

**SECTION 14 24 00**  
**HYDRAULIC ELEVATORS**

**PART 1 - GENERAL**

1.01 SUMMARY

A. Section includes:

0. Requirements for furnishing, installing and providing Maintenance for hydraulic passenger elevators as specified and detailed in the Contract Drawings.

B. Related work provided under other sections

0. Hoistway and Pit

- a. Clear, plumb, and substantially flush hoistway with variations not to exceed 1 inch at any point.
- b. Bevel cants not less than 75 degrees with the horizontal on any rear or sidewall ledges and beams that project or recess 2 inches or more into the hoistway. Not required on hoistway divider beams.
- c. Supports at each floor for car and counterweight guide rail fastening. Intermediate support when heights exceed 14 feet 0 inch. Building supports not to deflect more than 1/8 inch under normal conditions and 1/4 inch under seismic conditions.
- d. Installation of guide rail bracket supports in concrete. Inserts or embeds, if used, will be furnished under this Section.
- e. Wall blockouts and fire rated backing for control and signal fixture boxes that penetrate walls.
- f. Cutting and patching walls and floors. Finished floors slope away from elevator doors.
- g. Opening in hoistway wall or pit wall for hydraulic piping. Trench and backfill underground piping.
- h. Erect front hoistway wall after elevator entrances are installed.
- i. Grout around hoistway entrances and sills.
- j. Provide pit access ladder for each elevator.
- k. Provide structural support for car buffer impact loads, guide rail loads, and cylinder loads.
- l. Waterproof pit. Dry sump with flush grate. Provide pump or indirect drain to remove accumulated liquid.
- m. Protect open hoistways and entrances during construction in accordance with OSHA Regulations.

- n. Protect car enclosure, hoistway entrance assemblies, and special metal finishes from damage after installation.
- o. Hoistway venting or pressurization to prevent accumulation of smoke and gas as required by Local Building Code.
- p. Seal fireproofing to prevent flaking.

1. Machine Room

- a. Provide enclosure with access.
- b. Provide self closing and locking access door with panic door hardware.
- c. Provide ventilation, air conditioning and heating as required. Maintain minimum temperature of 55 degrees F, maximum 90 degrees F. Maintain maximum 80 percent relative humidity, non-condensing.
- d. Paint walls, ceiling, and floor.
- e. Provide class "ABC" fire extinguisher.
- f. Seal fireproofing to prevent flaking.
- g. Provide fire sprinklers where required.
- h. Only conduit, wiring, and equipment directly related to the hydraulic elevator allowed in elevator machine rooms.

2. Electrical Service, Conductors and Devices

- a. Provide lighting and Ground Fault Circuit Interrupter (GFCI) convenience outlets in pit and machine room.
- b. Provide conduit from the closest hoistway of each elevator group or single elevator to the firefighters' control room and communications distribution cabinet. Coordinate size, number, and location of conduits.
- c. Provide three-phase mainline copper power feeder to terminals of each elevator controller in the machine room with protected, lockable "OPEN," disconnect with auxiliary contacts to allow electrical interlock with battery power lowering unit.
- d. Provide single-phase copper power feeder to each elevator controller for car lighting and exhaust blower with individual protected, lockable "OFF," disconnect switch located in machine room.
- e. Provide single-phase copper power feeder to each elevator controller for tank heater, cylinder heat trace system and oil cooler system (min. 20 amps) with individual protected, lockable "OFF," disconnect switch located in machine room.
- f. Provide products-of-combustion sensor (NFPA 72, Chapter 5-3) in each elevator lobby, for each group of elevators or for single elevator and machine room to initiate firefighters' return feature. Provide detector at top of hoistway if sprinklered. Provide means for service access from outside the hoistway. Provide sensor signal wiring from hoistway or machine room connection point to elevator controller terminals.

- g. Provide temporary power and illumination to install, test, and adjust elevator equipment.
- h. Provide means to manually and automatically disconnect power to affected elevator pump unit and controller prior to activation of machine room overhead fire sprinkler system, and/or hoistway overhead fire sprinkler system. Manual shut-off means shall be located outside bounds of machine room.
- i. When sprinklers are provided in the hoistway, all electrical equipment, except seismic protective devices, located less than 4 feet above the pit floor shall be identified for use in wet locations (NFPA 70).
- j. Provide power feeder to elevator intercom amplifier located in the elevator machine room.
- k. Provide power feeder to each elevator controller in machine room for elevator car heating and air conditioning unit.

C. Equipment furnished by Sound Transit, installed under this Section:

- 0. Radio antenna
- 1. Production of combustion sensor
- 2. Network switch

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents:

- 0. American National Standards Institute (ANSI)
  - a. ANSI Z97.1 For Safety Glazing Materials Used in Buildings – Safety Performance Specifications and Methods of Test
- 1. American Society of Mechanical Engineers (ASME)
  - a. ASME A17.1 Safety Code for Elevators and Escalators Includes Requirements for Elevators, Escalators, Dumbwaiters, Moving Walks, Material Lifts, and Dumbwaiters with Automatic Transfer Devices
  - b. 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, Private Resident Elevators, and Escalators and Moving Walks
  - c. ASME A17.5 Elevator and Escalator Electrical Equipment
- 2. ASTM International (ASTM)
  - a. ASTM A36/A36M Standard Specification for Carbon Structural Steel
  - b. ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
  - c. ASTM A167 Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

- d. ASTM A568/A568M Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for
- e. ASTM A1008/A1008M Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable
- f. ASTM A1011/A1011M Standard Specifications for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
- g. ASTM B151/B151M Standard Specification for Copper-Nickel-Zinc Alloy (Nickel Silver) and Copper-Nickel Rod and Bar
- h. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
- i. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
- j. ASTM B418 Standard Specification for Cast and Wrought Galvanic Zinc Anodes

3. Americans with Disabilities Act of 1990 (ADA)

- a. ADA Accessibility Guidelines (ADAAG)

4. Consumer Product and Safety Commission (CPSC)

- a. CPSC 16 CFR Part 1201 Safety Standard for Architectural Glazing Materials

5. Federal Standard and NAAMM nomenclature

6. International Code Council (ICC)

- a. International Building Code (IBC) – Applicable to Projects Not Located Within Seattle.

- 1) IBC Chapter 30 Elevators and Conveying Systems

7. Institute of Electrical and Electronics Engineers, Inc. (IEEE)

- a. IEEE 446 IEEE Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications

8. Telecommunications Industry Association (TIA)

- a. TIA-568-C.0 Generic Telecommunications Cabling for Customer Premises

9. National Fire Protection Association (NFPA)

- a. NFPA 70 National Electrical Code
- b. NFPA 72 National Fire Alarm and Signaling Code
- c. NFPA 101 Life Safety Code

- d. NFPA 130 Standard for Fixed Guideway Transit and Passenger Rail Systems
- 10. Occupational Safety & Health Administration (OSHA)
  - a. 29 CFR Part 1926, Safety and Health Regulations for Construction
- 11. The Society for Protective Coatings (SSPC)
  - a. SSPC SP 6 Commercial Blast Cleaning
- 12. City of Seattle (COS)
  - a. Seattle Building Code (SBC) – Applicable to Projects Located Within Seattle
    - 1) SBC Chapter 30 Elevators and Conveying Systems
- 13. Washington Administrative Code (WAC)
  - a. Title 296: Department of Labor and Industries; Chapter 296-96: Safety Regulations and Fees for all Elevators, Dumbwaiters, Escalators, and Other Conveyances
- 14. American Welding Society, Inc. (AWS)
  - a. AWS A2.4 Standard Symbols for Welding, Brazing, and Nondestructive Examination
  - b. AWS D1.1/D1.1M Structural Welding Code – Steel
- 15. International Standards Organization (ISO)
  - a. ISO 281-1:1997 Rolling Bearings Dynamic Load Ratings and Rating Life

### 1.03 DEFINITIONS

- A. Terms used are defined in the latest edition of the Safety Code for Elevators and Escalators, ASME A17.1.
- B. Reference to a device or a part of the equipment applies to the number of devices or parts required to complete the installation.

### 1.04 SUBMITTALS

- A. Submit
  - 0. Pre-revenue Warranty Maintenance Plan
    - a. Submit a detailed Pre-revenue Warranty Maintenance Plan.
  - 1. Shop Drawings: Scaled and Fully Dimensioned Layout that includes plans of pit, hoistway, and machine room indicating equipment arrangement, elevation section of hoistway, details of car enclosures, hoistway entrances, and car/hall signal fixtures.
    - a. Indicate equipment lists, reactions, and design information on layouts include heat dissipation requirements for machine room and hoist beam load requirements.

- b. Power Confirmation Sheets: Include motor horsepower, code letter, starting current, full load running current, and demand factor for applicable motors.
  - c. Complete control and schematic wiring diagram of the elevator system and subsystems.
  - d. Elevator controller, including manufacturer's technical data and product data, and interface hardware and software requirements.
  - e. Within 60 days after Notice to Proceed and before beginning equipment fabrication, submit shop drawings and required material for review.
2. Finish Material: Submit 3-inch by 12-inch samples of actual finished material for review of color, pattern, and texture by Resident Engineer. Compliance with other requirements is the exclusive responsibility of the Contractor. Include signal fixtures, lights, graphics, Braille plates, and mounting provisions.

i) Operation and Maintenance Manuals

- b. In addition to the requirements stated elsewhere in the Contract Documents, include the following as minimums:
  - 1) Printed Instructions: Three sets of neatly bound instructions explaining all operating features.
  - 2) Complete installation, maintenance, adjustment, removal, and testing instructions and procedures for all elevator equipment and components. All instructions shall be at the adjuster's level and specific to the equipment installed.
    - a) Include inspection and maintenance standards including wear limits, settings and tolerances.
  - 3) Wiring Diagrams: Include a complete set within each Operation and Maintenance Manual, as well as three individually printed and bound complete sets, of as-installed straight-line wiring diagrams showing the electrical connections of all equipment and all modifications to control circuits. Furnish a legend sheet with each set of drawings to provide the following information:
    - a) Name and symbol of each relay, switch, or other apparatus.
    - b) Location on drawings, drawing sheet number and area, and location of all contacts.
    - c) Location of apparatus, whether on controller or on car.
    - d) Sequence of operation of apparatus connected with each elevator.
  - 4) Complete software documentation for all installed equipment, including software updates and or revisions during the progress of the Work.
  - 5) Lubricating instructions and schedule, including recommended grade of lubricants.

- 6) Hoistway cleaning procedures required to meet sign off requirements of L&I.
- 7) List of Special Tools required for inspection, adjustment, maintenance, repair and testing. Provide special tools to Sound Transit. Special tools shall be the property of Sound Transit and kept in the elevator machine room at all times when not in use.
- 8) List of recommended spare parts and stock quantities for routine maintenance of the equipment. Include a list of spare parts considered critical and for which long lead time frames (items not available within 48 hours) for acquisition would result in extended equipment down-time.
- 9) Parts Catalog: Complete parts catalogs listing all replaceable parts including Manufacturer's identifying numbers, current unit price and ordering instructions. Include the complete parts catalog in each Operation and Maintenance Manual, as well as three separate complete printed sets.
- 10) The Operation and Maintenance Manual shall contain only information related to the equipment installed. Generic information not relevant to the installed equipment shall not be included.

3. Special Tools

- a. Provide a complete set of special tools and instruments necessary for troubleshooting and making all adjustments on every part of the elevator installation. Any tools that are designed specifically for tasks associated with elevator inspection, maintenance and repair or that are required for these tasks, are special tools.
  - b. Diagnostic Equipment: Provide all diagnostic test devices complete with instructions, access codes, adjusters' manuals and set-up manuals for adjustment, diagnosis and troubleshooting of elevator system, and performance of routine safety tests.
  - c. Storage cabinet: Provide and install a lockable metal cabinet in each elevator machine room of suitable size for the storage of special tools and necessary spare parts. Cabinet shall be mounted on legs or a pedestal a minimum of 4 inches off the floor. Cabinet to be keyed to Sound Transit standard keying system.
4. Four sets of neatly tagged keys for all switches and control features properly tagged and marked.

B. Transmit

0. Testing Submittals

- a. Submit fiber optic performance test procedure and results.
1. Product Data for Special Elevator Equipment: Submit product catalogs for speakers, cameras, intercom/emergency telephone, Ethernet switch, traveling cable data cables, card reader and door controllers.
2. The Contractor shall submit material safety data and product data sheets for all products used by the contractor at the site or which may need to be replaced or

added to by the maintenance personnel. Such products include but are not limited to greases, oils and paint. The sheets shall have an index listing each product along with application method, approximate quantity required of the product and the component the product is associated with.

1.05 QUALITY ASSURANCE

- A. Comply with most stringent applicable provisions of the Code or Authority specified in Article 1.02, herein, including revisions and changes in effect on date of these Contract Specifications:

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver material in Manufacturer's original, unopened protective packaging.
- B. Store material in original protective packaging. Prevent soiling, physical damage, or moisture damage.
- C. Protect equipment and exposed finishes from damage and stains during transportation, erection, and construction.

1.07 WARRANTY MAINTENANCE

- A. Pre-revenue Warranty Maintenance:
0. Provide full service Warranty Maintenance as described in this section. This period shall commence upon installation and extend to the start of Revenue Service.
- a. Full service maintenance shall include standard monthly maintenance, replacement parts, and annual testing.
1. Document completed monthly maintenance during warranty within the installer-provided Maintenance Control Program (MCP) that is kept at all times within the elevator machine room.
2. Provide preventive maintenance as recommended by the manufacturer and in accordance with all applicable codes, during normal working hours. Systematically examine, adjust, clean, and lubricate equipment, parts, components, and subsystems. Repair or replace defective parts using parts produced by the manufacturer of installed equipment. Maintain elevator machine room, hoistway, and pit in clean condition.
3. Defective is defined to include, but not to be limited to; operation or control system failures, performance below required minimum, excessive wear, unusual deterioration or aging of materials or finishes, unsafe conditions, the need for excessive maintenance, abnormal noise or vibration, and similar unsatisfactory conditions.
4. Exercise each elevator during monthly maintenance visits and document in the MCP. Exercising of equipment shall consist of continuous operation through entire run of hoistway for one hour. Exercise equipment as necessary to meet a minimum of 150 hours of run time in the first year.
5. All warranty and maintenance work shall be performed by a company that has a current code compliant Maintenance Control Program (MCP) on file with L & I. Warranty maintenance shall meet the MCP criteria as outlined in ASME A17.1 as well as all manufacturer's recommended maintenance.

6. Equipment Manufacturer is responsible for upgrades and revisions of software and documentation of associated revision to the Operations and Maintenance Manual.
7. The Contractor shall document all maintenance and transmit maintenance records to Sound Transit.

B. Extended Warranty Maintenance:

0. Provide Extended Warranty Maintenance for a five year period commencing at the start of Revenue Service, per Appendix A "Extended Maintenance Services Scope of Work" and as generally described below.
  1. Provide full service preventive maintenance as recommended by the manufacturer and in accordance with all applicable codes, and 24 hour emergency callback service. Systematically examine, adjust, clean, and lubricate equipment. Repair or replace parts as necessary using parts produced by the manufacturer of installed equipment. Maintain elevator machine room, hoistway, and pit in clean condition.
  2. 24-hour emergency callback service shall comply with the following response times:
    - a. Service requests placed between 6:00am and 6:00pm: 1 hour.
    - b. Service requests other hours, weekends, and holidays: 2 hours.
  3. Removal of units from beneficial usage for maintenance purposes shall be coordinated with and approved by Sound Transit, unless removal is necessitated for emergency repair or adjustment. Normal preventive maintenance service shall be performed during off-peak operating hours.
  4. All units shall be available for use an average of 98.7% of property hours of operation over each three-month period during Extended Warranty Maintenance service. This includes allowance for equipment out of service time as the result of callbacks, scheduled preventive maintenance, and repairs. Contractor's failure to meet this unit availability provision for two consecutive three-month periods for any single elevator or escalator, or group of units, shall trigger an automatic maintenance audit by Sound Transit. Contractor agrees to expeditiously take corrective action in regard to identified deficiencies. Further, Contractor acknowledges Sound Transit's right to pass cost of said audit to Contractor.
  5. All warranty and maintenance work shall be performed by a company that has a current code compliant Maintenance Control Program (MCP) on file with L & I.
  6. Equipment Manufacturer is responsible for upgrades and revisions of software and documentation of associated revision to the Operations and Maintenance Manual.

1.08 PERMIT, TEST AND INSPECTION

- A. Obtain and pay for permit, license, and inspection fee necessary to complete the installation. Installation will be considered complete when the governing authority of Washington State Department of Labor and Industries has issued a permanent operating permit for each elevator.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Approved Manufacturers
  - 0. Hydraulic Installers: KONE, Otis, Schindler, Thyssen Krupp or approved equal.
  - 1. Hydraulic Equipment: Minnesota Elevator, Canton, Elevator Equipment Corp., Schindler, Thyssenkrupp or approved equal.
  - 2. Control Manufacturers: Manufacturers standard controls (non-proprietary), MCE, and Swift/CEC or approved equal.
  - 3. Car Enclosure: Brice-Southern, Hauenstein & Burmeister, KONE, Otis, Schindler, Thyssen Krupp, Tyler, Concept or approved equal.
  - 4. Hoistway Entrance: Brice-Southern, Hauenstein & Burmeister, KONE, Otis, Schindler, Thyssen Krupp, Tyler or approved equal.

### 2.02 MATERIALS

- A. Steel
  - 0. Sheet Steel (Furniture Steel for Exposed Work): Stretcher leveled, cold rolled, commercial quality carbon steel, complying with ASTM A1008, matte finish.
  - 1. Sheet Steel (for Unexposed Work): Hot rolled, commercial quality carbon steel, pickled and oiled, complying with ASTM A568 and A1011.
  - 2. Structural Steel Shapes and Plates: ASTM A36.
- B. Stainless Steel: Type 316 complying with ASTM A167, with standard tempers and hardness required for fabrication, strength, and durability. Apply mechanical finish on fabricated work in the locations shown or specified (Federal Standard and NAAMM nomenclature) with texture and reflectivity required to match Resident Engineer's sample. Protect with adhesive-paper covering.
  - 0. Non-directional orbital uniform finish: 80 grit orbital sanding over standard mill plate or shape to produce a uniform non-directional satin finish with 90 percent of mill marks removed to match Resident Engineers visual sample.
- C. Aluminum: Extrusions conforming to ASTM B221; sheet and plate conforming to ASTM B209.
- D. Nickel Silver: Extrusions conforming to ASTM B151/151M.
- E. Paint: Clean exposed metal parts and assemblies of oil, grease, scale, and other foreign matter and factory paint one shop coat of rust resistant primer. After erection, provide one finish coat of industrial enamel paint. Galvanized metal need not be painted.
- F. Prime Finish: Clean all metal surfaces receiving baked enamel paint finish of oil, grease, and scale. Apply one coat of rust resistant primer followed by a filler coat over uneven surfaces. Sand smooth and apply final coat of primer.
- G. Baked Enamel Finish: Prime finish in accordance with Article 2.02F. Apply and bake three additional coats of enamel in the selected solid color.

- H. Glass: Laminated safety glass, minimum 9/16 inch thick, conforming to ANSI Z97.1 and CPSC 16 CFR Part 1201.

## 2.03 EQUIPMENT

- A. Equipment shall be the same for all contracts except where specifically noted. Where variations occur, each contract shall be specified separately.
- B. Elevators
  - 0. Number:
    - a. As specified and as detailed on Contract Drawings
  - 1. Capacity and Loading Classification:
    - a. As specified and as detailed on Contract Drawings
  - 2. Speed: 125 feet per minute
  - 3. Operational Control: Selective collective, microprocessor based system
  - 4. Motor Control: Single speed AC with SCR soft start with closed transition
  - 5. Power Characteristics: 480 Volts, 3 Phase, 60 Hertz
  - 6. Stops and Openings: As specified and as detailed on Contract Drawings
  - 7. Floors Served: As specified and as detailed on Contract Drawings
  - 8. Travel: As specified and as detailed on Contract Drawings
  - 9. Minimum Clear Inside Car:
    - a. Geometry Type A: 5 feet 8 inches wide by 7 feet 10 inches deep
    - b. Geometry Type B: 7 feet 8 inches wide by 5 feet 3 inches deep
  - 10. Entrance Size: 4 feet 0 inches wide by 7 feet 0 inch high
  - 11. Entrance Type: As detailed in contract drawings.
  - 12. Door Operation: High-speed, heavy duty, master door operator, minimum opening speed 2.5 feet per second
  - 13. Door Protection: Infrared, full screen device, with differential timing and nudging and interrupted beam time
  - 14. Machine: Hydraulic pump
  - 15. Hydraulic Type: Dual telescope plungers
  - 16. Machine Room: As specified and as detailed on Contract Drawings
  - 17. Guide Rails: Planed steel tees
  - 18. Buffers: Spring
  - 19. Car Enclosure: As specified and as detailed on Contract Drawings Car ceiling height of 8 feet.

20. Signal Fixtures: Vandal resistant assembly.
21. Registration Lights: Single hall pushbutton riser. Single car operating panel per entrance. Vandal-resistant car and hall pushbuttons.
  - a. Hall buttons and control devices shall be NEMA 4.
22. Position Indicator: Dual digital with direction arrow.
23. Hall Lanterns: At all floors with volume adjustable electronic chime or tone. Sound twice for down direction. Vandal resistant.
  - a. Hall lanterns shall be NEMA 4 enclosures at all locations.
24. Hoistway wiring, conduit and enclosures shall be rated for wet locations.
25. Additional Features
  - a. Car roller guides
  - b. Car top inspection station
  - c. Guardrails at car top to meet code requirements for safety.
  - d. Firefighters' service, including alternate floor return feature
  - e. Battery pack standby power provision
  - f. Accessibility and emergency medical services access and signage
  - g. Hinged car return panels arranged for integral car operating panels
  - h. Hoistway access switches
  - i. Hoistway door unlocking device. All floors with locking escutcheon plugs.
  - j. Independent service feature
  - k. Platform isolation – jack to bolster connection(s)
  - l. Firefighters' elevator control panel located in Fire Command Center Room and remote wiring.
  - m. Tamper resistant fasteners for signal fixture faceplates
  - n. Sill support angles
  - o. Hydraulic pump unit and controller sound isolation
  - p. Seismic safety valve
  - q. Pad hooks and vinyl-covered pads
  - r. Battery pack emergency car lighting. Provide separate constant pressure test button in car service compartment. Illuminate portion of normal car lighting.
  - s. No visible company name or logo on any equipment viewable by passengers

- t. Auxiliary car operating panel for dual entry elevators
  - u. Wiring diagrams, operating instructions, and parts ordering information
  - v. System Diagnostic Equipment and instructions: The elevator installation shall be a design that can be maintainable by any licensed elevator maintenance company employing journeymen mechanics, without the need to purchase or lease additional diagnostic devices, special tools, or instructions from the original equipment manufacturer.
    - 1) Provide onsite capability to diagnose faults to the level of individual circuit boards and individual discreet components for the solid state elevator controller.
    - 2) If the equipment for fault diagnosis is not completely self-contained within the controllers but requires a separate, detachable device, that device shall be furnished to Sound Transit as part of this installation. Such device shall be in possession of and become property of Sound Transit.
      - a) Installed equipment not meeting this requirement shall be removed and replaced with conforming equipment at no cost to Sound Transit.
  - w. L&I Elevator Access Box: High Security Fire Key Box by Quality Elevator Products, Inc. Model SKB-2011 or approved equal. Color: Stainless steel #4 finish cover. Custom Label: "ELEVATOR". Provide Department of Labor & Industries elevator key cylinder. Locate box as shown on drawings. Refer to Architectural drawings for location.
  - x. Firefighters' Key Box: Knox-Box Elevator Key Box 1400 Series recessed mount and recessed mounting kit, or approved equal. Color: Red.. Engrave instructions for use on cover in accordance with Local Fire Authority requirements. Locate box as shown on drawings. Refer to Architectural drawings for location.
  - y. Keys for elevator access and car operating panel in the machine room.
  - z. Signage engraving filled with black paint or approved etching process
26. Etched stainless steel support signs, interior cab only
- a. Material: Stainless steel, etched copy and icon. Attached to interior elevator walls with VHB and silicone.
  - b. Thickness: 1/8 inch thick with eased edges
  - c. Size: 3-inch x 1-1/4-inch
  - d. Braille message: Stainless steel braille beads applied below 1/32-inch raised copy and Grade II braille.
  - e. Color: Reverse etched stainless steel, negative space is painted black

C. Car, General

- 0. Car Speed: plus or minus 10 percent of contract speed under all loading condition.
- 1. Car Capacity: Safely lower, stop and hold up to 125 percent of rated load.

2. Car Stopping Zone: plus or minus 1/4 inch under any loading condition.
3. Door Opening Time: Seconds from start of opening to fully open:
  - a. Two speed, side opening: 2.7 seconds
  - b. Single speed, center opening: 1.8 seconds
4. Door Closing Time: Seconds from start of closing to fully closed:
  - a. Two speed, side opening: 4.0 seconds
  - b. Single speed, center opening: 2.8 seconds
5. Car Ride Quality
  - a. Horizontal acceleration within car during all riding and door operating conditions.
  - b. Not more than 20 mg peak to peak in the 1 10 Hertz range.
  - c. Acceleration and Deceleration: Smooth constant and not more than 5 feet/second/second with an initial ramp between 0.5 and 0.75 second.
6. Sustained Jerk: Not more than 8 feet/second/second/second
7. Pressure: Fluid system components shall be designed and factory tested for 500 psi. Maximum operating pressure shall be 400 psi.
8. Noise and Vibration Control
  - a. Airborne Noise: Measured noise level of elevator equipment and its operation shall not exceed 50 dBA in elevator lobbies.
  - b. Noise level in cab shall not exceed 55 dBA for continuous noise or 60 dBA for intermittent noise under any condition including door operation and car ventilation exhaust blower on its highest speed.
    - 1) All dBA readings to be taken 5 feet off the floor and 1 foot from the wall using the "A"-weighted scale.
    - 2) Vibration Control: All elevator equipment provided under this Contract, including power unit, controller, oil supply lines, and their support shall be mechanically isolated from the building structure and electrically isolated from the building power supply and to each other to minimize the possibility of objectionable noise and vibrations being transmitted to occupied areas of the building.
  - c. Limit noise level in the machine room relating to elevator equipment and its operation to no more than 80.
    - 1) All DBA readings to be taken 3 feet off the floor and 3 feet from the equipment using the "A"-weighted scale.

D. Car Equipment

0. Frame: Welded or bolted, rolled or formed steel channel construction to accommodate load classification requirements.

1. Platform: Constructed of stainless steel frame with 1/4-inch stainless steel deck. Design and construct to accommodate load classification requirements. Wood construction not permitted.
2. Guide Shoes: Roller type with three or more spring dampened, sound-deadening rollers per shoe. Guide shoes to be designed for the load classification requirements.
3. Finish Floor Covering: 1/4-inch thick resin epoxy flooring with high solids with colored rubber chips in a troweled mortar system. "SoftTop" Decorative Flooring by General Polymers or approved equal, with "Shark-Grip" Slip Resistant additive to meet coefficient of friction. Color as selected by the Resident Engineer from the manufacturer's standard.
4. Sills: Extruded stainless steel with out extruded extension between car entrance columns to face of car front return. Cast-in-place concrete between sill and tactile warning surfacing.
5. Toe Guard: Minimum 14-gauge stainless steel, reinforced and braced to car platform, with random orbital finish.
6. Doors: Provide as specified for hoistway entrance doors.
7. Door Hangers: Two-point hanger roller with neoprene roller surface and suspension with eccentric up thrust roller adjustment.
8. Door Track: Bar or formed, cold-drawn removable steel track with smooth roller contact surface.
9. Door Header: Construct of minimum 12-gauge steel, shape to provide stiffening flanges.
10. Door Electrical Contact: Prohibit car operation unless car door is closed within tolerance allowed by Code.
11. Door Clutch: Heavy-duty clutch, linkage arms, drive blocks, and pickup rollers or cams to provide positive, smooth, quiet door operation. Design clutch so car doors can be closed while hoistway doors remain open.
12. Restricted Opening Device: Restrict opening of car doors outside the unlocking zone.
13. Door Operator: High speed, heavy-duty, master door operator capable of opening doors at no less than 2.5 feet per second. Accomplish reversal in no more than 2-1/2 inches of door movement. Open doors automatically when car arrives at a floor. Provide solid state door control with closed loop circuitry to constantly monitor and automatically adjust door operation based upon velocity, position, and motor current. Maintain consistent, quiet, and smooth door operation at all floors regardless of door weight or varying air pressure. Basis of Design: GAL MOVFR or approved equal.
14. Door Control Device
  - a. Infrared Reopening Device: Black, fully enclosed device. Full screen infrared matrix or multiple beams extending vertically along edge of each leading door panel to minimum height of 7 feet above finished floor. Device shall prevent doors from closing and reverse doors at normal opening speed if beams are obstructed while doors are closing, except

during nudging operation. If device fails, provide for automatic shutdown of car at floor level with doors open.

- b. Nudging Operation: After beams of door control device are obstructed for a predetermined time interval (minimum 20.0-25.0 seconds), warning signal shall sound and doors shall attempt to close with a maximum of 2.5 foot-pounds kinetic energy. Activation of the door open button shall override the nudging operation and reopen the doors.
- c. Interrupted Beam Time: When beams are interrupted during initial door opening, hold door open a minimum of 3.0 seconds. When beams are interrupted after the initial 3.0 second hold open time, reduce time doors remain open to an adjustable time of approximately 1.0-1.5 seconds after beams are reestablished.
- d. Differential Door Time: Provide separately adjustable timers to vary time that doors remain open after stopping in response to calls.
  - 1) Car Call: Hold open time adjustable between 3.0 and 5.0 seconds.
  - 2) Hall Call: Hold open time adjustable between 5.0 and 8.0 seconds. Use hall call time when car responds to coincidental calls.

15. Car Operating Panel

- a. One car operating panel without faceplate, consisting of a metal box containing the operating vandal resistant fixtures, mounted behind the car enclosure swing return panel(s).
  - 1) Panel shall be located as detailed in the Contract Drawings and as required by entrance type.
- b. Suitably identify vandal resistant assemblies including floor buttons, alarm button, door open button, door close button and emergency stop switch with SCS, Visionmark or Entrada Cast Tactile symbols recessed flush mounted. Configure plates in accordance with Local Accessibility Standards, WAC 296-96-02495, including Braille. Locate operating controls no higher than 48 inches above the car floor; no lower than 35 inches for stop device and alarm button.
- c. Provide minimum 3/4-inch diameter raised floor pushbuttons that illuminate to indicate call registration. Include 5/8-inch high designation of the floors served directly to the left of the pushbutton. Provide keyswitches to activate floor pushbuttons at intermediate levels. Platform and surface levels to have pushbutton only.
  - 1) Elevator car call buttons shall indicate floor levels consistent with Sound Transit's standard floor identification as follows:
    - a) P = Platform Level
    - b) M = Mezzanine Level (1, 2, 3, etc.)
    - c) B = Basement Level (1, 2, 3, etc.)
    - d)        S = Surface Level

- e) G = Garage Level (1, 2, 3, etc.)
- d. Provide alarm button at bottom of car operating panel to ring bell located on car, and sound distress signal at control panel. Illuminate button when activated.
- e. Provide keyed stop switch with markings to show “run” and “stop.” Locate in locked service compartment.
- f. Provide “door open” button to stop and reopen closing doors or hold doors in open position. Button operable only while car is stopped at a floor regardless of special operational features, except firefighters’ service.
- g. Provide “door close” button to activate door close cycle. Cycle shall not begin until normal door dwell time for a car call has expired, except firefighters’ service.
- h. Provide firefighters’ Phase II key switch with engraved instructions in accordance with Code requirements. Include light jewel, buzzer, and call cancel button.
- i. Provide firefighters’ telephone jack with bezel matching adjacent controls.
- j. Provide lockable service compartment with recessed flush door. Door material and finish shall match car return panel or car operating panel faceplate. Door shall contain an integral flush window for displaying the elevator-operating certificate. Inside surface of door shall accommodate mounting provisions for certificate.
- k. Include the following controls with function and operating positions identified by engraved signage painted black:
  - 1) Inspection switch
  - 2) Light switch
  - 3) 2-speed exhaust blower switch
  - 4) Independent service switch
  - 5) Constant pressure test button for battery pack emergency lighting
  - 6) 120-volt, AC, GFCI protected electrical convenience outlet
  - 7) Stop switch
- l. Provide black paint filled, engraved or approved etched signage with size and style approved by Resident Engineer as follows:
  - 1) Phase II firefighters’ operating instructions on main operating panel above corresponding key switch, with text in accordance with ASME A17.1.
  - 2) Car number on main car operating panel.
  - 3) “NO SMOKING” on main car operating panel.
  - 4) Car capacity in pounds on service compartment door.

5) Washington State Department of Labor and Industries conveyance number in 1/2 inch tall letters.

16. Car Top Control Station: In accordance with Code. Control station shall be provided with GFCI protected outlet and work light; include on/off switch and lamp guard. An additional GFCI receptacle shall be mounted at bottom of car. Mount to provide utilization while standing in an upright position.

E. Car Enclosure

0. Provide complete car enclosure as specified herein and detailed on Contract Drawings. Provide the following features.

a. Shell: Reinforced 14-gauge furniture steel. Apply sound deadening mastic to exterior.

b. Canopy: Reinforced 14-gauge furniture steel with lockable, hinged emergency exit. Interior finish white reflective baked enamel.

c. Front and Rear Return Panels and Integral Entrance Columns: Reinforced 14-gauge non-directional finish stainless steel. Swing entire unit on substantial pivot points (minimum three) for service access to car operating panel(s). Locate pivot points to provide full swing of front return panel without interference with sidewall finish or handrail. Secure in closed position with concealed three-point latching. Provide service compartment with recessed flush cover and cutouts for operating switches.

d. Transom: Reinforced 14-gauge non-directional finish stainless steel full width of enclosure.

e. Car Door Panels: Minimum reinforced 16-gauge non-directional finish stainless steel. Same construction as hoistway door panels.

f. Base: Non-directional stainless steel with concealed ventilation cutouts. Cutouts to be protected from penetration by debris or liquids.

g. Interior Wall Finish: Non-directional finish stainless steel on aluminum honeycomb panels. As specified and as indicated. Refer to architectural drawings for details of elevator cab interiors including metal and glass panel installations.

h. Ventilation: Two speed exhaust blower mounted to car canopy on isolated rubber grommets. Morrison Products, Model AA with diffuser and grille or approved equal.

i. Lighting: Provide minimum average 15 foot-candle illumination at car floor utilizing high output LED fixtures. Provide battery standby power for operation. Provide fixtures with wiring and hookup. Coordinate with emergency lighting requirements. Provide emergency lighting integral with portion of normal car lighting system. Include required transformer.

1) All fixtures shall be above the ceiling and not allow removal without special tools. Fixture replacement shall be able to be performed from within the elevator cab by non-elevator maintenance personnel.

j. Suspended Ceiling: Special design as shown in the Contract Drawings.

- k. Handrails: 1-1/2 inch diameter stainless steel tubes.

F. Operation

- 0. Simplex Automatic for single elevators, Selective Collective for elevators located in groups.
  - a. Approved microprocessor-based, group dispatch, car and motion control systems as follows including, as a minimum, the features described hereafter:
    - 1) MCE Motion 2000
    - 2) Schindler Miconic HX
    - 3) Swift Futura Hydro
    - 4) Thyssenkrupp TAC 32
    - 5) Smartrise
    - 6) Elevator Controls Corp. Pixel
  - b. Operate cars as a group, capable of balancing service and providing continuity of group operation with one or more cars removed from the system.
  - c. Register service calls on cars from pushbuttons located at each floor and in each car. Slow down, and automatically stop cars at landings corresponding to registered calls. Make stops at successive floors for each direction of travel irrespective of order in which calls are registered except when bypassing hall calls to balance and improve overall service; stop only one car in response to particular hall call. Assign hall calls to specific cars, and continually review and modify these assignments to improve service. Simultaneous to initiation of slowdown of a car for a hall call, cancel that call. Render hall pushbutton ineffective until car doors begin to close after passenger transfer. Cancel car calls in the same manner. Give priority to coincidental car and hall calls in car assignment.
  - d. Operate system to meet changing traffic conditions on a service demand basis. Include provisions for handling traffic, which may be heavier in either direction, intermittent or very light. As traffic demands change, automatically and continually modify group and individual car assignment to provide the most effective means to handling traffic conditions. Assign hall calls to individual cars, continually review and update assignments; provide means to sense long wait hall calls and preferentially serve them; give priority to coincidental car and hall calls in hall call assignment and accomplish direction reversal without closing and reopening doors.
  - e. Use easily re-programmable system software. Design basic algorithm to optimize service based on equalizing system's response to registered hall calls and equalizing passenger trip time to shortest possible time.
  - f. Required Features
    - 1) Dispatch Protection: Backup dispatching shall function in the same manner as the primary dispatching.

- 2) Delayed Car Removal: Automatically remove delayed car from group operation.
  - 3) Position Sensing: Reset car position when passing or stopping at each landing.
  - 4) Hall Pushbutton Failure: Multiple power sources and separate fusing for pushbutton risers.
  - 5) Duplicate communication link: All group and individual car computers.
1. Do not reverse car direction until all car calls have been answered or until all hall calls ahead of car and corresponding to direction of car travel have been answered.
  2. Illuminate appropriate pushbutton to indicate call registration. Extinguish light when call is answered.
  3. Other Items
    - a. Low-Oil Control: In the event oil level is insufficient for travel to the top floor, provide controls to return elevator to the main level and park until oil is added.
    - b. Independent Service: Provide controls for operation of each car from its pushbuttons only. Close doors by constant pressure on desired destination floor button or door close button. Open doors automatically upon arrival at selected floor.
    - c. Auto Operation: Provide field adjustable intermittent automatic operation, to be set initially for once every 3 hours through the entire run of the hoistway. Cycling shall be the full 24 hours each day throughout the year (or can be field adjusted). During such trips, elevator doors shall not open at any landing. Should a landing hall call be registered during auto operation the elevator shall stop auto operation and immediately respond to the hall call.
  4. Firefighters' Service: Provide equipment and operation in accordance with Code requirements.
  5. Automatic Stopping Zone: Stop car within 1/4 inch above or below the landing sill. Avoid overtravel/undertravel, and maintain stopping accuracy regardless of load in car, direction of travel, or distance between landings.
  6. Motion Control: AC type with unit valve suitable for operation specified and capable of providing smooth comfortable acceleration and deceleration. Limit the difference in speed between full load and no load to not more than plus or minus 10 percent of the Contract speed.
  7. Door Operation: Automatically open door when car arrives at main floor whether car call has been registered or not.
  8. Standby Lighting and Alarm: Car mounted, battery unit with solid state charger to operate alarm bell and car emergency light fixture. Battery to be rechargeable with minimum 5 year life expectancy. Coordinate location of light fixture with Resident Engineer. Provide constant pressure test button in service compartment of car operating panel. Provide lighting integral with portion of normal car lighting system. Include required transformer.

9. Battery Lowering Device: Upon loss of normal power, provide controls to automatically lower the car(s) nonstop to the lowest landing. Upon arrival at the lowest landing, the elevator doors shall open automatically and remain open until regular door time has expired. The elevator shall then become deactivated. The standby power source shall be provided via 12-volt DC battery units installed in machine room, including solid-state charger and testing means mounted in a common metal container. Battery to be rechargeable lead-acid or nickel-cadmium with a 10-year life expectancy.
10. Provide standby battery power for cab fans. Battery and fans shall provide complete cab air change per minute for a minimum of 1 hour. Upon restoration of normal power, the elevator shall automatically resume normal operation.
11. Automatic Light and Fan Shut Down: The control system shall evaluate the system activity and automatically turn off the cab lighting and ventilation fan during periods of inactivity. The settings shall be field programmable.
12. Elevator Remote Disable: During non-revenue hours, public access to and use of the elevators shall be restricted. The elevators shall be provided with control systems to permit the Link Control Center (LCC) to shut down elevators during non-revenue hours and enable operation during non-revenue hours.
13. Sump High Water Sensor:
  - a. Provide sump high water float switch with audible alarm. Switch shall be capable of notifying BMS system when capacity of sump has been exceeded, Bus Rapid Transit stations excluded.

G. Elevator Machine Equipment

0. Arrange equipment in spaces shown on Contract Drawings.
1. Pump Unit: Assembled unit consisting of dry or submersible positive displacement pump, induction motor, master-type control valves combining safety features, holding, direction, bypass, stopping, manual lowering functions, shut off valve, oil reservoir with protected vent opening, oil level gauge, outlet strainer, drip pan, muffler, and all mounted on isolating pads. Provide radiator type cooling unit to maintain oil at operating temperature. Enclose entire unit with removable sheet steel panels lined with sound-absorbing material. Provide closed transition SCR soft start. Design unit for 120 upstarts per hour.
2. Pumping Unit Control Valve: The control valve shall be manifold with up, down and check valve sections. A control section including solenoid valves will direct the main valve and control up and down starting, transition from full speed to leveling speed, up and down stops, pressure relief and manual lowering. Down speed and up and down leveling shall be controlled at the main valve sections. All of these functions shall be fully adjustable for maximum smoothness and to meet Contract conditions. The manual lowering feature will permit lowering the elevator at slow speed in the event of power failure or for adjusting purposes.
3. Tank Heater: The tank shall be provided with a temperature sensor which continuously monitors the oil temperature and transmits this information to the controller. Provide a removable thermostatically controlled (min. 500 W) screwed on heater.
4. Oil Cooling System: The oil cooler shall be capable of removing 20,000 BTU/Hour and be provided with an adjustable thermostat. The unit shall be provided with a 10 micron filter in the oil line with a restriction sight glass with bypass in case of

plugged filter. The unit shall be capable of being separated into two parts, a fan section and a pump section which can be remotely mounted from one another. The units shall be located in the elevator machine room so as not to inhibit access and maintenance of the elevator equipment.

5. Encoder: Direct drive, solid state or magnetic tape, absolute positioning.
6. Controller: UL/CSA labeled.
  - a. Compartment: Securely mount all assemblies, power supplies, chassis switches, and relays, on a substantial, self supporting steel frame. Completely enclose equipment with covers. Provide means to prevent overheating.
  - b. Relay Design: Magnet operated with contacts of design and material to ensure maximum conductivity, long life, and reliable operation without overheating or excessive wear. Provide wiping action and means to prevent sticking due to fusion. Contacts carrying high inductive currents shall be provided with arc deflectors or suppressors.
  - c. Use of SIL (Safety Integrity Level) rated devices for EPD (Electrical Protective Devices) where possible is preferred to traditional positively opened mechanical switches. These devices shall be listed/certified and labeled/marked to a SIL rating in accordance with the applicable requirements of IEC 61508-2 and IEC 61508-3 with a SIL rating equal to or greater than the SIL indicated for the applicable device shown in ASME A17.1.
  - d. The detection of a dangerous fault (e.g. with diagnostic tests, proof-tests, or by any other means) in SIL rated electrical/electronic/programmable electronic system (E/E/PES, or commonly referred to as "PES") that can tolerate a single fault shall cause the elevator to revert to a known fail-safe condition. Where necessary, to maintain the integrity of the SIL rated PES and maintain the fail-safe condition prior to a second fault that could lead to a dangerous condition, a manual reset shall be required to remove the SIL rated PES from the fail-safe condition.
  - e. Microprocessor Related Hardware
    - 1) Provide built-in noise suppression devices that provide a high level of noise immunity on all solid-state hardware and devices.
    - 2) Provide power supplies with noise suppression devices.
    - 3) Isolate inputs from external devices (such as pushbuttons) with opto-isolation modules.
    - 4) Design control circuits so that one side of power supply is grounded.
    - 5) Safety circuits shall not be affected by accidental grounding of any part of the system.
    - 6) System shall automatically restart when power is restored.
    - 7) System memory shall be retained in case of power failure or disturbance.

- 8) Equipment shall operate properly with a 500 kHz to 1300 MHz radio frequency signal, transmitted at a power level of not less than 100 watts Effective Radiated Power (ERP) at a distance of 3 feet.
  - 9) Equipment shall be provided with Electro Magnetic Interference (EMI) shielding within FCC guidelines.
- f. Wiring: CSA labeled copper for factory wiring. Neatly route all wiring interconnections and securely attach wiring connections to studs or terminals.
  - g. Provide controller or machine mounted auxiliary, lockable "off" disconnect if mainline disconnect not in sight of controller and pump unit.
  - h. Permanently mark components (relays, fuses, and PC board,) with symbols shown on wiring diagrams.
  - i. Provide reduced voltage motor starting circuits with solid-state motor starter.
7. Muffler: Provide in discharge oil line near pump unit. Design shall dampen and absorb pulsation and noise in the flow of hydraulic fluid.
8. Piping and Oil: Provide piping, connections, and oil for the system. All piping to be ASTM A53, Grade B, seamless schedule 80 steel or better. All piping shall have threaded/welded fittings except that a mechanical coupling shall be provided at the discharge of the power unit and at the connection to the safety valves in the pit. Mechanical fittings shall be Victaulic Type 77, with grade T gaskets or approved equal. Buried piping shall be secondarily contained with watertight Schedule 40 PVC sleeves between elevator machine room and pit. Thermostatically controlled heat tracing and insulation shall be provided for all piping which is exposed to the outdoors, or which is indicated to be insulated on the Contract Drawings. A minimum of two sound isolation couplings shall be provided between the pump unit and oil line and the oil line and jack unit. Provide isolated pipe stands or hangers as required.
9. Connection to Remote Monitoring Interface Terminal Cabinet
- a. Provide conduit and wiring between the elevator controller and the interface terminal cabinet for remote monitoring and control of each car by the Building Management System.
    - 1) Refer to Electrical drawings for interface terminal cabinet locations.
    - 2) Receive the following dry contact inputs to effect the following control actions for each car.
      - a) Phase 1 Recall – Primary (from fire alarm panel).
      - b) Phase 1 Recall – Alternate (from fire alarm panel).
      - c) Access control permissive.
      - d) Elevator Remote Disable.
    - 3) Provide normally open dry contacts for each of the following status items for each car:

- a) Elevator Warning Alarm
  - b) Passenger Alarm Pushbutton
  - c) Phase 1 Fire Operation
  - d) Phase 2 Fire Operation
  - e) Elevator door closed.
  - f) Independent Service
  - g) Elevator at floor (one contact per floor)
- b. Provide conduit and wiring between the hoistway sump, high water sensor and the interface terminal cabinet for remote monitoring by the Building Management System.
- 1) Provide normally open dry contact for each of the following status items for hoistway:
    - a) Sump high water alarm

H. Hoistway Equipment

- 0. Guide Rails: Planed steel T-sections of suitable size and weight for the application, structural support spacing, car weight, and seismic reactions, with brackets for attachment to building structure.
- 1. Buffers: Spring type with blocking and supports.
- 2. Hydraulic Jack Assembly
  - a. Cylinders: Seamless steel pipe. Two hydraulic cylinders designed to stand upright on the pit floor on either side of the car. Design head to receive unit-type packing and provide means to collect oil at cylinder head and return automatically to oil reservoir. The cylinder shall be finished with rust-inhibiting air-dry enamel. Apply two coats by brush, or spray according to manufacturer's recommendations.
  - b. Each cylinder shall have a machined steel flange at the upper end and a heavy steel bulkhead at the lower end.
  - c. A packing gland with guide bearing, wiper ring and packing especially designed for the hydraulic elevator service shall be mounted at the top of each cylinder along with an oil collector ring and drain hole. The plunger seals shall be urethane cup design with integral wipers or approved equal. Replace the packing glands after all construction is completed.
  - d. Provide a thermostatically controlled insulated heat tracing assembly on each cylinder to maintain the operating temperature of the oil within acceptable manufacturer's operating range. Provide product details, ambient operating temperature guidelines and design drawings for review and approval.
  - e. Plungers: Polished seamless steel tubing or pipe. The plunger surface shall be a minimum of 20 micro inches RMS and shall not exceed 35 micro-inches RMS for the entire plunger length in engagement with the cylinder seals. A stop ring electrically welded to the plunger to positively

prevent the plunger from leaving the cylinder. If plunger length exceeds 24 feet, provide two or more sections not exceeding 16 feet in length, or coordinate installation of longer unit at the jobsite. Join section by internal threaded couplings. Multiple section jack units shall be factory polished while assembled and marked for proper future reassembly. Isolate plunger from car frame(s). Each piston in multi-stage jacks to have individual head bearings and packing gland assemblies.

- f. Equalization: Provide direct mechanical means of equalizing position and speed of plungers. If speed and position of cylinders are not synchronized the elevator shall self-correct by auto-lowering to lowest floor and restarting. If after two attempts to readjust the position and or speed the plungers are not synchronized the elevator shall shut down.
  - g. Auxiliary Guides: Plungers shall be provided with an auxiliary guide means as per the manufacturer's recommendations to maintain the alignment of the jack assembly.
3. Jack Support and Fluid Shut-Off Valve(s): Provide steel pit channels and support beams (if required) to support jack assembly and transmit loads to building structure. Provide intermediate stabilizers as required. Provide manual on/off valve(s) in oil line(s) adjacent to pump unit and jack unit(s) in pit adjacent to jack unit(s). Provide a pipe rupture valve; it shall be located as close as possible to the cylinder inlet. In the event of failure in the pipe line or where the down speed exceeds allowable limits, the rupture valve shall close, bringing the car to a smooth stop.
4. Normal Terminal Stopping Devices: According to Code.
5. Copper Electrical Wiring and Wiring Connections
- a. Conductors and Connections: Copper throughout with individual wires coded and connections on identified studs or terminal blocks. Use no splices or similar connections in wiring except at terminal blocks, control compartments, junction boxes, or conduits. Provide 10 percent spare conductors throughout. Run spare wires from car connection points to individual elevator controllers in the machine room. Provide four pairs of spare shielded communication wires in addition to those required to connect specified items. Tag spares in machine room.
    - 1) All wiring within hoistway shall be suitable for wet locations.
  - b. Conduit: Painted or galvanized steel conduit and duct. Conduit size, 1/2 inch minimum. Flexible conduit not to exceed 36 inches in length. Flexible heavy duty service cord may be used between fixed car wiring and car door switches for door protective devices.
    - 1) All raceways and wiring mounted on the top of the elevator shall be suitable for wet locations. The routing of the raceways or conduit shall be routed to preclude damage from being stepped on during maintenance. If this is not possible provide steps or other additional protection.
  - c. Traveling Cables: Type ET flame and moisture resistant outer cover. Prevent traveling cable from rubbing or chafing against hoistway or equipment within hoistway. Refer to "special elevator equipment" for list for spares to be included in traveling cables.

- I. Entrance Equipment
  - 0. Door Hangers: Two-point hanger roller with neoprene roller surface and suspension with eccentric up thrust roller adjustment.
  - 1. Door Tracks: Bar or formed, cold drawn removable steel tracks with smooth roller contact surface.
  - 2. Door Interlocks: Operable without retiring cam. Paint interlocks flat black.
  - 3. Door Closers: Spring, spirator, or jamb/strut mounted counterweight type. Design and adjust to ensure the smooth quiet mechanical close of doors.
  - 4. Floor Numbers: Stencil paint 4-inch high floor designations in contrasting color on inside face of hoistway doors at each landing and adjacent to the leading edge of the door.
  
- J. Special Elevator Equipment: The elevators shall accommodate communication subsystem equipment which shall be provided by the Contract. This equipment and its appurtenances shall be built into the elevator at the factory, unless noted otherwise.
  - 0. CCTV Cameras: Provide and Install two cameras for each elevator
    - a. Axis P3364-VE or approved equal
    - b. Imaging device: 1/3 inch color CMOS 3-9 mm, vari-focal, auto iris lens
    - c. Ability to control and monitor video over IP network
    - d. Supported protocols: TCP/IP, UDP/IP (unicast, multicast IGMP), UPnP, DNS, DHCP, RTP, NTP
    - e. Supported video resolutions: 4CIF, 2CIF, CIF, QCIF
    - f. Digital compression: MJPEG, MPEG-4
    - g. Web user interface with up to five simultaneous users
    - h. Cameras to support low-light capability
    - i. Camera shall be connected by CAT6 to an Ethernet PoE switch located in a Contractor supplied enclosure attached to the elevator cab.
  - 1. CCTV Camera Enclosure: Provide and Install for each CCTV Camera.
    - a. Install CCTV cameras with protective housings.
    - b. Mini-dome with integrated camera and lens
    - c. Tamper resistant hardware
    - d. Rugged, high-impact, puncture-proof, opaque (smoked) dome plastic
    - e. NEMA 4X and IP 66
    - f. Input voltage: 18 - 30VAC, 24 VAC nominal
    - g. Above ceiling dimensions: 2 inches high by 3.5 inches wide, nominal
    - h. Below ceiling dimensions: 2.5 inches high by 5.5 inches wide, nominal

- i. Dome diameter: 3.75 inches, nominal
  - j. Cable: RJ45-10 connector for 100Base-TX Ethernet.
2. Emergency Communication System: Complying with ASME A17.1 and the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities (ADA), Accessibility Guidelines (ADAAG)."
- a. On activation, system dials preprogrammed number of monitoring station and identifies elevator location to monitoring station.
  - b. System provides two-way voice communication without using a handset and provides visible signals that indicate when system has been activated and when monitoring station has responded.
  - c. System is contained in flush-mounted cabinet, with identification, and instructions for use.
3. PA Speakers
- a. Provide and install an 8 ohm public address speaker in the car canopy and connect via speaker cabling to Contractor provided PA terminals in the interface terminal cabinet in the Elevator Machine Room.
  - b. Provide and install Atlas UKT speakers, 95-8-7 backbox, FAMT-6 adapter plate and 60-8A round satin aluminum finish grill or approved equal.
4. Radio Antenna: Provide mounting provisions for a Commprod antenna in the elevator cab ceiling. Antenna to be provided by Emergency Radio Contractor. Provide cabling from the car to the interface terminal cabinet in the machine room.
- 5.
6. For elevators requiring access to non-public floors: Provide and install Lenel 2210 door controller mounted in the NEMA 4X enclosure
7. For elevators requiring access to non-public floors: Provide and install HID iClass R40 card reader in the elevator cab.
8. Sound Transit-Provided PoE Ethernet Switch
- a. Install ST-provided PoE Ethernet switches.
  - b. One switch shall be installed in the elevator cab and the other in the elevator machine room.
  - c. Minimum of eight ports.
  - d. At least one fiber port for switch to switch connection.
  - e. Connect door controller and cameras to the Ethernet switch via CAT6 cable.
  - f. The Ethernet switch in the elevator shall be connected to the Ethernet switch in the elevator machine room via Contractor provided fiber optic cable in the travelling cable.

- g. Power for the switch shall be provided from elevator power for the switch in the elevator and from station UPS power for the switch in the elevator machine room.
  - h. Configuration settings from the Ethernet switch shall be coordinated with Sound Transit IT department.
9. Elevator Cab Enclosure: provide a NEMA 4X enclosure, attached to the elevator cab, accessible from inside the cab, sized to install the door controller, Ethernet switch, and fiber distribution panel.
- a. Layout of devices shall provide easy maintenance access.
  - b. Provide elevator power to all powered devices in the enclosure.
10. Communications Cabling and Wiring: Provide and install communications systems wiring within the traveling cable from car device to the elevator controller cabinet or the Interface Terminal Cabinet located in elevator machine room. Land wiring on terminal blocks or connectors specifically made for the intended use. Provide and install conduit between elevator controller and the Interface Terminal Cabinet.
- a. All cabling to be plenum rated and shall be as follows:
  - b. Elevator cab PoE ethernet switch to elevator machine room ethernet switch: 6-strand plastic (multi-mode), or glass (single mode) fiber optic cable. Terminate all strands of the fiber in an FDP with LC connectors on both ends. Provide patch cords from the FDP to the switches.
  - c. The fiber cable provided and installed shall be rated so that it can withstand the repeated movement associated with the duty cycle of the elevator (to be noted in product data submittal) while also meeting the Sound Transit performance criteria noted below over the expected life of the traveling cables.

1) Fiber Optic Performance Criteria

- a) Effective Minimum Bitrate (R) is two times the bandwidth

$$(\Delta f): R [\text{Mb/s}] = 2 * \Delta f [\text{MHz}]$$

- b) Attenuation Guidelines:

Glass Fiber	
Wavelength (nm)	Attenuation Rate (db/km)
1550	0.25
1625	0.25
Max Loss Budget Calculation	
Max Loss Budget [dB] =	(Length[km] * Attenuation Rate) + (Connector pairs * 0.25 dB) + (Number of splices * 0.25 dB)

Plastic Fiber	
Wavelength (nm)	Attenuation Rate (db/m)
650	0.2
Max Loss Budget Calculation	
Max Loss Budget [dB] =	(Length[m] * Attenuation Rate) + (Connector pairs * 2.5 dB) + (Number of splices * 2.5 dB)

c. Testing Requirements

- 1) Minimum Effective Bitrate of 2.5 Mb/sec.
- 2) Losses determined from OTDR testing within the calculated Max Loss Budget.

Example: 100 meter Elevator Traveling Cable Fiber Optic Criteria		
Fiber Material	Effective Minimum Bitrate	dB Max. Loss Budget
Plastic	2.5 Mb/sec	25.70 dB
Glass	2.5 Mb/sec	1.73 dB

- 3) Installing contractor shall demonstrate fiber optic performance via witnessed OTDR dB attenuation testing conducted in accordance with TIA-568-C.0 Compliant Fiber Optic Test Procedures. Fiber cable must meet the above performance upon initial testing and throughout the full life of the traveling cables.
- 4) Installing contractor to conduct testing for bandwidth to determine effective minimum bit rate over the fully connected traveling cable between nearest elevator machine room network connection switch and cab network switch. Regardless of traveling cable length, the Effective Minimum Bitrate of 2.5Mb/sec is required.
- 5) Test results shall be provided to Sound Transit under Submittals.

d. Paging speaker: One copper pair 16 AWG

- e. Radio Antenna: One super flex 75-ohm coaxial cable
- f. Wiegand cabling from the door controller to the access card reader.
- g. CAT6:
  - 1) Elevator cab: from the cameras and door controller to the PoE Ethernet switch.
  - 2) Elevator machine room: from the PoE Ethernet switch to RJ45 jacks on the interface terminal cabinet.
- h. Instrumentation: Minimum 6 shielded twisted pairs; minimum #18 gauge instrumentation cable
- i. Provide four pairs of spare shielded communication wires in addition to those required to connect specified items. Tag spares in machine room

## 2.04 COMPONENTS

### A. Hoistway Entrances

- 0. Complete entrances bearing UL fire labels.
- 1. Frames: stainless steel at all floors. Standard bolted head to jamb connection assemblies fabricated from not less than 14-gauge material. Permanently attach rear mounted Arabic floor designation plates, centerline at 60 inches above finished floor, on both sides of jambs existing. Provide main egress landing plates with Star designation. Braille indications shall be below Arabic floor designation.
- 2. Track support 3/16-inch thick steel track support plate shall extend between and be bolted to the vertical steel struts with a minimum of two bolts each end.
- 3. Door Panels: 16-gauge random orbital finish stainless steel, sandwich construction without binder angles.
  - a. Provide leading edges of side opening doors with rubber astragals. Provide a minimum of three gibs per panel, one at leading edge, one at trailing edge and one at center of leaf with gibs in the sill groove their entire length of travel.
  - b. Elevators in Rated Shaft: Provide safety glass vision panel approximately 4 inches by 20 inches in one panel of each door.
  - c. Elevators in Non-Rated Shaft: Provide 9/16 inch thick laminated tempered glass approximately 16 inches by 72 inches in each door panel
- 4. Sight Guards: 14-gauge, same material and finish as hoistway entrance door panels. Construct without sharp edges.
- 5. Sills: Extruded nickel silver.
- 6. Sill Support Angles: Structural or formed steel designed to support doorsill, based upon car loading classification. Provide grout under the sill. Five-inch by 5-inch by 1/2-inch cold-rolled structural steel angle, extend full width of hoistway. Fasten to building structure at maximum 18 inches on center. Refer to Contract Drawings for additional details.

7. Fascia, Toe Guards, and Hanger Covers: 14-gauge furniture steel with Manufacturer's standard finish. Provide fascia, toe guards, and hanger covers for rear entrances. Provide fascia for express hoistway travel.
8. Struts and Headers: Provide for vertical support of entrances and related material.
9. Finish of Frames and Doors: Random orbital finish stainless steel.

B. Hall Control Stations

0. Pushbuttons: Provide one riser with flush-mounted faceplates. Include pushbuttons for each direction of travel, which illuminate to indicate call registration. Include approved engraved message and pictorial representation prohibiting use of elevator during fire or other emergency situation as part of faceplate. Pushbutton design shall match car operating panel pushbuttons. Provide vandal resistant pushbutton and light assemblies. Circuit boards for hall call station switches shall be conformal coated.
1. Hoistway Door Unlocking Device: Provide unlocking device with a locking escutcheon in door panel plug at all floors, with finish to match adjacent surface.
2. Hoistway Access Switches: Mount in entrance frame side jamb at top and bottom floors. Provide fixture with faceplate.
3. Faceplate Material and Finish
  - a. Hall Lantern: Non-directional stainless steel.
  - b. Car Position Indicator: Non-directional stainless steel.
  - c. Lobby Position Indicator: Non-directional stainless steel.
  - d. Hall Pushbutton Station: Non-directional stainless steel.
  - e. Hoistway Access Switch: Non-directional stainless steel

C. Signals

0. Hall Lantern: Provide at each entrance to indicate travel direction of arriving car. Locate as detailed on Contract Drawings. Illuminate up or down lights and sound tone twice for down direction travel prior to car arrival at floor. Sound level to be adjustable from 20 80 dBA measured at 5 feet 0 inches in front of hall pushbutton and 3 feet 0 inches off floor. Illuminate light until the car doors start to close. Provide advanced hall lantern notification to comply with ADA hall call notification time. Minimum 2-1/2 inches in the smallest dimension, arrow lenses with faceplates. Provide vandal resistant lantern and light assemblies consisting of series of dots or lines for maximum visibility.
1. Car Position Indicator: Alpha-numeric digital indicator containing floor designations and direction arrows a minimum of 1/2 inch high to indicate floor served and direction of car travel. Locate fixture in each car operating panel. When a car leaves or passes a floor, illuminate indication representing position of car in hoistway. Illuminate proper direction arrow to indicate direction of travel. Provide vandal resistant indicator and light assemblies.
2. Lobby Position Indicator: Alpha-numeric digital indicator containing floor designations and direction arrows a minimum of 1/2 inch high to indicate floor served and direction of car travel. Locate fixture integral with hall lanterns at Plaza level. When a car leaves or passes a floor, illuminate indication representing

position of car in hoistway. Illuminate proper direction arrow to indicate direction of travel. Provide vandal resistant indicator and light assemblies.

3. Floor Passing Tone: Provide an audible tone of no less than 20 decibels and frequency of no higher than 1500 Hz, to sound as the car passes or stops at a floor served.
  4. Voice Synthesizer: Provide electronic device with easily re-programmable message and voice to announce car direction, floor, and emergency exiting instructions.
  5. Card reader override: Provide conduit and wiring to control panel. Fixtures shall be located as directed by the Resident Engineer. Coordinate size and location.
  6. Fire Fighters' Control Panel: Locate in the station's Fire Command Center Room. Furnish and install panel and all applicable wiring from each elevator to the fire panel. All supplied conductors shall conform to the requirements of NFPA 130. Associated conduit to be provided by Electrical. Fixture faceplate, No. 4 brushed finish stainless steel, including the following features:
    - a. Car position and direction indicator (digital readout or color SVGA display type). Identify position indicator with car number.
    - b. Indicator showing operating status of car.
    - c. Wiring to panel. Conduit from closest elevator hoistway of each group by others.
    - d. Two position fire fighter's emergency return switches and indicators with engraved instructions filled with red epoxy paint.
  7. Communication Failure: Provide phone line communication failure indicator light and reset keyswitch integral mounted within hall control station located at the primary phase 1 recall landing.
- D. Seismic Operations and Equipment
0. Provide design, components, and operation in accordance with ASME A17.1, Part XXIV.

## **PART 3 - EXECUTION**

### **3.01 EXAMINATIONS**

- A. Prior to beginning installation of equipment, examine hoistway and machine room areas. Verify that no irregularities exist that affect execution of work specified. Hoistway and pit to be evaluated and confirmed as sealed and waterproofed prior to commencing installation of elevator equipment.
- B. Do not proceed with installation until work in place conforms to Contract requirements.

### **3.02 INSTALLATION**

- A. Install all equipment in accordance with manufacturer's instructions, referenced Codes, these Specifications and approved submittal.
- B. Install machine room equipment with clearances in accordance with referenced Codes and these Specifications.

- C. Install all equipment so it may be easily removed for maintenance and repair.
- D. Install all equipment for ease of maintenance.
- E. Install all equipment to afford maximum accessibility, safety, and continuity of operation.
- F. Replace or refurbish all material to meet performance requirements outlined in this Section prior to station operation. There will be an extended period of time from the point that the elevators are installed to the final acceptance and station normal operation.
- G. Remove oil, grease, scale, and other foreign matter from the following equipment and apply one coat of field-applied machinery enamel.
  - 0. All exposed equipment and metal work installed as part of this work that does not have architectural finish.
  - 1. Machine room equipment, hoistway equipment including guide rails, guide rail brackets, and pit equipment.
  - 2. Neatly touch up damaged factory-painted surfaces with original paint and color. Protect machine-finish surfaces against corrosion.

### 3.03 FIELD QUALITY CONTROL

- A. Perform tests required by the elevator Section of the Washington State Department of Labor and Industries. Perform tests in accordance with procedures described in ASME A17.2.1 inspector's manual for Electric Elevators and as required by the authorities having jurisdiction in the presence of the Resident Engineer.
- B. Contractor is not relieved from furnishing and installing work shown or specified which may be beyond requirements of ordinances, laws, regulations or codes.
- C. Work at jobsite will be checked during course of installation. Full cooperation with reviewing personnel is mandatory. Accomplish corrective work required prior to performing further installation.
- D. Have Code Authority acceptance inspection performed and complete corrective work.

### 3.04 ADJUSTMENTS

- A. Install rails plumb and align vertically with tolerance of 1/16 inch in 100 feet 0 inch. Secure joints without gaps and file all irregularities to a smooth surface.
- B. Static balance car to equalize pressure of guide shoes on guide rails.
- C. Lubricate all equipment in accordance with manufacturer's instructions.
- D. Adjust motors, valves, controllers, leveling switches, limit switches, stopping switches, door operators, interlocks, and safety devices to achieve required performance levels.

### 3.05 CLEANING

- A. Keep work areas orderly and free from debris during progress of Contract. Remove packaging materials on a daily basis.
- B. Remove all loose materials and filings resulting from work.
- C. Clean machine room equipment and floor.

- D. Clean hoistways, car, car enclosure, entrances, and operating and signal fixtures per submitted procedure as required to meet sign off requirements of L&I.

### 3.06 DEMONSTRATION

- A. General: Furnish labor, materials, and equipment necessary for tests. Notify Resident Engineer 5 days in advance when ready for final review of unit or group. Final acceptance of installation will be made only after all field quality control reviews have been completed, identified deficiencies have been corrected, all Sound Transit's information and certificates have been received, and the following items have been completed to satisfaction of Resident Engineer.

- 0. Workmanship and equipment comply with these Specifications.
- 1. Contract speed, capacity, floor to floor, and door performance comply with these Specifications.
- 2. Performance of following are satisfactory:
  - a. Starting, accelerating, running
  - b. Decelerating, stopping accuracy
  - c. Door operation and closing force
  - d. Equipment noise levels
  - e. Lighting levels
  - f. Signal fixture utility
  - g. Overall ride quality
  - h. Performance of door control devices
  - i. Operations of special security operation and floor lock-off provisions.
  - j. Demonstrate CCTV Camera image on computer connected to data cable to Interface Terminal Cabinet
  - k. Demonstrate that PA system works by connecting to an amp and broadcasting voice over speaker.
  - l. Demonstrate phone installation by dialing designated ST control center.
  - m. Demonstrate each monitoring and control signal to Building Management System at Interface Terminal Cabinet
- 3. Test Results
  - a. In all test conditions, obtain specified speed, performance times, stopping accuracy without re-leveling, and ride quality to satisfaction of the Resident Engineer.
  - b. Temperature rise in motor windings limited to 120 degrees F above ambient. A full-capacity, 1-hour running test, stopping at each floor for 10 seconds in up and down directions, may be required.

- B. Performance Guarantee: Should tests reveal defects, poor workmanship, variance or noncompliance with requirements of specified Codes and/or ordinances, or variance or

noncompliance with the requirements of these Specifications, complete corrective work to satisfaction of Resident Engineer at no cost:

0. Replace equipment that does not meet Code or these Specifications requirements.
  1. Perform work and furnish labor, materials, and equipment necessary to meet specified operation and performance.
  2. Perform and assume cost for retesting required by Governing Code, Authority, and Sound Transit to verify specified operation and/or performance.
- C. Field Review Scheduling: Schedule progress and final equipment reviews with Resident Engineer. Reply promptly, in writing, to corrective work indicated on Resident Engineer's progress and/or final review reports, indicating status, schedule for completion, and questions.

### 3.07 TRAINING

- A. Provide orientation and training to familiarize Sound Transit operations personnel with the features and operation of the elevator.
0. Include step-by-step instructions for elevator operations, controls and features, including procedures for locking down elevators when not in service.
  1. Training shall include complete familiarization of the elevator and elevator machine room, including components installed within the machine room.
- B. Provide training materials that detail step-by-step instructions of elevator operations for use in future familiarization training of personnel.

### 3.08 COMMISSIONING

Refer to specifications Section 14 08 00 Commissioning of Conveying Equipment for further requirements pertaining to the work in this Section.

**END OF SECTION**