SECTION 14310

ESCALATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions, apply to this Section.

1.2 SUMMARY

A. Heavy-duty, transit-type escalators where shown on the contract drawings and as follows:

1. Escalator Width: 48” (40” step).
2. Escalator Balustrade: Laminated glass with 14 gauge stainless steel curved end panels at newels.
3. The scope of work shall comprise the design, manufacturer, supply, testing at the factory, transportation, delivery, off-loading, hoisting, erection, connection, installation, testing on site, setting to work and commissioning of equipment as required by contract documents.

B. Design Requirements: Meet all requirements as described in this specification section.

C. All engineering, equipment, labor, and permits required to satisfactorily complete elevator installation as required by contract documents.

D. Applicable conditions of General and Special Conditions.

E. Preventive maintenance as described herein.

F. Materials and Equipment:

1. All materials and equipment incorporated in the Works shall be suitable for the duty specified and shall be new and of first class commercial quality, free from imperfections, and selected for long life and minimum maintenance under the site conditions specified.
2. A commercial grade unit or an upgraded commercial grade unit as an attempt to meet the specifications shall not be acceptable.

G. Reliability Requirements:

1. Contractor shall ensure that the escalator system is suitable for its intended use when subject to the climatic conditions and operating environment of the terminal.
2. The escalator system shall achieve a level of safety and reliability that is as high as reasonably practicable.

1.3 RELATED WORK

A. Legal Wellway and Pit:

1. Clear, plumb, wellway with variations not to exceed 1" at any point.

2. Floor pockets and/or structural beams for support of escalator truss at each end and at intermediate locations as shown on the contract drawings. Support beam deflection shall not exceed 1/1000 of span under static load.
3. Fire rated enclosure of escalator truss including ends, sides and bottom in ceiling plenum.
4. Patching and finishing around escalator landing plates after installation.
5. Cladding and finishing of exposed truss surfaces.
6. Waterproof pit.
7. Protect open wellways during construction per OSHA Regulations.
8. Protect escalator truss, steps, landing plates, balustrades, handrails, and special metal finishes from damage.
9. Ventilation and/or air conditioning of escalator machine space.
10. Venting or other means to prevent accumulation of smoke and gas in escalator truss as required by Local Building Code.
11. Fire sprinklers per local Code requirement with protective guards.
12. Connection to truss drains to contaminated storage (may not drain to sewer line).
13. Stainless steel closure piece between adjoining units.
14. Guardrail around exterior of each truss as detailed on architectural drawings.
15. Closure pieces at escalator floor plates and where unit joins adjacent surfaces.

B. Electrical Service, Conductors and Devices:

1. Light with guard and GFCI convenience outlet in each pit and machine room space.
2. Three phase mainline copper power feeder to terminals of each escalator controller in the machine room space with protected, lockable "off", disconnect switch. Wiring from building and power supply to each disconnect.
3. Temporary power and illumination to install, test and adjust escalator equipment.
4. Conduit from the closest wellway of each escalator group or single escalator to the firefighters' control room and/or the control console. Coordinate size, number and location of conduits.
5. Data connection, CAT6A connection and junction box to each individual unit in machine space.
6. Telephone service with dedicated line from each home run location to each individual unit in machine room.
7. Fire alarm initiating devices in each pit. Provide alarm initiating signal wiring from connection point to controller terminals. Device to provide signal for general alarm and interruption of operation.
8. Conduit and wiring from upper pit of escalators identified on the drawings to adjacent vestibule breach doors. Coordinate size, number and location of conduits.

C. Related Sections:

1. Division 5 Section “Metal Fabrications” for machine beams, hoist beams, divider beams, sill angles, and ladders.
2. Division 5 Section “Gratings”.
3. Division 9 Section “Ceramic Tile”.
4. Division 10 Section “Pre-Engineered Elevator Panel Systems”.
5. Division 13 Section “Fire Monitoring System / Building Management Control System”.
6. Division 13 Section “Security System Equipment”.
7. Division 13 Section “Closed Circuit Television System”.

8. Division 14 Sections “Traction Elevators”, “Hydraulic Elevators”, “Freight Hydraulic Elevators”, and “Moving Walks”.
9. Division 16 Sections for Electrical and Communications Systems.

1.4 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.

C. Heavy-Duty Escalator: An escalator designed specifically for transit type usage. Substantially different from commercial units in the design of truss, machine, step chain, step chain-tensioning device, handrail drive system, steps, brake, and other components and equipment. The units shall be capable of operating 24 hours a day and be able to withstand loads of two persons on each exposed step. The units shall be capable of running under these types of loads over an extended period of time without failures due to operational requirements.

1.5 QUALIFICATIONS

A. Qualifications: Contractor must be able to demonstrate a successful track record of at least 7 years of similar installations with equipment proposed.

B. Acceptable manufacturers:

1. Otis
2. Schindler
3. ThyssenKrupp
4. KONE
5. Mitsubish

C. Compliance with Regulatory Agency: Comply with most stringent applicable provisions of following Code and/or Authority, including revisions and changes in effect on date of this specification:

1. Safety Code for Elevators and Escalators ASME A17.1.
2. Inspectors' Manual, ASME A17.2.3.
3. Elevator and Escalator Electrical Equipment, ASME A17.5
4. National Electrical Code, NFPA 70.
5. Americans with Disabilities Act (ADA)
6. Local fire jurisdiction.
7. Requirements of the IBC all other Codes, Ordinances and Laws applicable within the governing jurisdiction.
8. Life Safety Code, NFPA 101, and CCR Title 19.
9. Uniform Federal Accessibility Standard (UFAS).
10. Nevada State and Clark County Elevator Codes.

D. Warranty:

1. Material and workmanship of the installation shall comply in every respect with contract documents. In accordance with General Condition, correct defective material or workmanship, which develops within Warranty period to the satisfaction of Owner at no additional cost.
2. Defective is defined to include, but not 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.
3. Make modifications, adjustments and improvements to meet performance requirements in Parts 2 and 3.

1.6 DOCUMENT VERIFICATION

A. Contractor shall review contract documents for compatibility with its product prior to bidding. Review structural, architectural, electrical and mechanical documents, and escalator specification. Compliance with all provisions of contract documents is assumed and required. Owner will not pay for change to structural, mechanical, electrical or other systems required to accommodate Contractor's equipment.

1.7 SUBMITTALS

A. After award of contract and before beginning equipment fabrication, submit shop drawings and required material for review. Allow 30 days for response to initial submittal.

1. Preliminary delivery routing and access plan for each unit according to the structural and access details confirmed by Contractor.
2. Detailed method statement for positioning and installation of units, for items such as recesses for end supports bearing plates, floor plate trim angles, intermediate supports, machine plinth, box nuts for the tie-down bolts or uni-struts, etc. and loading applied on the supports, slab and machine plinth of each unit.
3. Power supply requirements for all units including circuit-wiring diagrams.
4. Machine room equipment heat dissipation value and ventilation/air conditioning requirements for all units.
5. Data on sound pressure level of driving machines.
6. Detailed layout and installation drawings coordinated with other Disciplines.
7. Detailed builder’s work drawings, coordinated with the Disciplines.
8. Circuit wiring diagrams of escalators at the relevant unit.
9. Complete list of safety devices with specifications.
10. Operation and Maintenance Manuals with list of spare parts recommended by Contractor.
11. Finish Material: Submit 3" x 12" samples or 12" lengths of actual finished material for review of color, pattern and texture by Owner. Compliance with other requirements is the exclusive responsibility of Contractor.

B. After award of contract and before beginning equipment fabrication, submit shop drawings and required material for review. Allow 30 days for response to submittal.

1. Scaled and Fully Dimensioned Layout: Plan of pit, wellway and machine room space indicating equipment arrangement and elevation section of wellway.

2. Design Information: Indicate equipment lists, reactions and design information on layouts.
3. Power Confirmation Sheets: Include motor horsepower, code letter, starting current, full load running current, and demand factor for applicable motors. Include circuit wiring diagrams.
4. Fixtures: Cuts, samples or shop drawings.
5. Finish Material: Submit 3" x 12" samples or 12" lengths of actual finished material for review of color, pattern and texture by Owner. Compliance with other requirements is the exclusive responsibility of Contractor.

C. Acknowledge and/or respond to drawing comments within 10 days of return; promptly incorporate required changes due to inaccurate data or incomplete definition so that delivery and installation schedules are not affected. Revision response time is not justification for equipment delivery or installation delay. Field verify existing conditions and dimensions prior to ordering equipment and verify all sizes.

1.8 PERMIT, TEST AND INSPECTION

A. Obtain and pay for permit, license and inspection fee necessary to complete the installation.

B. Perform test required by Governing Authority in accordance with procedure described in ASME A17.2.3 Inspectors' Manual for Elevators and Escalators in the presence of Owner.

C. Supply personnel and equipment for test and final review required by Owner, as indicated in Part 3.

D. Test Specification:

1. Contractor shall submit for review a Test Specification for the Factory Acceptance Tests, Partial Acceptance Tests, System Acceptance Tests and Tests to be conducted on completion. The specification shall detail the methods of conducting the tests and the tools and instruments used. Reference to the documents and drawings reviewed shall be included in this submission. The records/results shall be tabulated in a prescribed format applicable to this Contract and as reviewed by Owner.
2. The Test Specification shall include the design values of all quantities to be verified, with allowable tolerance or limits. Summary drawings or diagrams shall be verified with the Test Specification to show the dimensions and tolerances of all structural assemblies and sub-assemblies. In the case of welded fabrications, key diagrams giving all weld data shall be provided to enable systematic inspection to take place.
3. Inspection of incoming goods and components and sub-assembly tests, shall be performed in accordance with Contractor’s Quality Plan.
4. Verification of accuracy shall be required for all tools, apparatus, testing jigs, measuring instruments and “go” or “no go” gauges used for the purpose of routine tests.

E. Factory Acceptance Test:

1. The factory acceptance test is a pre-installation activity, the purpose of which is to ensure that equipment has been manufactured in accordance with the

Particular Specification as well as the General Conditions and that it is able to be commissioned.

2. Contractor shall submit before commencement of manufacture, a proposed Factory Acceptance Test Specification showing the components manufacturing program, quantities of each batch of manufacture, itemized for all major components.
3. All tests shall be carried out in the presence of Owner unless Owner waives such requirements. Contractor shall make available all premises used for manufacture of the Works to Owner for witnessing.
4. Contractor shall identify those components, both hardware and software, for which no reliable validated performance data exists, including assemblies of components which have no validated data produced specifically for this project.
5. For each component identified, Contractor shall produce a detailed test procedure, acceptance criteria and check sheets.
6. Owner will determine those tests where certification may be acceptable in lieu of Owner witnessed tests.
7. A log (Factory Acceptance Testing Log) shall be kept by Contractor, recording the tests carried out and their results, classified into the levels of acceptability, with copies of all test certification documents.
8. No installation of equipment shall begin until factory acceptance testing has been satisfactorily completed and certified by Supplier. Certificates shall be supported by copies of the Factory Acceptance Testing Log and report on faults found and corrective action taken, if any.

F. Tests on Completion:

1. Each escalator after completion shall require a site acceptance test, which will be comprised of comprehensive testing of the completely assembled installation, to ensure that every item has been correctly installed and adjusted and that the system operates in every respect in accordance with the requirements of this Particular Specification.
2. These test shall be made by Contractor and, if necessary, the Supplier/Manufacturer and observed by the Owner. Any defects, which become apparent in the course of these tests and/or deviations discovered without prior review by Owner during the tests, shall be made good. The defects shall be entered into a defect list. The Substantial Completion Certificate for the Works will not be issued until these tests have been completed and Owner considers that the equipment is safe for operation.

1.9 MAINTENANCE

A. The maintenance programs shall be designed to optimize safety, reliability and availability and reduce cost while minimizing disruption to the station daily operation. The levels of planned preventive maintenance shall be as follows:

1. First Line Maintenance: These are the regularly planned, routine inspections and minor associated work, such as greasing, replacing minor worn and faulty parts, checking and re-setting tolerances and reporting on condition. This shall also include the semi-annual and annual testing and examination of all the safety devices of the escalator.
2. Second Line Maintenance: This coves the overhaul of equipment and usually includes the replacement of modules, major parts and assemblies. Used parts or

modules could be returned to a central workshop or the manufacturer for repair/overhaul.

3. Third Line Maintenance: This is also known as workshop maintenance where the major components and assemblies are removed during the second line maintenance for maintenance and overhaul.
4. Corrective Maintenance: This covers the repair of defective equipment/systems and can take place at any of the above levels. At times it will be necessary to supplement the regular maintenance staff with more experienced staff and technical support for more complex diagnostic testing required to locate faults.

B. Warranty Maintenance:

1. Provide preventive maintenance monthly and 24-hour emergency call back service for one year commencing on date of final acceptance by Owner with after-hours callback at no additional cost to Owner. Systematically examine, adjust, clean and lubricate all equipment. Repair or replace defective parts using parts produced by the manufacturer of installed equipment. Maintain machine room space, wellway, and pit in clean condition.
2. Use competent personnel, acceptable to Owner, supervised and employed by Contractor.
3. The warranty maintenance period specified in Item 1 above shall be extended one month for each three month period in which equipment related failures average more than .25 per unit per month.

1.10 RELIABILITY REQUIREMENTS AND PENALTIES

A. Reliability

1. Contractor shall provide escalators that comply with the performance requirements of the Contract documents and that are of the highest market quality available. Contractor shall advise Owner if system performance or manufacturer requirements and/or recommendations conflict with operating parameters and reliability requirements established in the Contract documents.
2. A system failure shall be defined as any interruption of the normal mode of operation of an individual escalator where said unit is not available for Owner use. Interruption of Availability due to scheduled maintenance and inadvertent or automatic engagement of safety systems shall not constitute a system failure.
3. Each escalator shall be capable of operating at full load under normal modes of operation at a level of reliability (availability) of not less than 99 percent (round calculation to nearest whole percentage number) over a period of 365 days.
4. Availability (A) is defined as the portion of normal operational time during which the equipment is available for use, or

$$A = \frac{ATBF}{ATBF + ATTR}$$

Where:

ATBF = Average time between failure in days

$$= \frac{\text{Operating time, t (in days)}}{\text{Number of failures in time (t)}}$$

ATTR = The average time to restore (in days) an escalator to operation after a report of failure.

B. Penalty To Be Assessed Through Warranty Period.

1. A level of availability of 99% or more shall not be penalized. If availability is between 96 and 99%, 1% of the value of the bid item for the specific equipment (or scheduled value in the case of a Lump Sum bid) shall be assessed as liquidated damages. If availability is between 90 and 96%, 3% of the value of the bid item for the specific equipment (or scheduled value in the case of a Lump Sum bid) shall be assessed as liquidated damages. If availability is between 80 and 90%, 5% of the value of the bid item for the specific equipment (or scheduled value in the case of a Lump Sum bid) shall be assessed as liquidated damages. If the availability is less than 85%, the equipment shall be replaced at the sole expense of the Contractor. The warranty for the new equipment will commence at Owner acceptance of the new installation and will run for the duration specified in the appropriate technical specification.

PART 2 - PRODUCTS

2.1 SUMMARY [*modify as required by project*]

[*Insert new escalator number(s), rise and floors served by each*]:

SIZE:	48" WIDE (40" STEP)
SPEED:	100 F.P.M.
TYPE:	HEAVY-DUTY, TRANSIT-TYPE
OPERATION:	REVERSIBLE
BALUSTRADES:	LAMINATED GLASS WITH VERTICAL JOINTS AND 14 GAUGE STAINLESS STEEL CURVED END PANELS AT NEWELS; AS DETAILED ON ARCHITECTURAL DRAWINGS
DECK CONFIGURATION:	LOW STAINLESS STEEL
DECK MATERIAL:	14 GAUGE STAINLESS STEEL, SOLID
SKIRT PANELS:	12 GAUGE STAINLESS STEEL, SOLID WITH BLACK LOW FRICTION APPLICATION
HANDRAIL COLOR:	BLACK
STEP TREAD AND RISER:	CLEATED AND MESHED WITH ADJACENT STEP WITH YELLOW DEMARCATION STRIPS ON SIDE OF STEP.
DRIVE MOTOR GEAR BOX:	WORM, PLANETARY OR HELICAL
ADDITIONAL FEATURES:	

STEP DEMARCATION LIGHTING

EMERGENCY STOP BUTTONS

CAUTION SIGNS AT EACH LANDING

STAINLESS STEEL CHECKER PLATE (SIMILAR TO THOSE INSTALLED AT SATELITE D) HINGED FLOOR PANELS FOR SERVICE ACCESS; ALTERNATIVELY, ACCESS PANELS SHALL BE EQUIPPED WITH ROLLERS ON THE UNDERSIDE OF EACH PANEL.

SOFT-START MOTOR STARTER

MOTOR AND UNIT DESIGNED FOR CONTINUAL HEAVY DUTY OPERATION

NO VISIBLE COMPANY NAME OR LOGO

PROVIDE TROUBLE SHOOTING MAINTENANCE TOOL WITH FAULT DISPLAY IN NEWEL BASE.

PROVIDE FAULT FINDING AND MONITORING PANELS IN EQUIPMENT ROOMS AND PROVIDE REMOTE WIRING TO PANELS.

PROVIDE ALL EQUIPMENT AND WIRING NECESSARY TO INTERFACE WITH THE OWNER'S EXISTING HONEYWELL EBI BUILDING MANAGEMENT AND CONTROL SYSTEM FOR MONITORING EACH MOVING WALK. COORDINATE WITH HONEYWELL.

FOR THOSE UNITS SPANNING 35'-6", LOCATE INTERMEDIATE SUPPORTS AS INDICATED ON CONTRACT DOCUMENTS.

2.2 MATERIALS AND COMPONENTS [*modify as required by project*]

A. Steel:

1. Sheet Steel (Furniture Steel for Exposed Work): Stretcher leveled, cold rolled, commercial quality carbon steel, complying with ASTM A366, matte finish.
2. Sheet Steel (for Unexposed Work): Hot rolled, commercial quality carbon steel, pickled and oiled, complying with ASTM A568 and A569.
3. Structural Steel Shapes and Plates: ASTM A7, ASTM and A36.

B. Stainless Steel: Type 304 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 Owner's sample. Protect with adhesive paper covering.

1. No. 4: Bright directional polish (satin finish). Graining directions as shown or, if not shown, in vertical dimension.

C. Paint: Clean exposed metal of oil, grease, scale and other foreign matter and factory paint one shop coat of manufacturer's standard rust resistant primer. After erection, provide one finish coat of Industrial enamel paint. Galvanized metal need not be painted.

D. Prime Finish: Clean all surfaces receiving a baked enamel finish of oil, grease, scale and other foreign matter. Apply one coat of rust-resistant mineral paint followed by a filler coat over uneven surfaces. Sand smooth and apply final coat of mineral paint.

E. Baked Enamel: Apply and bake three additional coats of enamel in the selected solid color.

F. All equipment and metal work installed as a part of this work which does not have special architectural finish and which is exposed in the wellway shall be thoroughly cleaned of oil, grease, scale, and other foreign matter and given one coat of field-applied machinery enamel. Damaged factory-painted surfaces shall be neatly touched up with original paint and color.

G. All natural metals shall be stretcher-leveled, re-squared sheets. The grain of belting shall run in the direction of the longest dimension. A satin finish shall be provided by first removing tool-and-die marks and then finishing with No. 80, 100, and 120-grit sanding belts. All surfaces shall be perfectly smooth and without waves.

H. No wood or wood products shall be permitted in the escalator systems.

2.3 PERFORMANCE [*modify as required by project*]

A. Step Speed: Unit shall be capable of operating at contract speed under any loading condition in either direction of travel. The no-load to full-load speed shall not exceed +/- 4% of the advertised speed.

B. Handrail Speed: Consistent with step speed.

C. Ride Quality: Measured vibration during all riding and operating conditions.

1. Handrail Vibration: Not more than 15 mg peak to peak (adjacent peaks) in the 1-10 Hz range.
2. Step Vibration: Not more than 10 mg peak to peak (adjacent peaks) in the 1-10 Hz range.

2.4 OPERATION [*modify as required by project*]

A. Each unit shall be capable of operating smoothly and quietly at rated speed with synchronized step and handrail operation and speed in either direction of travel. Design for 24-hours per day, 7 days per week operation. Escalators shall be capable of operating without failure under full load (two persons on each step) and continual duty type conditions. Escalators shall be designed to operate in a temperature range of +25 to +120 degrees F., dry bulb, and all conditions of relative humidity.

B. Sound Level: Escalators shall be designed to operate at or below a sixty-five (65) decibels sound level, measured five (5) feet above the escalator at any location, with the escalator operating normally, either free running or under load. For multiple escalator installation, the noise measurements shall be made with only one (1) escalator unit in operation, but with the entire installation complete and in operating condition. An ambient level not to exceed forty-nine (49) decibels shall be maintained prior to units being turned on.

C. Noise and Vibration Control: Provide spray-on sound isolation at the steps and within truss as required to limit noise levels relating to escalator equipment and its operation to no more than 60 dBA, measured 3'-0" above escalator at any point of its length.

D. Vibration: Escalator shall be tested for vibration levels. A maximum velocity reading of four tenths (0.4) of an inch per secured shall not be exceeded.

E. Radio Frequency Protection: The 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. The equipment shall be provided with electro-magnetic interference (EMI) shielding within FCC guidelines and per airport parameters.

F. Fire Protection:

1. Contractor shall provide escalators constructed of non-combustible materials throughout, with the exception of step side plates, handrails, handrail rollers, chain step wheels, and electrical equipment, as defined in ASTM E 136. Handrails shall have a flame spread rating of seventy six (76) to two hundred (200), when tested in accordance with ASTM E 84.
2. Fire protection shall comply with requirements as defined in ASME A17.1.

2.5 MACHINE ROOM EQUIPMENT [*modify as required by project*]

A. Driving Machine: Worm geared, planetary or helical spur gear reduction unit coupled directly to AC induction or P.M.S.M. drive motor. Handrail drive shall be directly coupled to drive machine.

B. Drive Motor: Three (3) phase, operating at no greater than 1800 r.p.m. Motors shall be designed to operate in confined unvented spaces. Motor insulation class "B" or greater. Motor starting shall incorporate reduced current, solid-state closed transition starting. Provide neoprene isolation; not required where motors are directly attached to drive station. Continuous Duty Motor shall be provided.

C. Brake Operation: Safely decelerate, stop and hold rated load per Code requirements. Brakes shall stop escalator operating in the down direction at a rate not greater than three feet/second/second.

1. Each escalator shall be provided with the following brakes for stopping and locking of movable drive components.

a. Motor brakes shall be located on the motor shaft. Brake shall safely stop escalator upon activation of normal stop control, local or remote

EMERGENCY STOP buttons, activation of any safety device, or upon loss of power.

b. Service brake shall be located on the main drive shaft. Brake shall mechanically lock linkages to truss when repair work is being performed with truss.

2. Operational Sequence:

a. Motor Brake:

1) Brake shall be mechanically applied (fail safe) and electrically released.
2) Brake shall be capable of stopping and holding a descending escalator with a peak average load on the exposed steps in the incline area of: 40" wide step
3) Minimum stopping distance for an up or down traveling escalator under any load shall be no less than six (6) inches. Stopping distances shall be adjustable and set to the Authority approved distance. Stops shall be gradual and not abrupt.
4) Deceleration shall be smooth, gradual, and with no sudden stop at a rate not to exceed three (3) feet per second squared.
5) A thickness monitor shall be provided, and if brake lining becomes insufficient for safe usage, restart of escalator shall be prevented.

b. Service Brake:

1) Brake shall be manually applied and mechanically engaged to prevent movement of linkages, while escalator is disconnected from its power supply.
2) Electrical interlock that shall prevent escalator drive motors from starting while service brake is engaged shall be provided.

D. Controller: Wire to identified terminal block studs. Identifying symbols or letters identical to those on wiring diagrams permanently marked adjacent to each component on the controller. Enclose all components in steel cabinet and provide connecting cables of sufficient length to make it removable from machine room for ease of access to switches and wiring. Provide mainline circuit breaker and means to protect against overload and single phasing.

1. The escalator control equipment shall contain diagnostic capabilities as required for the ease of complete maintenance. The diagnostic system shall be an integral part of the controller and provide user friendly interaction between the service person and the controls. All such systems shall have non-volatile memory, that allows updating of the program.
2. Switchgear shall be mounted in free standing NEMA three (3) cabinets with strip heaters and labeled terminal strips.
3. The main control switch gear of an escalator shall contain at least the following devices: hour counter, auxiliary contactors, phase failure device, phase sequence monitor, and ground fault monitor.

4. The controller cabinet shall furthermore contain a permanently mounted fault indicator board with indicator lights. Each group of safety devices shall be connected to one (1) signal lamp.
5. The indication shall be locked automatically. Reset shall be done by a separate switch installed in the controller. The emergency stop shall not be locked.
6. All terminals shall have identification markings and all cables shall be provided with cable markers.
7. The controller shall be equipped with an AC induction motor reduced voltage electronic SCR starter. The starter shall be solid-state and provide the most efficient power from no load to full load while keeping the motor from stalling, shall release power to motor in a timed manner in order to achieve a soft start and shall protect the motor from overloading in compliance with NEMA requirements.
8. Efficiency Monitor: Provide each escalator with an electronic solid state, soft start and closed loop, energy use monitoring system. The soft start, WYE Delta circuits shall reduce the starting inrush current. The controller shall continually monitor the motor workload and automatically adjust the line current and voltage to the drive motor so it is always operating at its optimum efficiency regardless of the escalator load.
9. Microprocessor-Related Hardware:

    a. Provide built-in noise suppression devices which provide a high level of noise immunity on all solid-state hardware and devices.
    b. Provide power supplies with noise suppression devices.
    c. Isolate inputs from external devices (such as pushbuttons) with opto-isolation modules.
    d. Design control circuits so that one side of power supply is grounded.
    e. Safety circuits shall not be affected by accidental grounding of any part of the system.
    f. System fault log memory shall be retained in the event of power failure or disturbance.
    g. Equipment shall be provided with Electro Magnetic Interference (EMI) shielding within FCC guidelines.

10. Wiring: CSA labeled copper for factory wiring. Neatly route all wiring interconnections and securely attach wiring connections to studs or terminals.
11. Permanently mark components (relays, fuses, PC board, etc.) with symbols shown on wiring diagrams.
12. Monitoring System Interface: Provide controller with serial data link through RJ45 Ethernet CAT 6 or data connection and install all devices necessary to provide monitoring, which is compatible with the existing Building Management Control System. Provide monitoring for the following:

    a. Running
    b. UP (Forward) Direction
    c. DOWN (Reverse) Direction
    d. Stop Switch OK
    e. Safety Circuit OK
    f. Power OK
    g. Motor Overload OK

Contractor responsible to connect monitoring system interface to machine room monitoring compartment and LAN.

13. Remote Monitoring and Diagnostic: Equip each controller with standard ports, interface boards, and drivers to accept maintenance, data logging, fault finding diagnostic, and monitoring system computers, keyboards, modems and programming tools. The system shall be capable of driving remote color CRT monitors that continually scan and display the status of each escalator.

E. Demarcation Lights: Step demarcation lights shall be provided at both upper and lower landings. Each landing shall have a minimum of three (3) fixtures, green in color, and U.L.

F. Stop Switch: Per ASME A17.1.

2.6 WELLWAY EQUIPMENT [*modify as required by project*]

A. Truss, Transit Design:

1. Steel truss to safely carry entire load of transit type escalator, including all components, full-capacity load and weight of exterior truss and balustrade covering material; (not to exceed 10 lb. p.s.f.). Provide neoprene isolation pad at supports. Provide factor of safety per ASME A17.1 Section 802 and AISC. Provide clearly identified exterior cladding support attachment locations on exposed sides and bottom of the entire length of truss. Provide attachment plates back-up or devices as required for attachment of cladding by others. Provide truss extensions, if required. Provide intermediate supports according to structural and architectural drawings.
2. The deflection of the loaded truss shall not exceed 1/1000 of the span under live load of 320 pounds per 40 inch step.
3. The truss shall be coated with an anti-corrosive primer followed by one coat of finish paint, color as selected by Owner.
4. All trusses shall include supports for drywall truss cladding. These supports shall allow for easy attachments to truss exterior.

B. Isolation Mounting: A flexible component, vertically adjustable, shall be provided between the escalator mounting structure and the building support to reduce transmission of vibration. Joints between the escalator's front and sides and the floor shall remain flexible. A gap of approximately one inch maximum and 2”-1/16” at end of units for seismic support shall be left between the escalator and the floor. After installation, this gap shall be filled with elastic sealing material, e.g. silicone rubber. Under no circumstances shall these supports be cemented in, nor shall they have structural material butting against them.

C. Intermediate Support - In order to maintain a maximum truss deflection of 1/1000, the Contractor shall make provisions for pre-calibrated intermediate supports including all structural adjuncts to the truss and rubber isolation members. Locate intermediate supports as detailed on Architectural and Structural Drawings. Provisions shall include vertical adjustment capability. The intermediate supports shall rest on bearing structures.

D. Maintenance Drive Unit: Means shall be provided for reduced speed maintenance operation that shall be controlled by a manual handset. When operated, the escalator

shall run in the direction selected, at a speed of not more than ten (10) feet per minute. This speed shall be maintained with the steps in place and with them removed. The running shall be continuous so long as an “up” or “down” button on the handset is being pressed. The handset shall have a thirty (30) foot retractile type cord with a plug connector. When plugged into receptacle, there shall be no means of operating or running the escalator except by the service handset. Receptacles shall be located in both the top and bottom pits.

E. Dirt Catch Trays shall be provided on the floors of the machinery pits at both the lower and upper ends of the escalator.

F. Drip Pans:

1. Galvanized, 12GA, welded, water tight drip pans for the entire length and width of trusses shall be provided. Drip pans shall be of sufficient strength to support a concentrated weight of five hundred (500) pounds at any place in the drip pan. They shall also be sloped for proper drainage and collection of spent lubricants as well as any moisture or water which may enter the escalator.
2. Drip pans of sufficient size to collect and maintain, within truss areas, oil and grease drippings from step linkage and all forms of loose debris that may be deposited in drip pans from steps at turn around points at upper and lower portions of truss shall be provided. This system shall be separate from the water drain in order to prevent the discharge of spent lubricants into sewer system.
3. Access to drip pans at lower landings of escalators for the purpose of cleaning drain catch basins shall be provided.

G. Electrical Wiring:

1. Conductors: Copper throughout with individual wires coded and all connections identified on studs or terminal blocks. Type SO cable may be utilized for wiring conducting 30 volts or less, per NEC 620-21.
2. Conductors: 31 Volt RMS or greater. Provide conduit, junction boxes, connections and mounting means per requirements of Division 16. Provide painted or galvanized steel or aluminum conduit. Conduit size minimum 3/8". Flexible conduit exceeding 18" in length shall not be used.
3. Contractor shall be responsible for providing an extra twisted shielded pair for connection to data outlet at end of escalator as indicated on the contract documents.
4. Contractor shall be responsible for providing conduit and wiring from upper pit of escalators identified on the drawings to adjacent vestibule breach doors.

2.7 STEPS [*modify as required by project*]

A. Step Assembly: Single piece die-cast aluminum, fastened to the step chain axles. Step rollers shall have sealed bearings and be tired with synthetic composition material. Treads and riser shall be cleated. Steps shall be covered on the underside with sound-deadening material. Steps shall be removable from unit without disassembly of balustrade or decking. Provide 2" wide renewable step demarcation inserts on nosing of each step tread. Steps shall be designed for a minimum load of 674 pounds and a safety factor of eight (8).

B. Step Drive Assembly: Direct or indirect drive. Machine sprockets at each side over which step chains or step chain rollers shall pass and transmit motion from machine to steps. If indirect chain drive is used between machine and drive sprocket, provide emergency brake on drive assembly to automatically set if drive chain fails. Provide roller-type sealed bearings. The top sprocket assembly of the step driving unit shall be carried on two brackets rigidly attached to the truss to insure and maintain proper alignment of the unit and shall be removable intact from the truss.

C. Step Chains: Steel links with hardened pins connecting adjacent steps and engaging drive sprockets. Provide synthetic composition roller assemblies with sealed bearings rated for severe, heavy-duty operation. Escalator design shall permit chain inspection and operation while unit is running with steps removed (allow for one in five steps to remain in unit). Chains shall be protected from the elements during construction.

1. Contractor shall provide endless, roller type step chains; one (1) on each side of step.
2. Step chains shall be of heat-treated steel construction, supported at intervals by linkage wheels.
3. A means to prevent steps from coming into physical contact with each other, and to prevent chains from sagging or buckling shall be provided.
4. A means to maintain constant distance between step axles shall be provided.
5. An automatic tensioning device to maintain tension under load and to compensate for wear shall be provided. The device shall be located within the truss at the lower end.
6. A means for individual fine adjustment of tension for each linkage shall be provided.
7. Step chains shall be constructed to permit removal of segments as may be required for replacement purposes.
8. Support wheels spaced to distribute load and to guide linkage throughout run shall be provided. Rollers shall be constructed of polyurethane material, with diameter sufficient to provide reliability, maintainability, smoothness of motion, and to operate with noise level requirements specified. The chain rollers shall have polyurethane tires in hubs, hermetically sealed bearings, a diameter of not less than four (4) inches, must require no additional lubrication, and be mounted outside the chain link.
9. Wheels shall be affixed to permit rapid replacement.
10. Each pair of step chains shall be a matched set within manufacturing tolerances. Only precision, roller fishplate changes of high grade, heat treated steel shall be used as step chains. The pins, axles, bushing, and rollers shall be hardened and ground.
11. Step chain and chain pins shall have a minimal diameter of at least five-eighths (5/8) of an inch. In addition the diameter will be of a size so that the surface pressure as engaging points will not exceed 20N/mm^2 (7,900 lbs/sq. in.). This is to be based on the peak average step loads as follows: 40" side step 320 lbs. per step
12. The safety breaking factor of a step chain as defined as a ratio of chain breaking load to chain traction force, while assuming the maximum operating load of four hundred (400) pounds per step for forty (40) inch steps or three hundred and twenty (320) pounds per step for thirty two (32) inch steps, two hundred and forty pounds (240) pounds per step for twenty-four (24) steps, shall be at least five (5).
13. A text certificate for the chain-breaking load shall be provided.

14. A shielding device shall be provided to protect chain, track guides, and rollers against water, dirt and debris.

D. Step Tracks: Construct from steel. Tracks shall be bolted sections including transitions to facilitate maintenance and replacement if required. Track sections, including transitions, shall be factory installed and aligned to insure smooth, quiet operation of running gear under all conditions. The individual track section, together with transition section, step chain tension carriage, main drive shaft and handrail drive shaft shall form a fully independent assembly. The welding of tracks is not acceptable. The rolling surface shall be a minimum of 0.12" thick. Provide skirt brushes on all units.

E. Step Chain Sprockets: The step chain sprockets shall be accurately machined to distribute the load evenly on the sprocket teeth and on the chain rollers and shall be designed for smooth operation.

F. Step Chain Tension Carriage: Spring tensioning device to take up chain slack and maintain constant tension. The lower tension assembly shall be mounted on supporting pedestals that operate on tracks located on each side of the truss and shall be designed and installed to maintain proper tension on the step chains by means of compression springs. It shall be roller supported and have a calibrated tension range of nine inches. In the 180 degree reversing station, the step chain shall pass over a flat track surface, and the step rollers shall be guided through a precision-machined cast iron track section.

G. Bearings: Suitable bearings shall be provided. Bearings shall be of the ball or roller type. They shall be dust proof and self-aligning and shall be provided with lifetime lubrication.

1. All bearings shall be rated for severe, heavy-duty service, and shall be of the best quality available.
2. Sealed bearings shall be used where accessibility or manual lubrication is impractical in escalator design.
3. Bearings requiring manual lubrication shall be furnished with fittings to accommodate the use of a pressure gun for lubrication. Contractor shall furnish appropriate pressure gun.
4. Self-lubricating bearings or material or other than ball or roller type bearings may be used where practical.

2.8 SAFETY DEVICES [*modify as required by project*]

A. Safety devices required by ANSI/ASME A17.1 shall be provided on each escalator, including:

1. Broken step-chain device
2. Broken drive chain device (Not required with direct drive units)
3. Skirt obstruction device
4. Reversal stop device
5. Step up-thrust device
6. Handrail speed monitoring device
7. Missing step device
8. Step level device
9. Handrail entry device
10. Combplate impact device

11. Step demarcation lights

B. Safety devices depending upon interruption of electric circuit for their operation shall be interlocked with electric power supply to motor to apply brakes, and bring escalator to a smooth, safe stop in either direction of travel.

C. An interlock shall be provided to prevent operation of escalator until safety hazard or malfunction has been corrected if escalator stops because of malfunction, or actuation of one or more of the safety devices. Escalator can be restarted by use of keyed switch only.

D. Safety devices shall be mounted in locations accessible for maintenance within escalators, and these devices shall be designed for ease of adjustment or reset. Devices shall be located so that operation is not affected by direct moisture and debris.

E. If escalators are equipped with braking system dependent upon activation of springs, then springs shall be guidance compression type. The use of weights or self-excitation of the brake release shall not be allowed.

F. Disconnect switches capable of being looked in the “off” position shall be provided to both escalator pits, and at the drive of each escalator to prevent the starting of escalator from any other location.

G. At each escalator, Contractor shall provide the following minimum additional safety devices that shall interrupt electric power within escalator, and automatically apply brakes and bring escalator to a smooth stop in either direction of travel:

1. Devices to stop escalator should escalator have misalignment of steps, or linkages. This device, one (1) at top, one (1) at bottom, shall monitor steps before entry into comb as well as on return side and shall be manually reset.
2. Device or devices incorporating single operation to stop escalator should one (1) or both step linkages have significant amount of wear, experience breakage, change in length, change in strain, or should adjustable carriage move more than predetermined distance in any direction.
3. Device shall be employed to remove power if the escalator speed varies more than plus or minus twenty (+/-20) percent.
4. Device shall remove power from escalator and apply brakes should an object become wedged between step tread of one (1) step and riser of another step during the formation of a landing.
5. Newel bases shall have device to preclude a passenger’s hand from being carried into the handrail entrance of the newel. Should entrance of a foreign object accidentally occur, a device shall automatically apply brakes and bring escalator to a smooth stop in either direction of travel.
6. Device shall be provided to remove power and stop escalator should handrail break, lose motion, or stretch beyond a preset amount. The time between the stopping of the handrail and the removal of power to the drive unit will be adjustable from five tenths (.5) of a second to ten (10) seconds.
7. Devices shall be installed behind and through side panels at upper and lower landings of each escalator to remove power from escalator and apply brakes and bring escalator to a smooth stop, in either direction of travel, should the skirt panels be forced away from steps or if any object should become wedged between step and skirt panel.

8. Safety devices shall be incorporated at both the upper and lower combplates which shall disconnect electrical power to driving machine and activate the brake to bring the unit to smooth stop in either direction of travel should any object become wedged between the comb and the step in either a horizontal (225 pounds) or vertical (150 pounds) lifting direction.
9. Protection shall be provided to prevent accidental or sudden reversal of escalator direction from designated directions of travel.
10. A disconnect switch shall be provided in the top and bottom escalator pits which will, when used, stop the escalator or prevent starting.
11. In addition, a fault find device (diagnostic equipment) shall be provided, capable of producing indications of the following data:

    a. Date, time and cause of all escalator stoppages and failures.
    b. A monitoring of drive motor temperature.

2.9 LUBRICATION SYSTEM REQUIREMENTS [*modify as required by project*]

A. All parts, other than sealed items, requiring lubrication shall be designed for an automatic or remote lubricating system. The system shall operate only when escalator is running and the amount of lubrication shall be fully adjustable. A reservoir with a low oil signal to the controller, and a minimum capacity of two and one half (2-1/2) gallons shall be provided.

B. System shall be positive acting, located in escalator pit.

C. Reservoir level indications shall be provided where lubricants are contained within housings, supply tanks and larger filler cups.

D. Lubricants of the various assemblies shall be as applicable to that assembly.

E. Contractor shall furnish and mount near the lubricating system in the escalator pit, a framed lubrication chart for each escalator. The chart shall show the location of each lubrication point, type of lubricant to be used, and the frequency of lubrication.

F. Manual Lubrication: Location of manual lubrication points shall be easily accessible and available.

G. Indicators:

1. Escalator users shall be informed by means of indicator lights of the predetermined running direction of the escalator.
2. Two (2) circular cutouts, minimum diameter two and three quarter (2-3/4) inches, shall be provided in the upper and lower right-hand balustrade newels, in the handrail return side paneling, each containing an inset red and green light. The green light shall be illuminated at the entrance for escalator running direction and the red lamp shall be illuminated at the exiting end.

2.10 HANDRAILS [*modify as required by project*]

A. Construction: Laminated steel, wire mesh or steel cable and rubber running on brass, bronze or stainless steel guides. No cotton fabric shall be used. Handrail shall be manufacturer's standard oval cross section with a flat top and heavy-duty metal support section. Handrail shall be spliced and vulcanized with smooth joint. Handrail shall be driven at the same speed as the steps. Provide tensioning device and slack-tension switch. Provide a minimum contact of 180° of the handrail around the drive wheel.

2.11 BALUSTRADES, SKIRTS, DECKS [*modify as required by project*]

A. Interior Panel: Laminated glass (9/16" thick); vertical joints; with 14 gauge stainless steel curved end panels at newels; see architectural drawings for details.

B. Skirt Panels: Reinforced 12-gauge stainless cold rolled steel with anti-friction coating. Install to maintain clearance of step treads to skirt of not more than 3/16". Provide escalator safety strip brushes on interior skirt.

C. Deck Boards: Reinforced 14-gauge stainless steel metal. All deck section joints shall abut to provide a smooth surface-to-surface connection. Decking shall support a live load of 175 pounds per square foot without permanent deformation.

1. Provide continuous deck board between adjacent pairs of escalators. Vertical joints (long joints parallel to length of escalator) in deck board are not allowed.

D. Finishes:

1. Interior Panels:

a. Clear laminated glass with section joints vertical to horizontal and 14 gauge stainless steel curved end panels at newels.

2. Skirt Panels:

a. Provide stainless steel with black anti-friction coating.

3. Inner and Outer Deck:

a. Satin #4 stainless steel.

E. Trim and Moldings: Match deck finish.

F. Anti-slide knobs: Provide outer deck of adjacent units with anti-slide knobs. Finish of knobs to match deck finish. Provide according to architectural details. At a maximum spacing of 48" on center.

G. Floor Intersection Guards: Provide clear plexiglass intersection guards at floor penetrations as required per Code.

H. Panels shall be fastened to their supports with tamper-proof fasteners.

2.12 LANDINGS [*modify as required by project*]

A. Flat Steps: Provide upper and lower landings with three flat steps.

B. Combplates: Aluminum or plastic with steel reinforcements, or other alloy provided with non-slip surface. Provide removable comb sections. Teeth shall be designed to withstand a load of 250 pounds in the upward direction on any one tooth. Apply yellow powder coat finish. Provide combplate lighting in skirt panel on both sides of units at both upper and lower landings. Lighting shall maintain average illumination levels of 15-footcandles at step treads and 30-footcandles at transition.

C. Landing Access Plates: Stainless Steel Checker plate with non-slip surface. Plate shall extend from combplates to equipment access plates at upper and lower ends. Plates shall extend full width of truss. For adjoining units, the plates shall abut with a closure piece. Provide landing plate and access floor plate without visible manufacturers name or logo. Provide hinged plates or rollers on underside of plate so that when it is removed, no damage is caused to the surrounding areas.

2.13 SIGNAL AND CONTROL FIXTURES [*modify as required by project*]

A. Provide upper and lower stainless steel stanchion mounted operating stations. Mount on right side when facing unit. Match deck finish. Function and operating positions of switches and buttons shall be identified with engraved characters, which are readily visible from a standing position. Each station shall contain the following:

1. Red "emergency stop" button. The button shall be covered with a transparent cover, which can be readily lifted or pushed aside. When the cover is moved, an audible warning signal shall be activated. The signal shall have a minimum sound intensity of 80 dBA at the button location. The cover shall be engraved “EMERGENCY STOP”; “MOVE COVER” or equivalent legend (i.e., “LIFT COVER,” “SLIDE COVER,” etc.); and “PUSH BUTTON.” “EMERGENCY STOP” shall be in letters not less than 1/2“ (13mm) high. Other required wording shall be in letters not less than 3/16” (4.8mm) high. The cover shall be self-resetting.
2. Key switch to "start" unit or locate in front plate.
3. Key directional control switch. Switch shall be operable when standing in an upright position.

B. Fault Indicator: Provide upper and lower end of truss with fault indicator to display source of fault without removal of equipment access plate. Locate indicator in handrail inlet box upright position.

C. Diagnostic Access Port: Provide upper and lower landing with RJ-11 or RJ232 (whichever are compatible with data ports) diagnostic access port.

2.14 SIGNS [*modify as required by project*]

A. Landing Signs: Provide rear-mounted, flush, caution signs in skirt panel at top and bottom landings per ASME A17.1. by SCS or Owner-approved equivalent. Provide engraved stainless steel plate of code-required size with material and finish to match decking. Engraving fill shall be in code colors. Sign shall include pictorial and the following wording:

1. Caution
2. Passengers only
3. Hold Handrail
4. Attend Children
5. Avoid Sides
6. No Carts
7. No Wheelchairs

2.15 SAFETY REQUIREMENTS

A. Intersection Guards: Ceiling intersection guards (if applicable) shall be provided in accordance with Rule 802.39 of ANSI A17.1 Code

B. Anti-Slide: Anti-slide devices (if applicable) shall be provided in accordance with Rule 802.3h of ANSI A17.1 Code.

C. Barriers: Deck Barriers (if applicable) shall be provided in accordance with Rule 802.3i of the ANSI A17.1 Code.

D. Primary Brake: It shall be designed to provide approximately two-thirds greater braking horsepower in the "down" direction. The primary brake working in conjunction with the motor flywheel (if provided) shall provide a smooth stop in both directions of travel regardless of load. It shall stop the escalator whenever power is interrupted from any cause or by any of the safety devices and shall hold the escalator stationary under a full load condition.

E. Secondary Brake: If manufacturer standard provided. A secondary brake shall be provided integral with the main step chain sprocket assembly. It shall be arranged to operate should the drive unit become disconnected from the main step chain sprocket assembly.

F. Emergency Stop Buttons: A red stop button shall be visibly located at the top and bottom landing on the right side facing the escalator. The operation of either of these buttons shall stop the escalator. The buttons shall be covered with a transparent cover that can be readily lifted or pushed aside. When the cover is moved, an audible warning signal shall be activated. The signal shall have a sound intensity of 80 dBA minimum at the button location. Size, location, notices and installation shall be in accordance with ANSI A17.1 Code requirements.

G. Key Operated Switch: A key operated switch shall be provided in the right hand inner deck to "shut down" the escalator.

H. Speed Monitor/Anti-Reversal: The escalator shall be equipped with a speed monitor with anti-reversal device. An electronic detector shall be provided that constantly monitors escalator speed. If the escalator speed drops to 50 percent of nominal speed or exceeds nominal speed by 20 percent, a stop shall be initiated.

I. Broken Step Chain Device: A broken step chain device or devices shall be provided with electric contacts that shall cause the brake to be applied should either or both of the step chains break or should the tension on the chains drop below or exceed a predetermined value.

J. Broken Drive Chain Device: A broken main drive chain safety device shall be provided with electric contacts that shall cause the secondary brake to be applied should the main drive chain slacken or break. (Not required with direct drive units)

K. Stop Switches in Machinery Space: Service personnel during their maintenance routine shall provide a stop switch in both the upper and lower machinery spaces for use.

L. Skirt Switches (Skirt Obstruction Switches): The skirt panels at both the upper and lower section of the escalator shall be equipped with electrical switches. These switches shall sense an object being wedged between the skirt panel and the adjacent step. The resulting deflection of the skirt panel shall activate the electrical switch and cause the escalator to stop. The skirt switches shall be located to insure the escalator stopping before the wedged object reaches the comb.

M. Step Demarcation Lights: Green step demarcation lights shall be provided at both the lower and upper end, immediately outboard of the comb plate, consisting of a minimum of two (2) fluorescent fixtures, located within the step loop so as to define the periphery of the step. The demarcation lights shall be mounted perpendicular to escalator travel providing a "strobe" effect.

N. Step Up-thrust Device: A step up-thrust device shall be provided in the lower transition radius that shall detect upward step displacement should it occur as the steps travel through the lower transition radius. If activated, the escalator shall be brought to a smooth stop.

O. Handrail Speed Monitor/Stopped Handrail Device: A handrail speed monitor/stopped handrail device shall be provided to assure synchronous speed with step speed. If the deviation is greater than 20 percent or less than 50 percent, the emergency alarm shall sound. The alarm shall be controlled by an adjustable timer and shall continue to sound for a maximum of 15 seconds after which the escalator shall come to a smooth stop.

P. Handrail Entry Safety Device: The newel base where the handrail enters the escalator shall be equipped with a spring loaded flap enclosure that shall free objects that are in danger of becoming wedged between the handrail and the entry point. The device shall be equipped with a safety switch that when activated shall cause the escalator to come to a smooth stop.

Q. Step Level Device: Step level devices shall be located at the top and bottom of the escalator. These devices shall detect downward displacement of 1/8 inch or greater at the riser end of the step. When detected the device shall cause the escalator to stop prior to the detected step entering the comb. The device shall be of the manual reset type.

R. Comb plate Impact Device: A comb plate impact device shall be provided that shall sense wedging action occurring at and pressing severely against the comb plate. When activated the escalator shall be brought to a smooth stop.

S. Starting Switch Monitor: The escalator's electrical starting circuits shall be designed to prevent both the starting circuit and safety circuit from being energized at the same time.

T. Flat Steps: At the entrance and/or egress end of the escalator 3 (three) flat steps shall be provided before moving to or after completion of step formation.

U. Missing Step Device: A missing step device shall be provided to detect a missing step and bring the escalator to a stop prior to the gap resulting from the missing step emerging from the comb.

V. Phase Protection: An electrical contact shall sense any phase failure or phase reversal and bring the escalator to a smooth stop. This device shall also prevent the escalator from being started under the prevailing conditions.

W. Counter Tracks (Catching Arms): Shall be located at the lower end of the escalator to retain the step chain in case of breakage.

X. Turnaround Guards, Sheet Metal Aprons: Shall be provided at each end to prevent the accidental contact by service technicians with rotating equipment.

2.11 SEISMIC

A. Provide design, components, and operation per ASME A17.1, Part XXIV.

PART 3 - EXECUTION

3.1 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver materials 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 during transportation, erection, and construction.

3.2 INSTALLATION

A. Install all equipment in accordance with manufacturer's instructions, referenced codes, specification and Plans.

B. Install all equipment for ease of maintenance.

C. Install all equipment to afford maximum accessibility, safety and continuity of operation.

D. Remove oil, grease, scale, and other foreign matter from the following equipment, and apply one coat of field applied machinery enamel.

1. All exposed equipment and metal work installed as part of this work, which does not have architectural finish.
2. Machine room equipment and truss.
3. Neatly touch up damaged factory painted surfaces with original paint and color. Protect machine finish surfaces against corrosion.

3.3 FIELD QUALITY CONTROL

A. Have Code Authority acceptance inspection performed and complete corrective work.

3.4 ADJUSTMENTS

A. Track Alignment: Re-align factory installed tracks if required to ensure continuous 4-point contact with step and chain rollers. Secure joints without gaps and file any irregularities to a smooth surface.

B. Lubricate all equipment in accordance with manufacturer's instructions.

C. Adjust motors, brakes, controllers, stopping switches, and safety devices, etc., to achieve required performance levels.

D. Adjust brakes and controlled decent devices to stop escalator with variable load without toppling passengers. Drive machine brakes shall stop the down running escalator at a rate no greater than three feet/second/second.

E. Adjust handrail speed to coincide with step speed.

3.5 CLEANUP

A. Keep work areas orderly and free from debris during progress of project. Remove packaging materials on a daily basis.

B. Remove all loose materials and filings resulting from work.

C. Clean machine room equipment, truss interior and pit.

D. Clean balustrades, deck boards, skirt panels, operating and signal fixtures and trim.

3.6 ACCEPTANCE INSPECTION AND TESTS

A. General: Furnish labor, materials, and equipment necessary for tests. Notify Owner five (5) days in advance when ready for final review of each escalator 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 Owner information and certificates have been received, and the following items have been completed to satisfaction of Owner.

1. Workmanship and equipment comply with specification.
2. Contract speed, and performance comply with specification.
3. Performance of following are satisfactory:

    a. Starting and running
    b. Controlled descent
    c. Stopping
    d. Equipment noise levels
    e. Signal and operating devices
    f. Overall ride quality
    g. Handrail speed
    h. Safety Devices

4. Test Results:

   a. In all test conditions, obtain specified speed, handrail speed, controlled descent performance, stopping, ride quality and operation noise levels to satisfaction of Owner.
   b. Temperature rise in windings limited to 50° Celsius above ambient.

B. Equipment and Instruments: Furnish equipment and instruments to perform required tests. The following instruments may be necessary to compete the tests:

1. Multi meter.
2. 500-Volt Megger.
3. Alternating-current voltmeter and ammeter.
4. Celsius-calibrated thermometers (two minimum).
5. Precision tachometer.
6. Decibel meter for noise test.
7. Test weights for brake test.

C. Operating Tests:

1. Overspeed Protection Device: Test by operating at rated speed, tripping overspeed device manually.
2. Handrail-Tension Device: Test manually.
3. Broken Drive Chain Devices: Test by operating at rated speed, tripping broken chain device manually.
4. Insulation-Resistance Test: Test safety circuit and motor winding circuit at 500 Volts. Minimum resistance to ground shall be one megohm.
5. Running Test: Submit certified copy of type test based on Item 320.6 of ASME A17.2-1994 Inspectors' Manual. Run unit with no load continuously for period designated by Inspector to verify adequacy (period shall not exceed two hours).
6. Installation-Resistance Test: Test safety circuit and motor-winding circuit at 500 volts. Minimum resistance to ground shall be one megohm.

D. 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 specifications, complete corrective work to satisfaction of Owner at no cost:

1. Replace equipment that does not meet Code or specification requirements.
2. Perform work and furnish labor, materials and equipment necessary to meet specified operation and performance.
3. Perform and assume cost for retesting required by Governing Code Authority and Owner to verify specified operation and/or performance.

3.7 OWNER'S INFORMATION

A. Provide three sets of neatly bound and one CD of written information necessary for proper maintenance and adjustment of equipment and include the following as minimums:

1. Straight-line wiring diagram of "as installed" escalator circuits, with index of location and function of components. Provide one set reproducible master. Mount installation wiring diagrams on panels, racked, or similarly protected, in

escalator machine room space. Provide remaining set rolled and in a protective drawing tube. Maintain with addition of all subsequent changes. These diagrams are Owner's property.

2. Lubricating instructions, including recommended grade of lubricants.
3. Parts catalogs for all replaceable parts including ordering forms and instructions.
4. Keys for all switches and control features.
5. Diagnostic test device complete with access codes, adjuster's manuals, set-up manuals, etc., for adjustment, diagnosis and troubleshooting of escalator system.

3.8 INSTRUCTION AND TRAINING

A. Instruct Airport maintenance personnel in the proper use, operation, and daily maintenance of escalators. Review emergency provisions, including access and procedures to be followed in checking the source of an operational failure or malfunction.

END OF SECTION 14310