WMATA Representatives prior to acceptance inspection by the AHJ.

6. All malfunctions and deficiencies revealed by the tests shall be immediately corrected by the Contractor at no additional cost to the Authority.

7. Performance Guarantee: Should any of these tests identify any defects or evidence of poor workmanship, any variance or noncompliance with the requirements of the specified codes, ordinances or these specifications, the following work and or repairs shall be complete at no expense to the Authority.

a) Replace equipment that does not meet code or specified requirements.
b) Perform work and furnish labor, materials and equipment necessary to meet specified operation and performance.
c) Perform and assume cost for re-testing required by Governing Code Authority and the Authority to verify specified operation and performance.

2.10 PROTECTION

A. The Contractor shall be responsible for the security of the contents of each machine/controller room. The Contractor shall control access to that room, and ensure that it shall remain secure at all times until the completion of the Contractor's interim maintenance obligation.

B. Do not proceed with remainder of the work until the demonstration, installation, procedure*s* and personnel are approved.

PART 3 - EXECUTION

3.01 MAINTENANCE:

The Contractor shall perform full maintenance service for a period of two years on each escalator in accordance with the manufacturer's maintenance manual and WMATA ELES maintenance program prior to WMATA providing permanent maintenance. The period of maintenance shall begin after test(s) and Provisional Acceptance of each escalator and shall extend to the scheduled date of Final Acceptance for all units in the same facility plus a period of two years. In no case shall the interval between inspections and testing be greater than one month. The maintenance service during the warranty period shall be provided by fully trained escalator mechanics. The maintenance tasks shall include, but not limited to, the following:

a. Inspection of completed installation and periodic testing to maintain the escalators in completely operable condition.

b. Contractor shall provide support for periodic, accident and incident, PM compliance inspections.

c. Lubrication of parts, and the protection of the equipment.

d. Replacement of defective parts at no additional cost to the Authority.

e. Annual clean down of the escalator and wellway enclosure is required. Make necessary arrangements with Authority in order to minimize any inconvenience.

f. Contractors performing maintenance are responsible for all service, repair work and emergency call. The contractors shall provide unlimited service during revenue hours and twenty-four (24) hour (including Holidays) emergency call back service at no additional cost.

1) Provide twenty (24) hour (including Holidays) emergency service during the maintenance period consisting of a prompt response (within 1 hour) to emergency request by phone or otherwise from Authority or designated representative if an escalator is inoperable or in case of injury or potential injury to persons.

2) Unlimited service callbacks are included with a required response time of one (1) hour (included Holidays).

g. Periodic maintenance (based on WMATA schedule) shall be performed off peak hours to minimize service interruption.

h. Reporting: Detailed monthly records of tasks performed including names of individuals performing the tasks, date and time performed, and other pertinent data. In addition, the reports are to be provided in an electronic format acceptable to WMATA's needs.

I. Contractor performed maintenance shall follow the WMATA Office of Elevator and Escalator Operations procedures, schedules and check charts.

j. Within three (3) months prior to the termination of this contract, the Authority or his designated representative(s) shall make a thorough maintenance inspection of all equipment covered under this contract. The contractor shall provide personnel to remove, test, and operate equipment as necessary. All deficiencies found as a result of this inspection shall be corrected by the Contractor as required in this agreement with no additional cost to the Authority.

3.02 REMOTE MONITORING SPECIFICATIONS:

A. Allen Bradley DF1 or industry standard Modbus protocol shall be provided to transmit data from the Elevator/Escalator controller to the Authority's AEMS RTU computer control and data system. The Design-Builder shall provide a controller data interface to a DH-485 network located in the Elevator /Escalator machine room. The DH-485 controller interface shall be programmable for data rates up to 115Kbps. The interface shall allow other nodes such as other Elevator or Escalators to be readily incorporated into the DH-485 network. The controller data interface shall include one Allen Bradley SLC PLC per station to function as a data concentrator to consolidate data from all the controllers in the station. The software for the data concentrator shall be as specified by the Authority. The data concentrator shall receive controller data over the DH-485 data network and provide formatted data to the AEMS RTU through a RS 232 link. This data transmission may be accomplished by a separate PLC controller integrated into the control system.

B. The Elevator /Escalator control system shall automatically initiate the transmittal of data when data is requested by the Authority's AEMS system and continue until all data is received by the AEMS RTU in the station AC switchboard room. The Authority will perform final integration of the data in the AEMS system.

C. The Contractor shall also provide the required hardware to download data from any fault finding annunciator panel to a supplied laptop PC being utilized at the Elevator/Escalator location. The provided software shall permit the downloading and storage of data on the supplied laptop PC from multiple fault finding annunciator panels.

D. The Contractor shall install an Allen Bradley network interface module, (model 1761-NET-AIC or approved alternative) beside the PLC in the controller and provide 24 VDC power to the module. The Allen Bradley PLC will be used for remote monitoring capabilities into WMATA established engineering monitoring network.

1. Contractors shall provide all the wiring and program the PLC to communicate with station data concentrators on the DH-485 network. Coordination can be made with WMATA ELES Engineering.

2. The Contractor shall pull all remote monitoring cables to the interface in the escalator controller from the remote monitoring network going back to WMATA's Automated Energy Management System (AEMS) remote terminal unit (RTU).

3. Provide Ethernet communication between the escalator control room and WMATA's communication room. The communication port shall be located less than 6' from the controller and shall have minimum of two ports for data communication.

E. Escalator Remote Monitoring Data Specification

1. Overview

A. The design of the WMATA escalator & elevator monitoring system shall include a data concentrator PLC to gather data from the escalator control PLC's over an Allen Bradley DH 485 network. The QEI RTU shall read data from the WMATA data concentrator PLC via an RS 232 serial connection to a 1746-BAST module using Allen Bradley DF1 protocol. See figure 1.1 for reference. This specification defines data to be presented by the WMATA data concentrator PLC to the QEI RTU. The WMATA data concentrator PLC station shall pole the escalator & elevator controller(s) periodically for data and format the data into blocks within the WMATA data concentrator. An Ethernet TCP/IP connection is available at the Data concentrator PLC for future connection. The data concentrator PLC has been designed to collect data from up to (10) escalators and/or elevators. The data concentrator PLC is to be mounted into the existing QEI RTU enclosures and powered by a 120 VAC source from within the RTU. For Metro stations where more than (10) escalators and elevators are present additional data concentrator PLC's will be required.

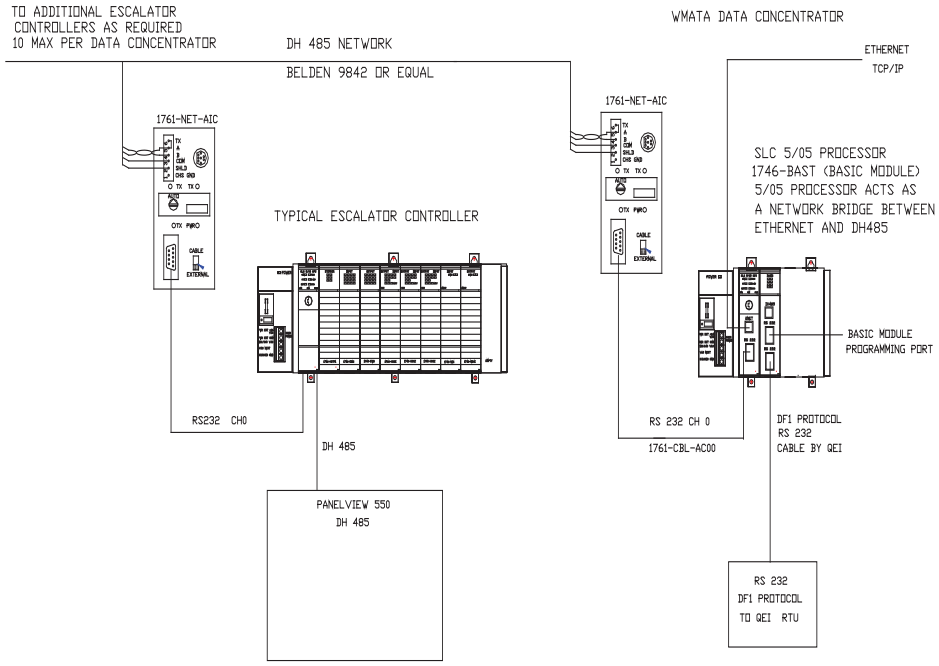


Figure 1.1

1. **Data Concentrator PLC Data File Assignments.**
   The WMATA data concentrator PLC shall store data for up to (10) escalators and/or elevators in any combination as defined in table 2.1.

Table 2.1

Escalator DH485 node #	Elevator DH485 node #	Status bits File	Analog Data File	DC PLC MSG file#	DC PLC MSG buffer file#
1		N20	N21	N81	N101
2		N22	N23	N82	N102
3		N24	N25	N83	N103
4		N26	N27	N84	N104
5		N28	N29	N85	N105
6		N30	N31	N86	N106
7		N32	N33	N87	N107
8		N34	N35	N88	N108
9		N36	N37	N89	N109
10		N38	N39	N90	N110
	11	N40	N41	N121	N141
	12	N42	N43	N122	N142
	13	N44	N45	N123	N143
	14	N46	N47	N124	N144
	15	N48	N49	N125	N145
	16	N50	N51	N126	N146
17		N52	N53	N127	N147
18		N54	N55	N128	N148
19		N56	N57	N129	N149
20		N58	N59	N130	N150
Data Concentrator PLC (DC)	25	N80	N79		

Each data file shall begin with word 1 (example: escalator #1 status bits begin with N20:1 and end at N20:20)

The data concentrator PLC communication ports shall be configured as follows.

Channel 1

Driver:	Ethernet
IP Address:	TBD
Subnet Mask:	TBD
Gateway Address:	TBD

Channel 2

Driver:	DH485
Baud Rate:	19.2K
Node Address:	25

1756-BAST basic module communication ports shall be configured as follows.

Port 1: Programming port

Settings -- 19,200 Baud, No parity, 8 bits, 1 stop bit, No handshaking

Port 2: DF1 port

Settings -- 19,200 Baud, No parity, 8 bits, 1 stop bit, No handshaking

DF1 – Op Code 19 (Full Duplex, NHS, ER, Enable DPD, CRC error checking,

Timeout = 50

Retries = 3

RTS on delay = 20 music

RTS off delay = 20 music

Module address = 10

DH485 Port – Not Available

3. Data Format

Data Concentrator status in File N80 per table 3.0

Table 3.0 Data Concentrator Status Bits

WORD	BIT	DATA TYPE	DESCRIPTION	"0" STATE	"1" STATE
1	0	BOOLEAN	Spare		
	1	BOOLEAN	Data Concentrator PLC Battery Status	FAULT	NORMAL
	2	BOOLEAN	Data Concentrator Basic Module Battery Status	FAULT	NORMAL
	3	BOOLEAN			
	4	BOOLEAN			
	5	BOOLEAN			
	6	BOOLEAN			
	7	BOOLEAN			
	8	BOOLEAN			
	9	BOOLEAN			
	10	BOOLEAN			
	11	BOOLEAN			
	12	BOOLEAN			
	13	BOOLEAN			
	14	BOOLEAN			
	15	BOOLEAN			

WORD	BIT	DATA TYPE	DESCRIPTION	"0" STATE	"1" STATE
2		BYTE	Data Concentrator checksum byte1		
3		BYTE	Data Concentrator checksum byte2		

Words 4 through 20 of the Data Concentrator status file (N80) are unused.

The Data Concentrator Analog data file (N79) is unused.

Escalator data:

Two 20 word (40 BYTE) blocks of data shall be developed for each escalator one block for status bits and one block for analog data. Table 3.1 defines the format of data for status bits. Table 3.2 defines the format for analog data.

Table 3.1 Escalator Status Bits

WORD	BIT	FAULT TYPE	DESCRIPTION	"0" STATE	"1" STATE
1	0	NON-LATCHED	AC OVERLOAD SENSOR FAULT(OCR)	FAULT	NORMAL
	1	NON-LATCHED	BRAKE WEAR LIMIT SENSOR FAULT	FAULT	NORMAL
	2	STATUS	BRAKE PICKED SWITCH (BK)	SET	NOT SET
	3	LATCHED	BROKEN STEP FAULT	FAULT	NORMAL
	4	LATCHED	BROKEN HANDRAIL FAULT	FAULT	NORMAL
	5	LATCHED	BROKEN STEP CHAIN FAULT	FAULT	NORMAL
	6	LATCHED	COMBPLATE IMPACT FAULT	FAULT	NORMAL
	7	NON-LATCHED	HANDRAIL ENTRY GUARD FAULT	FAULT	NORMAL
	8	NON-LATCHED	HIGH WATER	FAULT	NORMAL
	9	LATCHED	HANDRAIL OVER/UNDER SPEED FAULT	FAULT	NORMAL
	10	LATCHED	MAIN DRIVE CHAIN SENSOR FAULT	FAULT	NORMAL
	11	LATCHED	NON-REVERSAL SWITCH FAULT	FAULT	NORMAL
	12	NON-LATCHED	SKIRT IMPACT SENSOR FAULT	FAULT	NORMAL
	13	LATCHED	STEP LEVEL SENSOR FAULT	FAULT	NORMAL
	14	LATCHED	STEP UPTHRUST SENSOR FAULT	FAULT	NORMAL
	15	STATUS	GATE SWITCH FAULT	FAULT	NORMAL

WORD	BIT	FAULT TYPE	DESCRIPTION	"0" STATE	"1" STATE
2	0	LATCHED	MISSING STEP SENSOR FAULT	FAULT	NORMAL
	1	NON-LATCHED	MOTOR OVERTEMPERATURE FAULT	FAULT	NORMAL
	2	NON-LATCHED	24 VDC POWER SUPPLY (C3+)	FAULT	NORMAL
	3	STATUS	BALUSTRADE STOP SWITCHES	FAULT	NORMAL
	4	STATUS	BREAK WEAR 80% SENSOR	FAULT	NORMAL
	5		FAULT LATCHED	FAULT	NORMAL
	6		FAULT NON-LATCHED	FAULT	NORMAL
	7	STATUS	FIRE & SMOKE RELAY	FAULT	NORMAL
	8	STATUS	INSPECTION	NORMAL	INSPECT
	9	STATUS	PIT STOP SWITCHES	FAULT	NORMAL
	10	STATUS	RUNNING UP	NOT-RUN	RUNNING
	11	STATUS	RUNNING DOWN	NOT-RUN	RUNNING
	12	STATUS	ESCALATOR SLC 5/03 LOW BATTERY	FAULT	NORMAL

	13	STATUS	ESCALATOR SLC 5/03 COMM. ACTIVE	FAULT	NORMAL
	14	STATUS	ESCALATOR SLC 5/03 LOCAL/REMOTE STATUS	REMOTE	LOCAL
	15	STATUS	ESCALATOR SLC 5/03 RUN/PROG STATUS	PROG	RUN

WORD	BIT	FAULT TYPE	DESCRIPTION	"0" STATE	"1" STATE
3	0	STATUS	OUT OF SERVICE	FAULT	NORMAL
	1	LATCHED	STEP ROLLER DEGRAGATION	FAULT	NORMAL
	2	LATCHED	AXLE ROLLER DEGRAGATION	FAULT	NORMAL
	3	LATCHED	AC DRIVE FAULT	FAULT	NORMAL
	4				
	5				
	6				
	7				
	8				
	9				
	10				
	11				
	12				
	13				
	14				
	15				

Words 4 through 20 are unused.

Table 3.2 Escalator Analog Data

WORD	DATA TYPE	MIN VALUE	MAX VALUE	UNITS	SCALE FACTOR	DESCRIPTION
1	INTEGER	0	2047	FPM	X1	HANDRAIL 1 SPEED
2	INTEGER	0	2047	FPM	X1	HANDRAIL 2 SPEED
3	INTEGER	0	2000	AMPS	X10	DRIVE MOTOR CURRENT
4	INTEGER	0	2047	INCHES	X10	BRAKE STOPPING DISTANCE
5	INTEGER	0	2047	FPM	X1	STEP SPEED
6	INTEGER					FAULT CODE
7	INTEGER					
8	INTEGER					
9	INTEGER					
10	INTEGER					
11	INTEGER					

12	INTEGER					
13	INTEGER					
14	INTEGER					
15	INTEGER					
16	INTEGER					
17	INTEGER					
18	INTEGER					
19	INTEGER					
20	INTEGER					

Note: All analog values are multiplied by 16 in the data concentrator to bit shift left 4 bits to align with QEI's 12 bit analog data types.

A note on communication loss

A 60 second watchdog timer is coded into each escalator file. If communications are lost between the data concentrator and the escalator controller for more than 60 seconds the watchdog timer will timeout. When the timer has timed out the communications loss bit will be reset (0) to indicate the communications loss condition.

4. Time and date sync

The QEI RTU shall provide clock synchronization to the WMATA data concentrator PLC every 5 minutes. Table 4.1 defines the address and data format of the clock registers in the WMATA data concentrator PLC. The data concentrator PLC shall set the escalator controller date and time every day at 3 AM.

Table 4.1

FUNCTION	ADDRESS	FORMAT
YEAR	N13:10	4 DIGITS
MONTH	N13:11	2 DIGITS
DAY	N13:12	2 DIGITS
HOUR	N13:13	2 DIGITS 24 HOUR
MINUTE	N13:14	2 DIGITS
SECOND	N13:15	2 DIGITS

5 Data Concentrator PLC Program

The data concentrator PLC includes code to monitor up to 10 escalators. Each escalator has an independent code file and a configuration bit. If an escalator is to be monitored the configuration bit must be set corresponding to the DH485 station address of the escalator controller. If the configuration bit is reset (0), the status and analog data table values for the escalator or elevator will be set to 0.

The configuration bits are as follows.

Escalator Configuration Bit	DH485 Address of Escalator Controller	Elevator Configuration Bit	DH485 Address of Elevator Controller
B9:0/1	1	B9:1/1	11
B9:0/2	2	B9:1/2	12
B9:0/3	3	B9:1/3	13
B9:0/4	4	B9:1/4	14
B9:0/5	5	B9:1/5	15
B9:0/6	6	B9:1/6	16
B9:0/7	7	B9:1/7	17
B9:0/8	8	B9:1/8	18
B9:0/9	9	B9:1/9	19
B9:0/10	10	B9:1/10	20

6. Data Concentrator Gateway IP addresses.

The Data concentrator PLC acts as a gateway between the Ethernet and DH485 networks. The PLC contains a list of IP addresses, known as the routing table which will be allowed access to the DH485 network. The routing table will contain 20 addresses.

Station	IP Address
1	TBD
2	
3	
4	
5	
6	

7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	

END OF SECTION