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FINAL CONTRACT COMPLIANCE REVIEW

PART 1 GENERAL

1.01 FINAL CLEANING

- A. As a minimum:
1. Elevator hoistways and all equipment therein shall be cleaned and left free of rust, filings, welding slag, rubbish, loose plaster, mortar drippings, extraneous construction materials, dirt and dust. Include walls, building beams, sill ledges, and hoistway divider beams.
 2. Care shall be taken by workpersons not to mark, soil, or otherwise deface existing or new surfaces. Clean and restore such surfaces to their original condition.
 3. Clean down surfaces and areas which require final painting and finishing work. Cleaning includes removal of rubbish, broom cleaning of floors, removal of any loose plaster or mortar, dust and other extraneous materials from finish surfaces, and surfaces that will remain visible after the work is complete.

1.02 CONSULTANT'S FINAL OBSERVATION AND REVIEW REQUIREMENTS

- A. Review procedure shall apply for individual elevators, portions of groups of elevators and completed groups of elevators accepted on an interim basis or elevators and groups of elevators completed, accepted, placed in operation.
- B. Provider shall perform review and evaluation of all aspects of its work prior to requesting Consultant's final review. Work shall be considered ready for Consultant's final contract compliance review when all Provider's tests are complete and all elements of work or a designated portion thereof are in place and elevator or group of elevators are deemed ready for service as intended.
- C. Furnish labor, materials, and equipment necessary for Consultant's review. Notify Consultant five (5) working days in advance when ready for final review of elevator or group of elevators.
- D. Consultant's written list of observed deficiencies of materials, equipment and operating systems will be submitted to Provider for corrective action. Consultant's review shall include as a minimum:
1. Workmanship and equipment compliance with Contract Documents.
 2. Performance of following is satisfactory:
 - a. Door operation and closing force
 - b. Performance of door control devices
 3. Test Results:
 - a. In all test conditions, obtain specified contract speed and performance times to satisfaction of Purchaser and Consultant. Tests shall be conducted under both no load and full load condition.
- E. Performance Guarantee: Should Consultant's review identify defects, poor workmanship, variance or noncompliance with requirements of specified Codes and/or ordinances, or variance or noncompliance with the requirements of Contract Documents, Provider shall complete corrective work in an expedient manner to satisfaction of Purchaser and Consultant at no cost as follows:
1. Replace equipment that does not meet Code or Contract Document requirements.

2. Perform work and furnish labor, materials and equipment necessary to meet specified operation and performance.
 3. Perform retesting required by Governing Code Authority, Purchaser and Consultant.
- F. A follow-up final contract compliance review shall be performed by Consultant after notification by Provider that all deficiencies have been corrected. Provide Consultant with copies of the initial deficiency report marked to indicate items which Provider considers complete. If additional reviews are required due to Provider's gross non-compliance with initial and follow-up deficiency reports, consultant shall bill Provider at normal billing rates plus expenses, and Provider acknowledges it will pay for additional compliance reviews.

1.03 PURCHASER'S INFORMATION

- A. Provide three sets of neatly bound written information necessary for proper maintenance and adjustment of equipment within 30 days following final acceptance. Final retention will be withheld until data is received by Purchaser and reviewed by Consultant. Include the following as minimums:
1. Straight-line wiring diagrams of "as-installed" elevator circuits, with index of location and function of components. Provide one set reproducible master. Mount one set wiring diagrams on panels, racked, or similarly protected, in elevator machine room. Provide remaining set rolled and in a protective drawing tube. Maintain all drawing sets with addition of all subsequent changes. These diagrams are Purchaser's property.
 2. Lubrication instructions, including recommended grade of lubricants.
 3. Parts catalogs for all replaceable parts including ordering forms and instructions.
 4. Four sets of keys for all switches and control features properly tagged and marked. See Section 142200 – 2.04, J for key type requirements
 5. Neatly bound instructions explaining all operating features including all apparatus in the car and lobby control panels.
 6. Neatly bound maintenance and adjustment instructions explaining areas to be addressed, methods and procedures to be used, and specified tolerances to be maintained for all equipment.
 7. Diagnostic equipment complete with access codes, adjusters manuals and set-up manuals for adjustment, diagnosis and troubleshooting of elevator system and performance of routine safety tests.
- B. Acceptance of such records by Purchaser/Consultant shall not be a waiver of any Provider deviation from Contract Documents or shop drawings or in any way relieve Provider from his responsibility to perform work in accordance with Contract Documents.

END OF SECTION 017000

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SECTION 019000

RELATED WORK

PART 1 GENERAL

1.01 RELATED WORK BY CONTRACTOR / PROVIDED BY OTHER TRADES

- A. Hoistway and Pit:
 - 1. Cutting and patching walls and floors.
 - 2. Code compliant Pit access stationary ladder for each elevator.
 - 3. Protect open hoistways and entrances during construction per OSHA Regulations.
 - 4. Protect car enclosure, hoistway entrance assemblies, and special metal finishes from damage.
 - 5. Hoistway venting.

- B. Machine Room:
 - 1. Self-closing and locking access door.
 - 2. Ventilation and heating. Maintain minimum temperature of 55° F, maximum 90° F. Maintain maximum 80% relative humidity, non-condensing.
 - 3. Paint walls and ceiling.
 - 4. Class "ABC" fire extinguisher in each elevator machine room.

- C. Electrical Service, Conductors, and Devices:
 - 1. Lighting and GFCI convenience outlets in pit, machine room,
 - 2. Provide compact fluorescent lighting fixtures, per University specifications throughout elevator hoistway
 - 3. Single-phase copper power feeder to each elevator controller for car lighting and exhaust blower with individual protected lockable "open" disconnecting means located in machine room.
 - 4. Emergency telephone line to each individual elevator control panel in elevator machine room.
 - 5. Fire alarm initiating devices in each elevator lobby, for each group of elevators or single elevator and each machine room to initiate firefighters' return feature. Device at top of hoistway if sprinklered. Provide alarm initiating signal wiring from hoistway or machine room connection point to elevator controller terminals. Device in machine room and at top of hoistway to provide signal for general alarm and discrete signal for Phase II firefighters' operation.
 - 6. Provide additional heat detectors at locations within code distance to existing sprinkler heads.
 - 7. Firefighters' telephone jack and announcement speaker in car with connection to individual elevator control panels in elevator machine room and elevator control panel in firefighters' control room.
 - 8. Conduit from the closest hoistway of each elevator group or single elevator to the firefighters' control room and/or main control console. Coordinate size, number, and location of conduits with Elevator Contractor.
 - 9. Means to automatically disconnect power to affected elevator drive unit and controller prior to activation of machine room fire sprinkler system and/or hoistway fire sprinkler system. Manual shut-off means shall be located outside bounds of machine room.
 - 10. When sprinklers are provided in the hoistway all electrical equipment, located less than 4'-0" above the pit floor shall be identified for use in wet locations. Exception: Seismic protection devices.

Single-phase power feeders to main control console and firefighters' control panel.
 - 11. Single-phase power feeder to elevator intercom amplifier in the elevator machine room.
 - 12. Single-phase power feeder to each elevator controller in machine room with protected lockable "open" disconnecting means for car heating and air conditioning unit.

13. Single-phase power feeders to machine room elevator monitoring panel/display unit with single-phase, protected lockable "open" disconnecting means.
 14. Single-phase power feeders to machine room rope brake air compressor feeder circuits with single-phase protected lockable "open" disconnecting means.
- D. Standby Power Provision: If existing
1. Standby power of normal voltage characteristics via normal electrical feeders to run one elevator at a time and/or single elevator unit at full-rated car speed and capacity.
 2. Conductor from auxiliary form "C" dry contacts, located in the standby power transfer switch to a designated elevator control panel and/or single elevator unit. Provide a time delay of 30 - 45 seconds for pre-transfer signal in either direction.
 3. Standby single-phase power to group controller, and each elevator controller for car lighting, exhaust blower, emergency signaling device, intercom amplifier
 4. Means for absorbing regenerated power during an overhauling load condition per NEC 620.91. Elevator(s) will employ IGBT drive, presenting a non-linear active load.
 5. Standby power to machine room ventilation or air conditioning.
 6. Standby power to emergency communications device(s).
 7. Standby power to machine room rope brake air compressor feeder circuits

END OF SECTION 019000

SECTION 142200

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SECTION 142200

ELECTRIC TRACTION ELEVATOR MODERNIZATION

PART 1 GENERAL

1.01 WORK INCLUDED

- A. 2 traction elevator(s) as follows:
 - 1. 2 Geared Passenger Elevators, Cars No. 248 & No. 249
- B. All engineering, equipment, labor, and permits required to satisfactorily complete elevator modernization required by Contract Documents.
- C. Applicable conditions of General, Special, and Supplemental Conditions, Division 1, and all sections listed in Contract Documents "Table of Contents."
- D. Additional equipment or finishes furnished under other sections, installed under this section:
 - 1. In car Firefighters' telephone jack(s)
- E. Cartage and Hoisting: All required staging, hoisting, and movement to, on, and from the site including new equipment, reused equipment, or dismantling and removal of existing equipment.
- F. Unless specifically identified as "Reuse," "Retain," or "Refurbish," provide new equipment.
- G. Hoistway, pit, and machine room barricades as required.

1.02 RELATED WORK PROVIDED UNDER OTHER SECTIONS

- A. See Related Work Provided Under Other Sections.

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.
- C. Provisions of this specification are applicable to all elevators unless identified otherwise.

1.04 QUALITY ASSURANCE

- A. Approved Contractors: Alternate Contractors must receive approval of Purchaser and/or Consultant at least 14 calendar days prior to bid date.
 - 1. 5280 Elevator, Elevators Unlimited, Peak Elevator, Centric Elevator, KONE, Otis, Schindler, ThyssenKrupp.
- B. Compliance with Regulatory Agencies: Comply with most stringent applicable provisions of following codes, laws, and/or authorities, including revisions and changes in effect:
 - 1. Safety Code for Elevators and Escalators, ASME A17.1
 - 2. Guide for Inspection of Elevators, Escalators, and Moving Walks, ASME A17.2
 - 3. Elevator and Escalator Electrical Equipment, ASME A17.5

4. National Electrical Code, NFPA 70
5. Americans with Disabilities Act, ADA
6. Local Fire Authority
7. Requirements of IBC, DSA, and all other Codes, Ordinances and Laws applicable within the governing jurisdiction
8. Life Safety Code, NFPA 101
9. Uniform Federal Accessibility Standard, UFAS
10. University of Colorado at Boulder standards and practices
<http://www.colorado.edu/facilitiesmanagement/pdc/construction/standards/index.html>

C. Warranty:

1. Material and workmanship of installation shall comply in every respect with Contract Documents. Correct defective material or workmanship which develops within one year from date of final acceptance of all work to satisfaction of Architect, Purchaser and Consultant at no additional cost, unless due to ordinary wear and tear or improper use or care by Purchaser. Perform maintenance in accordance with terms and conditions indicated in the Preventive Maintenance Agreement.
2. Defective is defined to include, but not be limited to: Operation or control system failures, car 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. Retained Equipment: All retained components, parts, and materials shall be cleaned, checked, modified, repaired, or replaced so each component and its parts are in like new operating condition. Retained equipment must be compatible for integration with new systems. All retained equipment shall be covered under the warranty provisions, of Article 1.04, D, 1 & 2 above.
4. Make modifications, requirements, adjustments, and improvements to meet performance requirements of Sections 017000 and 142200.

1.05 DOCUMENT AND SITE VERIFICATION

- A. In order to discover and resolve conflicts or lack of definition which might create problems, Contractor must review Contract Documents and site conditions for compatibility with its product prior to submittal of quotation. Review existing structural, electrical, and mechanical provisions for compatibility with Contractor's products. Purchaser will not pay for change to structural, mechanical, electrical, or other systems required to accommodate Contractor's equipment.

1.06 SUBMITTALS

- A. Provide Submittals as requested including all materials, sub-contractors and suppliers.

1.07 PERMIT, TEST AND INSPECTION

- A. Obtain and pay for all State, municipality and City of Boulder permits, licenses, and inspection fees necessary to complete installation.
- B. Perform test required by Governing Authority in accordance with procedure described in ASME A17.2 Guide for Inspection of Elevators, Escalators, and Moving Walks in the presence of Authorized Representative.
- C. Supply personnel and equipment for test and final review by Consultant as required in Section 017000.

PART 2 PRODUCTS

2.01 SUMMARY

- A. Passenger Elevator(s)
- B. Unless specifically identified as "retain existing," provide new equipment.

	Existing Equipment	Disposition
Number:	Cars 248 and 249	Retain Existing
Capacity:	Car 248: 2500# Car 249: 5000#	Retain Existing
Class Loading:	Passenger Class A	Retain Existing
Contract Speed:	350 F.P.M.	350 F.P.M.
Roping:	1:1	Retain Existing
Hoist Machine:	Geared	Car 248: Retain Existing Car 249: Provide and Install New
Machine Location:	Overhead	Retain Existing
Operational Control:	Selective Collective Microprocessor-Based System	Selective Collective Microprocessor-Based System
Motor Control:	DC Variable Voltage Variable Frequency Microprocessor Based with Digital Closed-Loop Feedback	Provide new AC VVVF micro processor Based with Digital Closed Loop
Power Characteristics:	Field Verify	Retain Existing
Stops:	Car 248: 7 Front Car 249: 9 Front	Retain Existing
Openings:	Car 248: 7 Front Car 249: 9 Front	Retain Existing
Floors Served:	Car 248: B, M, G, 1-4 Front Car 249: SB, B, M, G, 1-4	Retain Existing
Travel:	Field Verify	Retain Existing
Platform Size:	Field Verify	Retain Existing
Entrance Size:	Car 248: 3'-6" Wide X 7'-0" High Car 249: 4'-0" Wide X 7'-0" High	Retain Existing
Entrance Type:	Car 248: Single Speed, Side Opening Car 249: Two Speed, Side Opening	Retain Existing

	Existing Equipment	Disposition
Door Operation:	High Speed, Heavy-Duty, Door Operator, Minimum Opening Speed 2-1/2 F.P.S.	Retain Existing
Door Protection:	Infrared, Full Screen Device	Infrared, Full Screen Device with Differential Timing, Nudging and Interrupted Beam Time
Safety:	Field Verify	Retain Existing
Guide Rails:	Planed Steel Tees	Retain Existing
Buffers:	Oil	Retain Existing
Car Enclosure:		As Specified
		Assure Battery Powered Emergency Car Lighting.
Signal Fixtures:		Install LED Illumination in all existing fixtures
Hall and Car Pushbutton Stations:		Retain Existing
		Retain Existing
Car Position Indicators:		Retain Existing
		Firefighters' Control Panel
Hall Lanterns:		Retain Existing
In Car Lanterns:		Retain Existing
Hall Car Position Indicator:		Retain Existing
Communication System:		Intercom with Distress Signal
		Retain Existing
Fixture Submittal:		N/A
Additional Features, Cars 248 and 249:		Car Top Inspection Station
		Firefighters' Service, Phase I and II, including Alternate Floor Return

Existing Equipment

Disposition

Hoistway Access Switches, Top And Bottom Floors

Hoistway Door Unlocking Device, All Floors

Platform Isolation

Load-Weighing Device

Anti-Nuisance Feature

Independent Service Feature

Card Reader Provisions, All Cars

Firefighters' Control Panel and Remote Wiring

Machine, Power Conversion Unit, and Controller Sound Isolation

Tamper Resistant Fasteners for All Fastenings Exposed to the Public

One Year Warranty Maintenance with 24-Hour Call-Back Service

Firefighters' Telephone Jack

Emergency Paging Speaker Installation

Signage Engraving Filled with Black Paint or Approved Etching Process

No Visible Company Name or Logo

Wiring Diagrams, Operating Instructions, and Parts Ordering Information

Monitoring System

System Diagnostic Means and Instructions

Non-Proprietary Control System and Diagnostics Provisions without the purchase of additional tools or devices
MCE – 4000 Traction Control

2.02 ALTERNATES:

Provide an alternate pricing for the following:

- A. Alternate # 1: Replace Existing Car Operating Panel in each car.
1. Car Operating Panel:
 - a. One surface mount car operating panel with faceplate, consisting of a metal box containing vandal resistant operating fixtures, mounted into the stationary front return panel
 - b. Front return panel to be pinned in place and skinned in No. 4 brushed stainless steel.
 - c. Faceplate of car operating panel shall be hinged and constructed of stainless steel, satin finish.
 - d. Suitably identify floor buttons, alarm button, door open button, door close button and emergency push-to-call button with SCS or Entrada cast tactile symbols rear mounted. Configure plates per local building code accessibility standards including Braille. Locate operating controls no higher than 48" above the car floor; no lower than 35" for emergency push-to-call button and alarm button.
 - e. Provide minimum 3/4" diameter raised floor pushbuttons which illuminate to indicate call registration.
 - f. Voice Synthesizer: Provide electronic device with easily reprogrammable message and female voice to announce car direction, floor, emergency exiting instructions, etc.
 - g. Provide alarm button to ring bell located on car. Illuminate button when actuated.
 - h. Provide keyed stop switch at bottom of car operating panel in locked car service compartment. Mark device to indicate "run" and "stop" positions.
 - i. Provide "door open" button to stop and reopen doors or hold doors in open position.
 - j. Provide "door close" button to activate door close cycle. Cycle shall not begin until normal door dwell time for a car or hall call has expired, except firefighters' operation.
 - k. Provide firefighters' Phase II key switch with engraved instructions filled red. Include light jewel, buzzer, and call cancel button.
 - l. Install firefighters' telephone jack with approved mounting, Car 249.
 - m. Provide lockable service compartment with recessed flush door. Door material and finish shall match car return panel or car operating panel faceplate. Inside surface of door shall contain an integral flush window for displaying the elevator operating permit.
 - n. Include the following controls in lockable service cabinet with function and operating positions identified by permanent signage or engraved legend:
 - 1) Inspection switch.
 - 2) Light switch.
 - 3) Three-position 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) Card reader override switch.
 - 8) Stop switch.
 - o. Provide black paint filled (except as noted), engraved, or approved etched signage as follows with approved size and font:
 - 1) Phase II firefighters' operating instructions on inside of Fireman's Service cabinet door.
 - 2) Car number on main Car operating Panel
 - 3) "Certificate of Inspection on File in Building Office" on service cabinet door panel.
 - 4) "No Smoking" on main car operating panel.
 - 5) Car capacity in pounds on service cabinet door panel.
- B. Alternate # 2: Replace all hall pushbutton stations, hall lanterns and position indicators.
1. Pushbuttons: Provide flush mounted riser adjacent to hoistway entrances. Include single call button and "in use" light which illuminates when hall call is registered. Pushbutton design shall

- match car operating panel pushbuttons. Provide vandal resistant pushbutton and light assemblies. Include approved engraved message and pictorial representation prohibiting use of elevator during fire or other emergency situation as part of faceplate. Provide any cutting and patching required
2. NEW Hall Lantern, All Car(s): Provide at each entrance to indicate travel direction of arriving car. Illuminate up or down LED lights and sound tone once for up and twice for down direction prior to car arrival at floor. Sound level shall be adjustable from 20-80 dBA measured at 5'-0" in front of hall control station and 3'-0" off floor. Illuminate light until the car doors start to close. Provide advanced predictive hall lantern notification to comply with ADA hall call notification time. Car direction lenses shall be arrow shaped with faceplates. Lenses shall be minimum 2-1/2" in their smallest dimension. Provide vandal resistant lantern and light assemblies consisting of series of dots or lines for maximum visibility.
 3. Car Direction Lantern: Provide flush-mounted car lantern in all car entrance columns. Illuminate up or down LED lights and sound electronic tone once for up and twice for down direction travel as doors open. Sound tone once for up direction and twice for down direction. Sound level shall be adjustable from 0 - 80 dBA measured at 5'-0" in front of hall control station and 3'-0" off floor. Provide adjustable car door dwell time to comply with ADA requirements relative to hall call notification time. Car direction lenses shall be arrow shaped with faceplates. Lenses shall be minimum 2-1/2" in their smallest dimension. Provide vandal resistant lantern and light assemblies consisting of series of dots or lines for maximum visibility
 4. Car Direction Lantern: Provide flush-mounted car lantern in all car entrance columns. Illuminate up or down LED lights and sound electronic tone once for up and twice for down direction travel as doors open. Sound tone once for up direction and twice for down direction. Sound level shall be adjustable from 0 - 80 dBA measured at 5'-0" in front of hall control station and 3'-0" off floor. Provide adjustable car door dwell time to comply with ADA requirements relative to hall call notification time. Car direction lenses shall be arrow shaped with faceplates. Lenses shall be minimum 2-1/2" in their smallest dimension. Provide vandal resistant lantern and light assemblies consisting of series of dots or lines for maximum visibility.
 5. Car Position Indicator: Alpha-numeric digital indicator containing floor designations and direction arrows a minimum of 1/2" 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.
 6. Hall Position Indicator, Cars 248 & 249: Alpha-numeric digital indicator containing floor designations and direction arrows a minimum of 1/2" high to indicate floor served and direction of car travel. Mount integral with hall lanterns at Main floor. Provide vandal resistant indicator and light assemblies.
 7. 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.

2.03 CAR PERFORMANCE

- A. Car Speed: $\pm 3\%$ of contract speed under any loading condition.
- B. Car Capacity: Safely lower, stop and hold 125% of rated load.
- C. Car Stopping Zone: $\pm 1/4"$ under any loading condition.
- D. Door Opening Time: Seconds from start of opening to fully open:
 1. Cars 248: 2.3 seconds.
 2. Cars 249: 2.5 seconds.
- E. Door Closing Time: Seconds from start of closing to fully closed:
 1. Cars 248: 4.0 seconds.
 2. Cars 249: 4.4 seconds.

- F. Car Ride Quality:
 - 1. Horizontal and vertical acceleration within car during all riding and door operating conditions. Not more than 20 mg peak to peak (adjacent peaks) in the 1 – 10 Hz range.
 - 2. Measurement Standards: Measure and evaluate ride quality consistent with ISO 18738, using low pass cutoff frequency of 10 Hz and A95 peak-to-peak average calculations.

- G. Noise and Vibration Control
 - 1. Airborne Noise: Measured noise level of elevator equipment and its operation shall not exceed 60 dBA inside car under any condition including door operation and car ventilation exhaust blower on its highest speed. Limit noise level in the machine room relating to elevator equipment and its operation to no more than 80 dBA. All dBA readings to be taken 3'-0" off the floor and 3'-0" from the equipment 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.

2.04 OPERATION

- A. Selective Collective Microprocessor-Based:
 - 1. Operate car without attendant from pushbuttons in car and located at each floor. When car is available, automatically start car and dispatch it to floor corresponding to registered car or hall call. Once car starts, respond to registered calls in direction of travel and in the order the floors are reached.
 - 2. Do not reverse car direction until all car calls have been answered, or until all hall calls ahead of car and corresponding to the direction of car travel have been answered.
 - 3. Slow car and stop automatically at floors corresponding to registered calls, in the order in which they are approached in either direction of travel. As slowdown is initiated for a hall call, automatically cancel hall call. Cancel car calls in the same manner. Hold car at arrival floor an adjustable time interval to allow passenger transfer.
 - 4. Answer calls corresponding to direction in which car is traveling unless call in the opposite direction is highest (or lowest) call registered.
 - 5. Illuminate appropriate pushbutton to indicate call registration. Extinguish light when call is answered.

- B. Firefighters' Service: Provide equipment and operation in accordance with State of Colorado, Boulder Authority Having Jurisdiction or the most stringent code requirements enforceable at the facility location.

- C. Automatic Car Stopping Zone: Stop car within 1/4" above or below the landing sill. Maintain stopping zone regardless of load in car, direction of travel, distance between landings, hoist rope slippage, or stretch.

- D. Remote Monitoring and Diagnostics: Equip each controller with standard ports, interface boards, and drivers to accept maintenance, data logging, fault finding diagnostic and monitoring computers, keyboards, modems, and programming tools. The system shall be capable of driving remote color LCD monitor(s) that continually scan and display the status of each car and call. Provide each group with a full, interactive elevator monitoring (EMS) system. This system must be compatible with the existing University of Colorado at Boulder system.

- E. Motion Control: Microprocessor based AC, variable-voltage, variable frequency with digitally encoded closed-loop velocity feedback suitable for operation specified and capable of providing smooth, comfortable car acceleration, retardation, and dynamic braking. Limit the difference in car speed between full load and no load to not more than $\pm 3\%$ of the contract speed.

- F. Door Operation: Automatically open doors when car arrives at main floor. At expiration of normal dwell time, close doors.
- G. Standby Lighting and Alarm: Car mounted battery unit with solid-state charger to operate alarm bell and car emergency lighting. Battery to be rechargeable with minimum 5-year life expectancy. Include required transformer. Provide constant pressure test button in service compartment of car operating panel. Provide lighting integral with portion of normal car lighting system.
- H. Security System: Provide provisions to limit access to each building floor for cars as follows:
 - 1. Individual floor lockout means in and security control panel to prevent registration of car calls to any selected secure floor.
 - 2. Arrange system so that independent service overrides security system.
 - 3. Arrange system so that firefighters' service overrides security system.
 - 4. Actuate hall lantern each time car arrives at main lobby during secure mode operation.
 - 5. Provide warning light and signal in lobby indicator panel to indicate an attempt to register unauthorized destinations or to open car doors when car is moving or parked at a secured floor. Provide reset switch or button to cancel warning light and signal.
- I. Card/Proximity Reader Security System: Provide provisions in car operating panel for reader unit. Mount reader unit as directed by Architect and cross connect from car pushbuttons to control module in machine room. Reader control unit, mounting brackets, wiring materials, logic circuits, etc., by Security Subcontractor. Elevator control systems shall facilitate system tracking of persons accessing secure floors via printout by passenger I.D. number, floor accessed, and time of entry.
- J. Key requirements for all key operated devices must conform to the University master key plan, Medco models

2.05 MACHINE ROOM EQUIPMENT

- A. Arrange equipment in existing machine room spaces
- B. Geared Traction Hoist Machine, Car #248: Retain existing.
 - 1. Restore, clean and paint to function and appear in like new condition.
 - 2. Drain, flush and provide new gear lubricant.
 - 3. Replace worn gears and bearings.
 - 4. Provide supplemental rope and sheave guards as required.
 - 5. Retrofit new direct drive, digital, closed-loop velocity encoder on hoist machine.
 - 6. Provide drip pans to collect lubricant seepage.
 - 7. Clean and true motor commutator. Provide new commutator brushes.
 - 8. New AC V3F induction drive motor to existing gear case.
 - 9. Completely disassemble, clean, and inspect all brake components. Replace all worn or damaged parts. Reassemble and test for proper operation.
- C. Geared Traction Hoist Machine, Car #249: Provide New
 - 1. Single worm geared or helical geared traction type with AC induction or P.M.S.M. ACV3F motor, brake, gear, drive shaft, deflector sheave, and gear case mounted in proper alignment on an isolated bedplate. Provide bedplate blocking to elevate deflector sheave above machine room floor.
 - 2. Provide hoist machine mounted direct drive, digital, closed-loop velocity encoder.
 - 3. Provide hoist machine drip pans to collect lubricant seepage.
- D. Solid State Power Conversion and Regulation Unit:
 - 1. Provide solid state, alternating current, variable voltage, variable frequency (ACV3F), I.G.B.T. converter/inverter drives.

2. Design unit to limit current, suppress noise, and prevent transient voltage feedback into building power supply. Provide internal heat sink cooling fans for the power drive portion of the converter panels. Conform to IEEE standards 519-1992 for line harmonics and switching noise.
 3. Isolate unit to minimize noise and vibration transmission. Provide isolation transformers, filter networks, and choke inductors.
 4. Suppress solid-state converter noises, radio frequency interference, and eliminate regenerative transients induced into the mainline feeders or the building standby power generator.
 5. Supplemental direct-current power for the operation of hoist machine brake, door operator, dispatch processor, signal fixtures, etc., from separate static power supply.
- E. Encoder: Direct drive, solid-state, digital type. Update car position at each floor and automatically restore after power loss.
- F. Controller: UL/CSA labeled. MCE Model- Motion 4000
1. Compartment: Securely mount all assemblies, power supplies, chassis switches, relays, etc., on a substantial, self-supporting steel frame. Completely enclose equipment with covers. Provide means to prevent overheating.
 2. Relay Design: Magnet operated with contacts of design and material to insure 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.
 3. 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 with one leg of power supply grounded.
 - e. Safety circuits shall not be affected by accidental grounding of any part of the system.
 - f. System shall automatically restart when power is restored.
 - g. System memory shall be retained in the event of power failure or disturbance.
 - h. Equipment shall be provided with Electro Magnetic Interference (EMI) shielding within FCC guidelines.
 4. Wiring: CSA labeled copper for factory wiring. Neatly route all wiring interconnections and securely attach wiring connections to studs or terminals.
 5. Permanently mark components (relays, fuses, PC boards, etc.) with symbols shown on wiring diagrams.
 6. Monitoring System Interface: Provide controller with serial data link through RJ45 Ethernet connection and install all devices necessary to monitor items outlined in Section 2.13. Provide monitoring node in each controller and wire terminals to all devices to be monitored. Elevator contractor responsible to connect monitoring system interface to machine room monitoring compartment and LAN. Wiring from the LAN to the machine room monitoring compartment by others.
 7. Provide controller or machine mounted auxiliary, lockable "open," disconnect if mainline disconnect is not in sight of controller and/or machine.
- G. Sleeves and Guards: Provide 2" steel angle guards around cable or duct slots through floor slabs or grating. Provide rope and smoke guards for sheaves, cables, and cable slots in machine room and secondary machinery levels.
- H. Machine and Equipment Support Beams: Retain existing in place. Provide all required supplemental supports and attachments.
- I. Governor: Retain existing.
1. Clean.
 2. Check bearings and replace if required.

3. Recalibrate and seal.
 4. Retrofit bi-directional electrical shutdown switch
- J. Emergency Brake:
1. Provide means to prevent ascending car over-speed and unintended car movement per Code.
 2. Acceptable emergency brake devices:
 - a. BODE Rope Brake
 - b. Hollister-Whitney Rope Gripper
 3. Mount the auxiliary brake on suitable structural steel supports. Provide a drawing showing the supports, stamped by Professional Engineer verifying the adequacy of the support provided.
 4. Provide control circuits to enable the device to function as required by Code.

2.06 HOISTWAY EQUIPMENT

- A. Guide Rails: Retain main and counterweight guide rails in place.
1. Clean rails and brackets. Remove rust.
 2. Check all rail and bracket fastenings and tighten.
 3. Realign rails as required to provide smooth car ride.
 4. Provide supplemental rail brackets and/or backing as required by Code or to enhance car ride quality.
- B. Buffers, Car, and Counterweight: Retain existing.
1. Drain, flush, refill, and test.
 2. Rebuild as required and paint.
 3. Retrofit switch to limit elevator speed if buffer is compressed.
 4. Retrofit buffer access ladder and platform.
- C. Sheaves: Retain existing.
1. Regroove or replace if required.
 2. Check all fastenings and tighten.
 3. Replace worn bearings.
- D. Counterweight: Retain existing. Replace worn rollers.
- E. Counterweight Guard: Metal guard in pit. Where counterweight is provided between adjacent elevators, provide runway guard next to the adjacent elevator.
- F. Governor and Encoder Pit-tensioning Sheaves: Retain existing. Rebuild as required. As a minimum completely disassemble, clean, replace worn or faulty parts, and recalibrate governor.
- G. Hoist and Governor Ropes: Retain existing or replace if estimated remaining life is less than five years. No proration is allowed under terms of Maintenance Agreement.
- H. Terminal Stopping: Provide normal and final devices. Provide emergency terminal speed limiting devices.
- I. Electrical Wiring and Wiring Connections:
1. 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, or junction boxes. Provide 10% spare conductors throughout. Run spare wires from car connection points to individual elevator controllers in the machine room. Provide four pair of spare shielded communication wires in addition to those required to connect specified items. Tag spares in machine room.

2. Conduit: Painted or galvanized steel conduit, EMT, or duct. Conduit size, 1/2". Flexible heavy-duty service cord may be used between fixed car wiring and car door switches for door protective devices.
 3. Traveling Cables: Flame and moisture-resistant outer cover. Prevent traveling cable from rubbing or chafing against hoistway or equipment within hoistway. Provide five (5) pair of shielded wires and two (2) RG-6/U type coaxial cables for card reader. Provide two (2) pair 14 gauge wire for CCTV power.
 4. Auxiliary Wiring: Connect fire alarm initiating devices, emergency two-way communication system, firefighters' phone jack, paging speaker, card reader, intercom, and announcement speaker in each car controller in machine room. If required
- J. Entrance Equipment: Retain existing. Refurbish/replace and adjust assemblies to ensure smooth and quiet mechanical open and close of doors.
1. Door Hangers and Rollers: Replace as required.
 2. Door Track: Refurbish and/or replace as required.
 3. Door Interlocks: Refurbish and/or replace as required.
 4. Door Closers: Refurbish and/or replace as required
- K. Hoistway Door Unlocking Device: Provide unlocking device with escutcheon in door panel at all floors, with finish to match adjacent surface.
- L. Hoistway Access Switches: Mount in wall at top and bottom floors. Provide switch with faceplate.
- M. Entrance Equipment: Retain existing.
- N. Floor Numbers: Stencil paint 4" high floor designations in contrasting color on inside face of hoistway doors or hoistway fascia in location visible from within car.

2.07 HOISTWAY ENTRANCES

- A. Frames: Retain existing.
- B. Transom Panels: Retain existing.
- C. Door Panels: Retain existing.
- D. Sight Guards: Retain existing. Replace damaged sight guards.
- E. Sills: Retain existing. Clean and polish. Check and tighten all fastenings.
- F. Fascia, Toe Guards, and Hanger Covers: Retain existing. Provide as required where damaged or missing. Check and tighten all fastenings.
- G. Struts and Headers: Retain existing. Check and tighten all fastenings.

2.08 CAR EQUIPMENT

- A. Frame: Retain Existing. Check and tighten all fastenings.
- B. Safety Device: Retain existing. Check and tighten all fastenings. Disassemble, clean, and inspect components. Replace all worn or damaged parts. Reassemble and test for proper operation.
- C. Platform: Retain existing. Reinforce if required. Check and tighten all fastenings.

- D. Platform Apron: Provide new extended platform apron to meet Code. Minimum 14 gauge steel, reinforced and braced to car platform front with black enamel.
- E. Guide Shoes: Retain existing. Check and tighten all fastenings. Replace worn rollers or inserts.
- F. Sills: Retain existing. Clean and polish. Check and tighten all fastenings.
- G. Doors: Retain existing. Retrofit dual gibs, one at trailing edge and one at leading edge of each panel.
- H. Door Hangers: Retain existing. Replace roller or complete hanger assembly as required. Check and tighten all fastenings.
- I. Door Track: Retain existing. Clean and sand for smooth, quiet operation. Check and tighten all fastenings.
- J. Door Header: Retain existing. Check and tighten all fastenings.
- K. Door Electrical Contact: Retain existing. Check and tighten all fastenings. Replace worn parts.
- L. Door Clutch: Retain existing. Check and tighten all fastenings
- M. Restricted Opening Device: Restrict opening of car door(s) outside unlocking zone.
- N. Door Operator: Retain existing. Check and tighten all fastenings. Automatically adjust and maintain appropriate torque regardless of variable door weight or air pressure.
- O. Door Control Device: Retain Existing
- P. Car Operating Panel: Retain Existing modify as necessary

2.09 CAR ENCLOSURE

- A. Car Enclosure Passenger/Service Elevator: Retain existing. Check and tighten all fasteners.

2.10 HALL CONTROL STATIONS

- A. Pushbuttons: Retain Existing modify as necessary

2.11 SIGNALS

- A. Hall Lantern, All Car(s): Retain Existing
- B. Car Position Indicator: Retain Existing
- C. Hall Position Indicator, Retain Existing.
- D. 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.

2.12 MONITORING SYSTEM

- A. General: Provide an interactive system to monitor and manage the elevator equipment ("units") hereinafter called "system." Data collection, data storage, and real-time monitoring portion of the

system shall be based on Microsoft Windows and be able to run on Windows 2000 Pro, XP Pro, or later operating systems. Provide the following features:

1. Network based, capable of interfacing with control systems via either serial data link or hardwired interface connections.
 2. Operate on any TCP/IP based network system including but not limited to an Ethernet, Token Ring, Arc-Net, Lift-Net, etc.
 3. Expansion capability to add unlimited number of monitoring terminals on the network.
 4. Monitoring terminals shall operate peer-to peer or with a single client server. Failure of a single network device shall not affect the operation of the remainder of the system.
 5. Complete backup of system data shall be accomplished at any single terminal/server location.
 6. Display multiple banks, including multiple buildings, on a single monitoring terminal screen.
- B. **Monitoring Display:** The system shall be capable of simultaneous monitoring of at least five hundred units on a single monitoring station utilizing a graphical representation of a plan view of the facility. Each elevator shown on the plan view shall be individually displayed and shall be visible on the monitoring system display terminal without the need to scroll. Each individual unit, when operating "normally," shall be displayed in green. In the event of a malfunction of any individual unit, the unit shall be displayed by a red blinking light on the monitoring system display. Units which are intentionally placed out of service shall be shown as yellow in the display mode. When malfunctioning units, or units intentionally placed out of service are returned to normal operation the graphical representation for that unit(s) shall automatically return to green. The user shall have the ability to display additional information, such as the cause of fault/alarm, for all units by selecting the unit with a "mouse click" from the plan view of the facility. All monitored units shall be visible from any monitoring terminal on the network. Entry into the network shall be multi-level password protected.
- C. **System Capabilities:**
1. The system shall be capable of real time display of all monitored status points on all monitored equipment. Fault and event notification screens and audible alarms shall be immediately displayed on selected monitoring stations. Different fault and event tables shall be defined on a per-bank basis. The system shall collect and store all status, fault, and event information for later reporting and analysis. The system shall provide statistical analysis of hall call response times, traffic patterns, fault conditions, service logs, and security usage in graphical and tabular format.
 2. The system shall maintain a record of every status point change occurring on the monitored equipment and provide the ability to replay these events in a simulation at a later time in real time, slow speed, single step, reverse, or fast forward. This information shall be retained for a period of at least twenty-six weeks and a mechanism shall be provided whereby this information may be archived.
 3. The system shall store traffic fault and statistical data for a period of at least three (3) years. The system shall log error type, car number, floor position, and major system status points whenever a fault or logged event occurs.
 4. The system shall provide interactive control of certain features provided in the elevator control system. These features may be revised as the requirements of the building change. Some of these interactive controls may include, but are not limited to: Security floor lockouts, entering car and hall calls, Firefighters' service, lobby recall, VIP service, up/down peak service, etc.
 5. In the case of a power failure the system shall be capable of connecting to emergency power back-up unit. The loss of power shall not affect any stored data. The system shall have the capability to detect the loss (disconnect) of any individual unit from the monitoring system by periodically polling all units to ensure that normal communications between the unit(s) and the terminals/server are maintained.
 6. The system will automatically re-boot the program and continue to operate after a power loss or other system malfunction.
- D. **Monitoring Equipment:** The monitoring equipment shall have these minimum characteristics:
1. **Monitoring Station Hardware:** Provide one (1) monitoring station.

- a. Central Processing Unit: IBM compatible microcomputer – desk top or mini-tower (multiple machine rooms or lobby displays)
 - b. Type: Pentium or most current high-performance processor
 - c. Speed: Most current high-performance
 - d. Internal Hard Drive: Adequate storage for three years data for entire system
 - e. Modem: Most current high-performance
 - f. Display Monitor: 19" – 20" LCD flat panel, color, capable of simultaneous display of all monitored units
 - g. Printer: Current HP Color Desk Jet Series
 - h. Keyboard: MS Windows compatible
 - i. Mouse: MS Windows compatible
 - j. Power Requirements: 90-230 Volts AC, 50-60Hz @ 8A
 2. Monitoring Station Operating System Software
 - a. MS Windows 2000 Pro, XP Pro, or later
 - b. MS Windows 2000 Server or later
- E. Network requirements:
1. Maximum local network rated distance (2-20 gauge shielded TP): > 10 miles
 2. Maximum number of nodes (combined PC, inputs/outputs): 500
 3. Maximum I/O points per node (input or output): 2040
 4. Access time to status bit change (typical 6-car bank): < 25ms
 5. Must be capable of operating on RS485, RS422, Ethernet, Token Ring, Arc-net, Lift-Net, Fiber-Optic and mixed WAN TCPIP Networks
- F. Monitoring Requirements: The system shall display and record the following information for each monitored unit. Serial data links may include many more points. Items listed below are minimum requirements.
1. Group status:
 - a. Group operational mode
 - b. All units to be monitored on the same screen in a graphical format
 - c. In/out of service
 - d. Standby power
 - e. Supervisory failure
 - f. Location and direction of hall calls
 2. Individual car status, expandable menus:
 - a. Direction of travel
 - b. Independent service
 - c. Inspection service
 - d. Firefighters' service
 - e. Hospital Code Blue service
 - f. Position of elevator
 - g. Door status (open, opening, closing, closed)
 - h. Door dwell time
 - i. Load by-pass
 - j. Standby power
 - k. Power on/off
 - l. Door detector
 - m. Safety circuit
 - n. Door zone
 - o. Stop switch
 - p. Alarm button
 - q. Registered car calls
 - r. Out of level
 - s. Machine room temperature exceeds 95 degrees
 - t. Stop counter (number of starts)

- u. Car speed
 - v. Door open times
 - w. Door close time
 - x. Start to stop motion time
 - y. Emergency 2-way communication device
 - z. Air conditioner/heater
 - 3. Keyboard, mouse, and time clock control capabilities:
 - a. Floor lockouts (car or hall)
 - b. Lobby recall
 - c. VIP service
 - d. Firefighters' service
 - e. Hospital Code Blue service
 - f. Up/down peak
 - 4. Faults monitored with visual and audible alarm, triggered by combinations of any of the above status points:
 - a. Safety circuit
 - b. Alarm bell
 - c. Stop switch
 - d. Emergency 2-way communication device
 - e. Door reversal device
 - f. At least six (6) user selectable faults or events (i.e. water in pit, high machine room/cab temperature)
- G. Reporting Requirements: System shall provide reports in color graphical format both on-screen and in printed form capability to conveniently switch from one report type to another and from one bank to another using minimal mouse clicks and key strokes. Reports shall be displayed after minimal waiting time. Data for all reports shall be continuously recorded and stored. Reports shall be displayed by simply selecting a date and time range, bank of equipment and report type. Date and time range selections shall carry forward from one report selection to the next. Reporting functions shall be subdivided into the following categories:
- 1. Traffic Reports:
 - a. Number of hall calls per floor (hall call distribution on a per floor basis)
 - b. Number of hall calls per hour (24 hour time-line)
 - c. Hall call waiting times per floor (hall call waiting time distribution on a per floor basis)
 - d. Hall call waiting times per hour (24 hour time-line)
 - e. Distributed hall call response graph (24 hour time-line)
 - f. Detailed hall call response graph (% calls / n seconds)
 - g. Longest wait times including floor #, wait time, date, time and direction
 - 2. Fault Reports:
 - a. Ten most recent faults (most recent faults listed per bank)
 - b. Fault Log: Displays the entire fault log for a given time period
 - c. Faults per car (fault distribution on a per car basis)
 - d. Faults per floor (fault distribution on a per floor basis)
 - e. Faults per day/week/month (fault distribution on a per unit or group basis)
 - 3. Car Use Statistics:
 - a. Car use by hour (24 hour time-line of car calls, car starts, door cycles, delayed car, load by pass)
 - b. Car use statistics (same as above, shown for an entire bank)
 - 4. Group Service Log:
 - a. Cars in service (24 hour time-line with text log of group availability of each car)
 - b. Group functions (24 hour time-line with text log of actuation of group functions – Up peak, down peak, fire service, emergency power, etc.)
- H. Interface to Third Party Building Management Systems: The elevator monitoring system shall be capable of interfacing and exchanging data with a variety of third party building management systems

such as Siemens, Landis & Staefa, Johnson Controls, SCADA, and others. Information shall be exchanged by Modbus protocol, open protocol, or other suitable methods as required.

- I. Interactive Features: The control system shall be capable where desired of operating interactive control features provided in the elevator control system. These features may be revised as the requirements of the building change. Some of these interactive controls may include but are not limited to: security floor lockouts, entering car and hall calls, Firefighters' return service, lobby recall, VIP service, up/down peak or hospital Code Blue service. Local codes may affect the availability or operation of these features.
 1. Security Access Features: The monitoring system shall be capable of providing security enable/disable of all hall and car calls through on-screen menus at a minimum. The monitoring system shall also be capable of interfacing directly with card readers and security keypads in stand-alone mode, and indirectly through a serial interface with a third party security system. When in stand-alone mode, the monitoring system shall maintain a database of elevator users and security pass codes. When on secure mode the use of each elevator will be recorded in a file together with the time, authorized pass code and destination for each call.
 2. Elevator Control Features: Each elevator shall be capable of being controlled through the monitoring system. All control points shall be capable of seven-day twenty-four hour time clock automatic operation or manual operation from the mouse and keyboard. The control points shall include, but not be limited to, the following (where allowed by local codes):
 - a. Car call security lockout
 - b. Hall call security lockout
 - c. Firefighters' service
 - d. Independent service
 - e. VIP Service
 - f. Hospital Code Blue service
 - g. Standby power to selected car
 3. Paging Feature: The monitoring system shall be capable of paging a service technician or other personnel based on pre-defined parameters of elevator faults or conditions. The paging system shall provide the ability to page multiple numbers determined by the type of event triggering the notification and shall be able to page different numbers based on preset times of day (i.e. different shifts). The system shall be capable of sending text messages to full text pagers in addition to supporting standard DTMF pagers.
 4. Remote Access Feature: The monitoring system shall be capable of allowing approved individuals under multi-level password control to access all system features via the local area network, internet, or via modem over the public telephone network to review the performance of the equipment or to evaluate a fault condition. The remote access feature shall be integrated into the monitoring system and shall not use third party "remote control" software products.
 5. Data Transmission to Central Support Location: The system shall be capable where desired of transmitting fault, car usage and other data to a remote service desk or other office location for further processing, technician dispatch or other purposes. The data may be transmitted via the local area network, internet, or via modem over the public telephone network.

2.13 EXECUTION

2.14 SITE CONDITION INSPECTION

- A. Prior to beginning installation of equipment, examine hoistway and machine room areas. Verify no irregularities exist which affect execution of work specified.
- B. Do not proceed with installation until work in place conforms to project requirements.

2.15 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver material in Contractor'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.

2.16 INSTALLATION

- A. Install all equipment in accordance with Contractor's instructions, referenced codes, specification, and approved submittals.
- B. Install machine room equipment with clearances in accordance with referenced codes, and specification.
- 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. 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 pit equipment.
 - 3. Neatly touch up damaged factory-painted surfaces with original paint color. Protect machine-finish surfaces against corrosion.

2.17 FIELD QUALITY CONTROL

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

2.18 ADJUSTMENTS

- A. Install rails plumb and align vertically with tolerance of 1/16" in 100'-0". Secure joints without gaps and file any 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 Contractor's instructions.
- D. Adjust motors, power conversion units, brakes, controllers, leveling switches, limit switches, stopping switches, door operators, interlocks, and safety devices to achieve required performance levels.

2.19 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 and floor.
- D. Clean hoistways, car, car enclosure, entrances, operating and signal fixtures.

2.20 ACCEPTANCE REVIEW AND TESTS

- A. Consultant's Final Observation and Review Requirements.

END OF SECTION 142200