# TRACTION ELEVATOR SPECIFICATION

Section 14 20 00

# 5597 POWER
# OTTAWA, ON

**Prepared By:**

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## PART 1 - GENERAL

1.1 Related Work

.1 Co-ordinate work with related trades, including:

.1 Section 01 01 00 - General Instructions.
.2 Section 01 61 00 - Common Product Requirements.
.3 Section 05 12 23 - Structural Steel.
.4 Section 05 50 00 - Metal Fabrications.
.5 Section 06 10 11 - Rough Carpentry.
.6 Section 26 - Electrical Service

1.2 Reference Standards

.1 Perform work to the following minimum standards:

.1 ASME A17-2010/CSA-B44-10 Safety Code for Elevators and Escalators
.2 CSA C22. No77 Motors with Inherent Overheating Protection.
.3 CSA C22 No. 141 Unit Equipment for Emergency Lighting.
.4 Technical Standards and Safety Act 2000, Ontario Regulation 209/01 and Ontario Regulation 223/01.
.5 TSSA Code Adoption Document Amendment 261-13, latest amendment.
.6 C22 Canadian Electrical Code, particularly Section 38.
.7 2006 National Building Code.
.8 CAN/CSA B651 Barrier-Free Design Guidelines.
.9 CAN/CSA Z320 Building Commissioning Standards.
.10 Canada Labour Code, Part 2, Occupational Safety and Health Regulations including Section 13.13.
.11 Occupational Health and Safety Act including Section 109 of Ontario Regulation 213/91.
.12 CSA Z432-04 Safeguarding of Machinery.
.13 TSSA document: Elevator Machine room Equipment Guarding - Best Practices
.14 LEED Gold Certification.
.15 Addendum to ANSI/ASHRAE/IESNA Standard 90.1-2007, Energy Standard for Buildings Except Low-Rise Residential Buildings (cab lighting systems to have efficacy of not less than 35 lumens per watt, cab ventilation fans shall not consume over .33 watts/cfm at maximum speed, when stopped and unoccupied with doors closed for over 15 minutes, cab interior lighting and ventilation shall be de-energized until required for operation).

.2 Finished elevator installations are to have appropriate guards and be Health-and-Safety-regulation compliant with respect to physical and electrical hazards.

.3 In case of discrepancy, the above standards take precedence over details elsewhere in this specification.

1.3 Type of Elevators

.1 Two (2) gearless, machine room-less (MRL) elevators .

.2 Power Supply

| | | |
|---|---|---|
| .1 | Motor and controllers: | 600 Volts nominal, 3 Phase, 3 Wire, 60Hz. |
| .2 | Lighting supply: | 120 volts, 1 phase, 60Hz (dedicated). |

1.4 Permits and Inspections

.1 Complete Design Submission and related research necessary for regulatory approval of Work.

.2 Obtain and pay for necessary Municipal or Provincial inspections and permits and make such tests as are called for by the regulations of such authorities. Make tests in the presence of the authorized representatives of authorities.

.3 Provide the Owner and the Consultant with copies of inspection reports the same day they are received from authorities.

1.5 Taxes

.1 Pay all taxes properly levied by law including Federal, Provincial and Municipal. Taxes to be invoiced as an identified extra.

1.6 Measurements

.1 Before the execution of the work, verify all dimensions with the actual site conditions.

1.7 Quality of Work

.1 Perform work by mechanics skilled in the installation of elevators and escalators. Provide adequate supervision.

.2 Comply with all applicable provisions of all federal, provincial and local labour laws.

1.8 Samples

.1 Submit to the Architect or Consultant for approval, upon request, samples of any visible elevator finishes including:
- .1 Cab wall finishes.
- .2 Cab ceilings.
- .3 Cab doors.
- .4 Hoistway entrance doors and frames.
- .5 Signal and operating fixtures.

1.9 Shop Drawings and Product Data

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Before beginning work, prepare all drawings necessary to show the general arrangement of the elevator equipment and other data which is called for and is to be submitted for review. Provide these drawings within two (2) weeks after notification of award of contract.

.3 Drawing review is for the sole purpose of ascertaining conformance with the general design concept and does not constitute approval of the design details inherent in the shop drawings, responsibility for which shall remain with the Contractor. Review shall not relieve the Contractor of responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents.

.4 Indicate on shop drawings:

- .1 Size and location of machine, controller and drive.
- .2 Location of fence style guarding (if applicable).
- .3 Size and location of car, hoisting beam, guide rails, buffers and other components in hoistway.
- .4 Rail bracket spacing and maximum loads on guide rails.
- .5 Reactions at points of support.
- .6 Weights on principal components.
- .7 Top and bottom clearance and overall travel of car.
- .8 Location of circuit breaker, switchboard panel or disconnect switch, light switch and feeder extension points in control room.
- .9 Include on general arrangement drawings:

.1 Type, size, location of hoistway entrances showing details of fastening to hoistway structure.
.2 Plan and section view of hoistway and control room.

.10 Location and size of access doors.

.11 Loads on hoisting beam.

.12 Heat generation of equipment in control room.

.5 Provide product data for:

.1 Signal and operating fixtures, operating panels and indicators.

.2 Cab design and components.

.3 Doors and frame details.

.4 OHSA/MOL and TSSA compliant equipment guarding.

1.10 Project Record Documents

.1 Before final acceptance of equipment, provide three (3) sets of reproducible as- built wiring diagrams as well as three (3) sets of all final issue shop drawings including General Arrangement Drawing. One set of drawings to be laminated or enclosed in plastic protectors and marked "as-built". Provide all drawings stamped as “as built” by a Professional Engineer registered in the province.

.2 Record actual locations of equipment, names of equipment manufacturers and suppliers, concealed conduit and boxes, concealed devices, disconnects and shut-off valve.

.3 Mark up all field changes or additions to original wiring diagrams in red.

1.11 Operation and Maintenance Data

.1 Provide three (3) hard copies and one (1) soft copies, in English of the Operation and Maintenance manuals. Include in the manuals a copy of the safety authority registered design submission and inspection reports.

.2 Bind data in vinyl hard cover 3 D ring type loose leaf binders for 212 x 275 mm size paper. Binders must not exceed 75 mm thick or be more than 2/3 full.

.3 Enclose title sheet labelled "Operation Data and Maintenance Manual", project name, date and list of contents. Show project name on binder face and spine.

.4 Organize contents into applicable sections of work to parallel project specifications breakdown. Mark each section by labelled tabs protected with celluloid covers fastened to hard paper dividing sheets.

.5 Include the following maintenance data for each elevator:

.1 Description of elevator system's method of operation and control including, but not restricted to, motor control system, emergency power operation, door operation, and special or non-standard features provided.
.2 Consolidated replacement parts list.

.6 Provide legible schematic wiring diagrams covering all electrical equipment as supplied and installed, including all changes made to final work, with all symbols listed corresponding to identity or markings on both control room and hoistway apparatus. Cover one (1) copy in plastic or glass, frame and mount in control room. Include lubrication chart.

.7 Include all wiring diagrams for all equipment on controllers.

.8 List information on each piece of equipment including:

.1 Approval drawing number.
.2 Model, part and serial number.

.9 Detail the following maintenance information:

.1 Lubrication products and schedules.
.2 Trouble shooting procedures.
.3 Adjustment techniques.
.4 Operational checks.
.5 Maintenance of special finishes.
.6 Planned maintenance tasks and their frequencies.

.10 List recommended spare parts to be maintained on site to ensure optimum efficiency. List all special tools and appropriate unique applications. Detail manufacturer and supplier names and addresses.

1.12 Maintenance Service

.1 Provide complete interim maintenance of the elevators during the construction period until twelve (12) months after date of Final Certificate of Completion of the last elevator as part of this contract.

.2 As a minimum all inspections, tests and maintenance procedures are to be carried out in accordance with the CSA Standard B44-10 and Elevating Devices Code Adoption Document - Amendment 263/13r1.

.3 Systematically clean, lubricate and adjust all of the equipment as required.

.4 Repair or replace electrical and mechanical parts of any equipment as required, whether due to defect or normal wear and tear.

.5 Use only genuine standard parts of manufacturer of equipment.

.6 Perform work by competent personnel under supervision and in direct employ of manufacturer, or manufacturer's licensed agent.

.7 Schedule work during regular Elevator Trade working hours with Owner.

.8 Maintain locally an adequate stock of parts for replacement or emergency purposes and have qualified staff available to ensure fulfilment of parts requirements in a timely fashion.

.9 Include 24 hour call-back service required by equipment stoppage or malfunction at all times at no additional cost.

.10 Ensure no unit is out of service longer than 12 hours - keep Owner completely informed of equipment malfunctions on a continuing basis.

.11 Remove garbage at each examination.

.12 Provide a log book in the control room, record all callbacks and repairs, as work is carried out. Provide an "acknowledgement of inspection" form at each inspection. Do not employ a computerized log book.

.13 Provide a storage cabinet in the control room suitable for storing spare parts and project documents.

.14 Provide an approved container in the control room for the storage of oil and rags. Empty on a regular basis.

1.13 Layout

.1 Design equipment to suit space as shown on Architectural drawings distributed at time of project tender, including hoistway cross-sections, overhead dimensions, pit depths, control room dimensions and control room location.

.2 In the event that design changes are proposed by the Contractor with respect to any of the above-noted dimensions, required either for convenience or by physical necessity, notify Consultant and Architect in writing without delay.

1.14 Guarantee

.1 Guarantee that the materials and workmanship of the apparatus installed under these specifications are first-class in every respect and make good any defects, not due to improper use or care, which may develop within one (1) year from the date of acceptance.

.2 Provide an extended warranty of an additional two (2) years for finished surfaces visible to elevator passengers. Warranty coverage to include imperfections that may develop on painted and architectural steel surfaces, as well as shifting, delamination, bending or other imperfections of joints, panels and skins. Warranty does not cover damage by mis-use.

.3 Commence warranty of work at date of certification of Final Completion, as certified by the Consultant.

1.15 Consultant's Certification of Payment

.1 The Consultant will certify progress payments for work only after it has been installed.

.2 Progress payments may be withheld for, whether or not certified by the Consultant, for any of the following:

.1 Defective work or deficiencies not corrected.
.2 Failure of Contractor to make payments properly to Sub-contractor(s) or for material and labour.
.3 Failure to work to schedule.
.4 Damage to the building or another contractor.
.5 Failure to meet specifications or performance criteria.

1.16 Elevator Performance

.1 With equipment adjusted to the required parameters, operate elevator with smooth acceleration and provide a comfortable and agreeable ride to the passengers.

.2 Meet required parameters in conjunction with dependable, consistent elevator operation and without undue wear or excessive maintenance over the life of the elevator installation.

.3 Provide brake to brake time of 7.5 seconds at 150 fpm based on typical 11 foot floor heights.

.4 Set single-slide opening doors to safely open in 2.7 seconds and close in 3.8 seconds.

.5 Provide adjustable dwell times and independent dwell settings for car and hall calls. Set the dwell times to 2 seconds for car, and 3 seconds for hall initially.

.6 Maintain floor levelling accuracy of 5 mm or better.

.7 Set door detector interrupt and nudging time to 20 seconds. Set door to close at reduced speed in nudging mode.

.8 Limit cab noise levels to 60 dB when moving and 68 dB during a door operation cycle, as measured by a sound meter located in the centre of the cab and set on the "A" scale with an "F" response.

.9 Limit horizontal vibrations in both the post-to-post and front-to-back axis to 20 milli-g in the 2 - 10 hz range.

.10 Limit vertical vibrations to 20 milli-g.

.11 Adjust typical acceleration rate to 0.04 g.

.12 Limit jerk rate (change in rate of acceleration) to 2.44 $m/s^3$.

.13 Provide car speed to within 3% of contract speed in both directions.

## PART 2 - PRODUCTS

2.1 Description of Elevators and Features

Table 1.1 – Overview

| FIELD | REQUIRED |
|---|---|
| Type | Gearless Machine Room-less Traction |
| Class | Passenger |
| Capacity | 1360 kg (3000 lbs) |
| Speed | 0.762 m/s (150 fpm) |
| Landings | See architectural drawings |
| Travel | See architectural drawings |
| Hoistway Size | See architectural drawings |
| Overhead Size | See architectural drawings |
| Pit Depth | See architectural drawings |
| Door Opening | 1067mm (42") wide, 2134 mm (84”) high One speed side opening |
| Hall Entrance Finish | Brushed stainless steel doors and frames |
| Type of Control | Microprocessor based |
| Type of Operation | Duplex selective collective |

Table 1.2 – Special Features

| FIELD | REQUIRED |
|---|---|
| Fire Fighters’ Operation | Phase I recall and Phase II in-car operation |
| Emergency Power | Sequenced emergency power operation |
| Independent Service | Include in each cab |
| Seismic | Zone 2 design |
| Remote Monitoring | Not required |
| Card Reader | Required in-car |
| Security Camera | Required in-car |

Table 1.3 - Signals

| FIELD | REQUIRED |
|---|---|
| Push Buttons | Stainless steel, LED illuminated |
| Car Operating Panels | Single car operating panel |
| Position Indicators | Required in car operating panel and main lobby |
| Lanterns | Required in each car door jamb |
| Appendix “E” of B44 | Full compliance required |
| Emergency Phone | Provide two-way communication in cabs |

2.2 Components

.1 Use major elevator components from standard product line of one manufacturer unless otherwise approved.

.2 Use components only which have performed satisfactorily together under conditions of normal use in not less than three (3) other elevator installations of similar design and for a period of at least two (2) years. Furnish names and addresses of owners or managers of buildings, in which proposed combination of major components has so performed.

.3 Major components are defined to include motors, motor drives, controllers and machines.

.4 Furnish materials and equipment new, the best of their respective kinds and installed in a neat, accurate, workmanlike manner.

.5 Provide only system designs field tested for the application, with adequate capacity to meet all performance criteria and to provide long term, reliable operation.

.6 Provide stainless steel to ASTM A480M, type 304, no. 4 satin finish or XL-Blend S as specified.

.7 Use paint with CGSB 1-GP-104Ma, alkyd enamel semi-gloss, for machinery, colour to be selected by Architect.

.8 Provide elevator control equipment manufactured and installed by one of the following:

.1 Otis Canada Inc.
.2 Motion Control Engineering (MCE)
.3 GAL Manufacturing
.4 KONE Inc.
.5 ThyssenKrupp Elevator
.6 Automatisation JRT Inc.

.9 Other manufacturers are not acceptable unless approved in writing by tender-issuing authority.

2.3 Electrical Components

.1 Provide insulated wiring to connect all parts of the equipment.

.2 Use steel compression type fittings where electrical metallic tubing is used. Fittings with set screws are not acceptable unless a separately identified grounding conductor is also installed inside raceway.

.3 Provide suitable communication system and any security system junction boxes on the outside of the controller. Provide uninterrupted shielded wiring from the communication system in car to junction box located at controller in control room. Clearly label junction boxes accordingly.

.4 Provide a separately identified box for the fire alarm connection and emergency power signal.

.5 Include at least 10% spare conductors in each cable. Terminate spares at terminal blocks, suitably identified.

.6 Include spares of at least six (6) pairs of shielded wires and one (1) CAT 5 cable for audio, video or other electronic equipment, such as a card reader system.

.7 Do not parallel conductors to increase capacity unless individually fused.

.8 Do not use armoured flexible metal conduit as grounding conductor.

.9 Install anti-shorts at all wiring entry points.

.10 Provide additional disconnect switches and wiring as required to suit control room layout. Provide and install all required conduit and wiring from disconnect switches to elevator controllers.

.11 Include wiring for run in conduit, by others, for connections to elevator-related devices remote from hoistway.

.12 Connect all wiring where required to building fire alarm system. Fire alarm signal are to be brought to a demarcation point and labeled in the elevator control room by Division 16.

.13 Limit use of flexible conduit on car top to items that require movement or periodic adjustment.

.14 Provide insulated wiring having a flame retarding and moisture resisting outer cover. Run wiring in metal conduit or tubing or wire ducts.

.15 When using conduits or troughs through floor, extend conduit or trough at least 100 mm (4") above floor.

.16 Do not run conduit or wiring along the pit floor. Install all conduit and wiring a minimum of 300 mm (12") above pit floor.

.17 Use type ETT travelling cables.

.1 Suitably suspend the travelling cables to relieve strain in the individual conductors.

.2 Install travelling cables with a continuous run from the controller to the elevator cab. Do not terminate or couple the travelling cables under the car or in the hoistway.

.3 Suitably protect travelling cables from damage where they make contact with the hoistway, hoistway equipment or trimmer beams.

.18 Run high voltage wiring in electrical metallic tubing or other galvanized steel raceway. Include a covered ground wire same size as feeders in the raceway.

.19 For wiring that is run in conduit or tubing, comply with Table 6 of CEC Part 1.

2.4 Sound Isolation

.1 Include resilient pads to effectively isolate machine from machine beams or flooring. Design for transmisivity of less than 10% at full speed and full load. Use a minimum of 37 mm thick pads. Do not use built-up pads.

.2 Prevent lateral displacement of machine.

2.5 Roller Guides

.1 Equip car and counterweight with heavy duty roller guides, individually spring loaded, mounted on top and bottom of car and counterweight frames. Provide minimum diameter 102 mm (4") for car, 76 mm (3") for counterweight.

.2 Provide each guide with durable, oil resistant and resilient tired ball bearing rollers to run on the finished rail surfaces.

.3 Do not lubricate guide rails. Maintain each roller on its respective guide in uniform contact with rail surface at all times by means of substantial adjustable springs or by resilient mountings.

.4 Provide guide operation, which is inaudible to passengers in car or outside hoistway with car operating at rated speed and car fan turned off.

.5 Use roller tire material which will not develop flat spots after standing idle for 72 hours under average environmental conditions.

2.6 Guide rails and Brackets

.1 Provide car guide rails of 15 lbs/ft and counterweight rails of 8 lbs/ft minimum.

.2 Align and file all joints.

.3 Erect guide rails plumb and parallel within maximum deviation of 1 mm per any 6,000 mm section and 0 mm per any 25 mm section.

.4 Use metal shims only and provide lockwashers under nuts and tapped bolts.

.5 Compensate for expansion and contraction of guide rails.

.6 Use splice plates and guide rails with contact surfaces accurately machined to form smooth joints.

.7 Provide planed steel tees, erected plumb and fasten to hoistway by heavy steel brackets.

.8 Use "T" shape tongue and groove rails, connect with steel splice plates.

.9 Extend rails to approximately 150 mm from underside of overhead machine beams.

.10 Bolt or weld brackets directly to steel. Do not use clips.

.11 In concrete structures, provide inserts in concrete formwork or self-drilling expansion shell bolt anchors for support of brackets. Where Engineer considers any concrete fastener improperly installed either replace fastener or demonstrate stability of fastener by performing on site test under which fastener is subjected to four times manufacturer's safe pull out or working load.

.12 Do not burn out fastening holes.

.13 Where pits are waterproofed, anchor guide rails in pit so as not to reduce effectiveness of waterproofing.

.14 Include steel reinforcement for car and counterweight guide rails where necessary.

.15 Provide a minimum 150 mm (6") clearance below the guide rails in the pit to ensure that the rails do not bottom.

.16 Provide additional trimmer beams as required above the level of the last landing served, and between the levels of the floor slabs of each landing served to accommodate structural design. Include any rail stiffening and/or bracket extensions as required.

2.7 Hoist, Governor and Compensation Rope

.1 Provide hoist and governor ropes with fibre core from same factory production run in accordance with good practice and the CSA Elevator Code.

.2 Provide springs on one end of hoist ropes.

.3 Use approved wedge clamp type sockets.

.4 Secure the returned end of the wire ropes with two retaining clips. Set first clip approximately 50 mm (2") above top of wedge clamp, and second clip 100 mm (4") above first clip.

.5 Properly seize rope ends or use fibre-glass tape.

.6 Provide guarding for exposed ropes to a minimum of 991 mm (39”) in any area considering to be a “working platform”.

.7 Provide system engineered for expected hoist rope life of 10 years minimum based on four trips to the lobby per day per building occupant and considering information: car weight, car capacity, car speed, type of car guide, percent counter weight, roping ratio, angle of wrap, drive sheave diameter, undercut profile and angle, deflector sheaves, number of reverse bends, number of ropes, rope diameter, rope grade, lay direction, rope type/construction and bending length.

.1 Provide this calculation and the above data with shop drawing submission.

.8 Design electrical drive system to compensate weight of hoist ropes and travelling cables.

2.8 Car and Counterweight buffers

.1 Provide buffers, stands and associated pit steel.

.2 Use reduced stroke buffers and emergency terminal stopping devices where pit depth or overhead height does not permit installation of normal stroke buffers.

.3 Include buffer extensions and working platform complete with ladder where necessary to suit pit depth.

.4 Provide a switch on each floor mounted car buffer to prevent operation of the elevator towards buffer if buffer does not return to normal position.

.5 Mount any conduit approximately 300 mm (12") above pit floor. Suitably support this conduit.

2.9 Counterweight

.1 Provide counterweight for smooth and electrically efficient operation.

.2 Provide counterweight of structural or formed metal frame type with metal or concrete filler weights equal to mass of complete car plus 40% to 42% of rated load. Provide rods through weights and frame.

.3 Provide steel retaining arrangement to prevent counterweight leaving guide rails, in event, roller guide assemblies leave their attachments. Fasten retaining arrangement to counterweight frame independent of primary guiding means.

.4 Provide means to securely retain the weight sections in the metal frame.

.5 Provide counterweight guard in pit. Paint in contrasting colour the maximum run-by sign on guard.

.6 Provide blocking under counterweight, where required.

.7 Statically balance the counterweight so that, at the centre of the hoistway, the counterweight hangs in the centre of the rails with the top roller guides removed.

2.10 Safeties and Governor

.1 Design car and/or counterweight safety to release when car or counterweight moves in "UP" direction.

.2 Provide a centrifugal governor complete with power removal switch.

2.11 Gearless Machine and AC Motor

.1 Provide low speed, quiet, gearless traction machine located in the hoistway overhead. Do not exceed 85% of maximum machine sheave shaft load.

.2 Provide high tensile, 724 mPa or better steel shaft with 32 micro finish or better.

.3 Design brake to be spring applied, electromagnetically released and quietly operated by direct current, inaudible outside of elevator hoistway.

.4 Make traction sheave thick enough to permit at least one re-machining of traction grooves. Provide 600 mm outside diameter minimum.

.5 Sound isolate, using at least 37 mm thick, one-piece rubber or neoprene pads. Provide engineered vibration isolation.

.6 Provide 28 poles for smooth, quiet operation.

.7 Include AC reversible, high start torque and low current consumption, designed to withstand loading and inertia particular to elevator duty. Provide 60 minute duty based on 180 stops per hour.

.8 Conform to NEMA MG1-18-426 - 436 inclusive.

.9 Impregnate windings with insulation and bake to prevent absorption of moisture.

.10 Provide not less than one megohm insulation resistance between motor windings and motor frame - Class F or H insulation system.

.11 Thermally protect motor. Impregnate windings with insulation and bake to prevent absorption of moisture and oil.

.12 Provide less than 3% slip at full load.

.13 Prevent lateral displacement of machine.

.14 Provide all necessary machine beams, bearing/mounting plates and tie- down supports.

.15 Design so that surface temperature of machine does not exceed 38 degrees C during heavy operation.

.16 Provide sealed, no-maintenance, bearings, rated for a minimum 5 years' life. Do not use motor bearings as thrust for worm shaft.

2.12 Emergency Brake

.1 Provide an emergency brake that applies directly to the elevator hoist ropes or to the drive sheave.

.2 Activate the emergency brake if the elevator overspeeds or if the elevator moves more than 500 mm (20") away from the floor with the doors open.

.3 Arrange that when the emergency brake applies, it removes power from the elevator hoist motor and driving machine brake.

.4 Locate the emergency brake release in the control room or arrange such that it is easily accessible.

.5 Clearly label and permanently label the emergency brake as well as the drive machine brake.

2.13 Solid State Motor Drive

.1 Provide Variable Voltage Variable Frequency AC flux vector, fully regenerative, drive system. Design equipment to operate unaffected under minor levels of voltage fluctuations and harmonics generated from within and outside the building.

.2 Provide robust equipment capable of reliable operation with ambient temperature between 5 and 40° C.

.3 Make drive system capable of producing full torque at zero speed and shall utilize a shaft mounted position transducer to accurately monitor the rotating frequency.

.4 Take power for system from proposed building 3 phase power supply.

.5 Change AC voltage to DC, and a power transistor invertor circuit will change the DC voltage to AC to power the elevator motor.

.6 Control motor speed and torque by varying the frequency and amplitude of AC voltage.

.7 Eliminate surges on the AC line which might cause blowing of the DC line fuses or which might cause trouble in other equipment connected to AC line. Filter DC if necessary.

.8 Modify frequencies emanating from rectifier drive which are objectionable to personnel or which interact with any building equipment.

.9 Produce no voltage distortion or notches in excess of the limits suggested in IEEE 519. Limit EMI through the use of shielding, efficient power conductor run and filters. Electrical measurements to be taken at the elevator control room mainline disconnect switches.

.10 Provide stepless acceleration and deceleration and smooth operation at all speeds.

.11 Limit control room noise level, with all elevators operating, to 70 dBA as measured from the centre of the control room on an “S” response.

.12 Include regenerative braking of motor during deceleration by feeding power generated by motor, back to ac power lines. Failure of the drive’s system to remove regenerated power shall cause the drive’s output to be removed from the hoist motor.

.13 Provide closed loop tachometer feedback control. Continuously monitor the elevator speed signal from the velocity transducer and compare it with the intended signal to verify proper and safe operation of the elevator and to correct the actual elevator speed to match the intended speed.

.14 Automatically re-start equipment which has stopped due to ac power failure.

.15 Limit Voltage Total Harmonic Distortion, measured at the disconnect switch to 5%, and limit any individual harmonics to 3%. Provide Variable Voltage Variable Frequency AC drive system. Design equipment to operate unaffected under minor levels of voltage fluctuations and harmonics generated from within and outside the building. Limit Voltage Total Harmonic Distortion to 2%, and limit any individual harmonics to 0%.

2.14 Sheaves and Supporting Beams

.1 Provide deflector sheaves, idler sheaves and overhead sheaves, including bearings and beams, necessary for roping arrangement required by the control room and hoistway space shown on the Architectural drawings.

.2 Provide sheaves of cast iron, accurately machined and grooved for the diameter of ropes used.

.3 Provide all sheaves sufficiently larger than that required by Code, in pitch diameter and thickness, to permit at least one regrooving of sheave.

.4 Provide means to retain suspension members in their respective position on all sheaves.

2.15 Controller and Cabinet

.1 Provide a solid state controller equipped with programmable logic microprocessor controls and self-diagnostic features. Provide fully non-proprietary version of all control equipment including:

.1 All required diagnostic are “on board”.

.2 All programming, tools and diagrams required for long-term maintenance are provided with the controller as the Building Owner’s property.

.3 The controller will not shut down or alter its functionality in any way after a pre-determined increment of time or use.

.4 Any elevator contractor shall be allowed to purchase parts, supplies, diagrams, support or training directly from the factory at the same cost level as the original installer. A published price list shall be supplied with the controller.

.5 Parts, including circuit boards, shall be available for direct purchase from the factory in numbers and not on a one-for-one “exchange only” basis.

.2 Enclose the controller in enamelled, ventilated, sheet steel cabinet, with swing-type doors at front.

.3 Provide robust equipment capable of reliable operation with ambient temperature between 5 and 34° C.

.4 Provide relays and contactors particularly designed for elevator duty.

.5 Provide a suitable communication system junction box on the outside of the controller and identify it accordingly. Provide a separate identified box for the fire alarm connection, emergency power signal and security cabling.

.6 Cord all field wiring and insulate from metal contact.

.7 Permanently identify all switches, relays and fuses.

.8 Mechanically fasten all conductors in controller. Do not employ plastic adhesive clips or brackets.

.9 Provide protection against reverse and open phasing of main feeders.

.10 Provide separate plexiglass cover over high voltage section, including 600 V elements, to allow working on the controller with the main doors open.

.11 Include properly sized primary and secondary fuses for each transformer used in the controller.

.12 Mount all controller components, including resistors, inside the cabinets. Do not mount components on controller doors or removable panels.

.13 Govern motion of cars by means analysing real position of car in hoistway. Position device shall be positively connected to the car by mechanical or electrical means. Travelling to a terminal landing for recycling is not acceptable. Stepper relays are not acceptable.

.14 Do not employ components or controller logic which will disable or otherwise alter the operation of the elevator after a pre-determined number of starts, door cycles, etc.

.15 Use microprocessors for all logic related functions such as dispatcher, car controller and motion control. Provide crystal regulated frequencies. Provide a dispatching program in ROM, with at least 40% spare capacity. Power each processor from a separate power supply. Isolate the inputs and outputs by optical devices or relays.

.16 Use easily removable printed circuit boards for all solid state devices other than high power SCR's and rectifiers. Use gold plated edge connectors. Protect circuits from oxidation. Make all wiring connections through properly dimensioned pads.

.17 Design solid state circuits to operate in the anticipated environment. Provide means to restart the elevator system efficiently in the event of power interruption. Incorporate noise suppression devices in power supplies, inputs and outputs.

.18 To facilitate testing and troubleshooting, arrange control circuits to ground one side of the control power supply used for external circuits. (External circuits are those outside of microprocessors or solid state devices, such as relays, lights, limits, locks and buttons.) Arrange the design so that safety circuits are not compromised by accidental grounding of control circuits.

.19 Install wiring runs neatly. Terminate wiring at studs or terminal strips, using connections that assure substantial electrical and mechanical integrity. Identify all major components exactly as they are indicated on wiring diagrams. Use engraved lamicoid or metal tag mounted immediately adjacent to the component.

.20 Provide battery back-up for all circuits containing volatile memory to retain all information for at least 48 hours without regular power.

2.16 Position Transducer

.1 Arrange the closed loop feedback power control to continuously monitor the actual elevator speed signal from the velocity transducer and compare it with the intended speed signal to verify proper and safe operation of the elevator.

.2 Accomplish electrical stepping using solid state devices, pulse generators or magnetic switches. Do not use electro-mechanical stepper switches or tape readers. Design the unit so that parts are accessible for easy adjustment.

2.17 Control and Operation

.1 Provide microprocessor-based duplex selective collective automatic control optimized to minimize passenger waiting times. Submit a full description of proposed control systems including their features, the conditions which bring these into operation and response time.

.2 Provide dispatching programs in ready-only-memory, with a minimum of 40% spare capacity.

.3 In the event of failure of the automatic dispatch system, provide alternate dispatching means to ensure service to all landings and for both travel directions.

.4 When lifting rated load, do not permit car speed to vary from rated speed by more than 5%.

.5 In the controller, include absolute floor encoding which, upon power up, shall move the car to the closest floor to identify the position of the elevator.

.6 Arrange elevator so that momentary pressure of one or more of its car buttons causes car to start.

.7 Provide a time delay to hold the car for an adjustable interval at landings at which stops are made to enable passengers to enter or leave the car.

.8 Do not start car unless the car door is in the closed position and all hoistway doors are locked in the closed position.

.9 If down landing buttons are pressed while the car is travelling up, the car shall not stop at these landings, but shall allow these calls to remain registered.

.10 After the highest car and landing calls have been answered and the door interlock circuit is established, the car shall automatically reverse and respond to down car and landing calls.

.11 Cause the car to start before this time upon registration of a car button for another landing.

.12 Permit car to be registered to establish direction of travel when car has answered the furthest call, even if other landing calls are registered.

.13 When the car has been started, either in response to its own car button calls or to landing calls, respond to its own car button calls and to landing calls registered for direction in which car is travelling in order in which landings are reached, irrespective of sequence in which calls were registered. When travelling down the car will not respond to up calls, but these will remain registered and be answered on the next up trip.

.14 If no car buttons are pressed and a car starts up in response to several down calls, it shall proceed first to the highest down call and reverse to collect other down calls. Similarly, up calls shall be collected when the car starts down in response to such calls.

.15 If the car stops for a landing call and a car button is pressed within a pre-determined interval thereafter, corresponding to the direction in which the car is travelling, the car shall proceed in the same direction regardless of other landing calls registered.

.16 Provide the elevator with a self-levelling feature that will automatically bring the car to the floor landings. Self-levelling shall, within its zone, be entirely automatic and independent of the operating device, shall correct for over travel or under travel and shall maintain the car within 10 mm of the landing irrespective of load and direction of travel.

.17 The main floor as described in this section is the first floor.

.18 Normally, park one car at first floor and designate the second a free car, parked at landing last served.

.19 Arrange idle free car to answer landing calls either above or below landing at which car is standing except first floor landing calls.

.20 When free car is clearing calls, automatically start the other car, parked at first floor, to answer landing calls under the following conditions:

.21 Registration of up call from landing below free car while it is travelling up.

.22 Registration of up or down call from landing above free car while it is travelling down.

.23 Inability of free car to clear all registered landing calls within approximately forty (40) seconds, or to move in response to registered landing calls within this time limit.

.24 Allow only one car to stop in response to any one landing call.

.25 Return first car to clear all of its calls to the first floor.

.26 Should all cars finish their calls at the first floor, designate one car the free car.

.27 If a car is removed from service arrange other car to answer its own calls as well as all landing calls.

2.18 Security System Provisions

.1 Provide a security system interface to provide restrictive operation to the car and hall calls of the elevators with a proximity card reader system. Security system will be supplied and installed by others.

.2 A labelled security interface system junction box shall be provided on the outside of the controllers and the wires shall be identified for the security system. Provide as a minimum, eight (8) pairs of shielded cables, #18 AWG. Terminate cables in the junction box on terminal strip, clearly designating these cables as for future security system use. Secure other end of cables behind the car operating station to allow for future interconnection with proximity card reader.

.3 Provide a 240 mm wide x 100 mm high cut out at each car operating panel. Provide space behind cut-out and provided translucent, smoked, plexiglass, 7 mm thick, flush mounted in cut-out opening.

.4 Isolate all car and hall call circuits to prevent electrical feedback through any inter-connections with proximity card reader controls.

.5 Run wiring between the elevator machine room and car operating panel without splices, breaks, or joint connections.

.6 Include for coordinating the installation of the proximity card reader devices as well as coordinating the interfacing and connection requirements to ensure a workable security system.

.7 Provide ability to restrict calls to specific floors.

.8 Provide security override for Emergency Service operation.

.9 Provide keyed manual over-ride of security system, in case of system malfunction. Provide one over-ride per car and one global over-ride. Locate key switches as indicated at time of shop drawing review.

2.19 Automatic Emergency Power Operation

.1 The emergency power system shall be arranged by “Others” so that:

.1 The emergency power source is capable of providing sufficient power to run one (1) elevator at contract speed and capacity.

.2 The emergency power will be provided on the same lines and the same disconnect as the normal power.

.3 Two pairs of signal wires will be run to the elevator controller.

.4 One pair of wires will be shorted together giving a closed circuit to indicate that the elevator will be supplied by normal power.

.5 The same pair of signal wires will give an open circuit to indicate that the elevator will be supplied by emergency power.

.6 The second pair will provide an advanced warning signal that is closed for normal power and opens 20 seconds prior to transfer from emergency to normal power or from normal power to emergency power during an emergency power test.

.2 Arrange elevator circuits, wiring and controls so that:

.1 A signal light marked "ELEVATOR EMERGENCY POWER" is illuminated in the control panel.

.2 All cars are automatically and sequentially brought to the main floor.

.3 Any car delayed by some malfunction is by-passed.

.4 Elevator control equipment and motor drive are not damaged on transfer to and from emergency power.

.5 On Automatic setting, elevator 1 will continue to operate on emergency power after other elevators have been recalled.

2.20 FEO - Phase I Emergency Recall Operation

.1 Provide for all cars, emergency recall service which will be initiated automatically or manually by any recall switch. When recall has been initiated:

.1 The elevator controlled by the recall switch and on automatic operation, including independent service operation, shall return directly to the recall level where the doors shall open and remain open. The elevator shall not respond to the landing or car call buttons. Travelling to a terminal landing first and then reversing to travel to the recall level is not acceptable.

.2 The elevator that is stopped with the doors closed, or is travelling towards the recall level, shall proceed non-stop to the recall level.

.3 The elevator travelling away from the recall level shall reverse at or before the next available landing without opening its doors.

.4 A car stopped at a landing shall have its emergency stop switch rendered inoperative as soon as the doors are closed and the car starts to move. A moving car shall have its emergency stop switch rendered inoperative.

.5 All call registered lights and directional lanterns shall be extinguished and remain inoperative. Position indicators, in the car and at the recall level, should remain in service.

.6 The car shall be provided with a visual and audible signal system which shall be activated to alert passengers that the car is on the emergency recall operation and at least the visual signal shall remain operative until the car reaches the recall level.

.7 An elevator stopped at a floor other than the recall level with doors open shall close its doors and proceed non-stop to the recall level.

.8 Door re-opening devices that may be affected by smoke or hot gases shall be rendered inoperative.

.9 If the elevator is on inspection operation, a signal shall warn the inspector to return the car to the recall level. The elevator shall remain under the control of the inspector.

.10 The recall operation shall be terminated when both switches at the main control panel and lobby panel are in the “RESET” or “OFF” position, as is appropriate.

.11 Include for connecting the fire alarm signal through the recall switch.

2.21 FEO - Phase II Emergency In-Car Operation

.1 Provide in-car emergency service for each elevator initiated by a key switch located in the car station. The switch shall be marked "OFF - HOLD - ON" and the key shall be removable in the OFF and HOLD positions. The switch shall become effective in initiating in-car emergency operation when in the "ON" position, provided the emergency recall operation is in effect and the car has returned to the recall level. During emergency in-car operation, the elevator shall operate as follows:

.1 The elevator shall be operable only by a person in the elevator.

.2 The elevator shall not respond to elevator landing calls.

.3 The opening of power-operated doors shall be controlled only by continuous pressure on the "DOOR OPEN" button. If the "DOOR OPEN" button is released during the "OPEN" motion, the door shall reclose immediately. When doors are fully open, they shall remain open until closed as in point 5.

.4 Door re-opening devices for power-operated doors shall be rendered inoperative.

.5 The doors shall be closed and the car started by registering a car call and constant pressure on the "DOOR CLOSE" button or on any car call button.

.6 Momentary operation of the in-car emergency service switch to the "HOLD" position shall cancel registered car calls.

.7 When the car is at a landing and the key switch in the car is turned to the "HOLD" position, the doors shall remain open and car calls cannot be registered.

.8 When the car is at a landing and the key switch in the car is turned to the "OFF" position, the car shall automatically return to the recall level as on emergency recall operation regardless of the position of the emergency recall switch.

.9 The elevator shall be returned from In-car operation only when the car is at the recall level and the in-car switch is in the "OFF" position.

2.22 Independent Service

.1 Include independent service by means of key-operated switch in car service panel to allow removal of a car from group service and to operate independently in response to car calls only and as follows:

.1 Render the hall lanterns and/or car riding lanterns inoperative. Car position indicator to remain operational.

.2 Cause the car to park with the doors open. Arrange the controls so that the car responds to any car calls registered if a button is held until the doors are closed and the interlocks made-up.

.3 Cause the doors to reopen if the button is released at any time up to the point at which the elevator starts to move. Render inoperative the normal door protective devices.

.4 Render the door detector inoperative.

2.23 Load Weighing

.1 Provide load weighing with means to measure the load in the car within 5% of the elevator capacity. Device to monitor deflection of spring at rope hitch

.2 Design device to provide a signal to the controller for:

.1 Preventing a loaded car from answering registered hall calls.

.2 Designating hall calls to the most available car and controlling traffic analytically.

.3 Dispatching a parked car from the main floor as soon as the car has been loaded to a pre-set setting.

.3 Adjust the load weighing device to ensure that it will operate over the required range of settings.

.4 Verify that the load weighing device has a long term stability such that the settings do not require re-adjustment more frequently than every two years.

.5 Use load weighing to pre-torque elevator and prevent movement in reverse direction when leaving a floor.

.6 Provide an Anti-Nuisance operation which will cancel car- registered calls when the number of calls is not reasonably proportional to the cab load

2.24 Access to Pit, Hoistway and Top of Car Inspection

.1 Accommodate walk-in pit access where required. Provide interlock of pit-access doors if required. Determine if vision panel will be required on pit-access door based on elevator equipment location.

.2 At the top landing for all elevators, provide keyed-access to car top.

.1 Provide between car crosshead and hoistway door, a single operating fixture containing the following: an emergency stop switch, continuous pressure buttons for operating the car and a switch for making the buttons on top of the car operable. Operation from top of the car shall be obtained by simultaneous, continuous pressure of the appropriate direction button and a safety operating button after these buttons have been made effective.

.2 Operation from top of the car shall not be possible unless all electric door contacts are closed.

.3 Means shall also be provided so that when the car is to be operated from the top of the car, automatic levelling, power door operation and the normal operating devices car and landing are made ineffective.

.4 Arrange circuits to prevent car moving away, when on top of car operation, by any other means.

.5 The speed of the elevator shall be not more than 150 fpm and not less than 50 fpm while on inspection mode.

.6 Provide appropriate circuitry so that top of car operation accomplishes smooth start and stop when operated by any sequence of car top buttons.

.3 At all landings, provide a hoistway door unlocking device. Provide a collar for holes in door.

.4 Provide car top guard rail and toe-board on all non-access sides of the elevator car top where the distance to a wall exceeds 300 mm. Comply with TSSA Director’s Order 245/10.

.1 Include for an intermediate rail and toe board.

.2 Include weight of railings in engineered design.

.3 Where overhead does not allow standard railings, provide collapsible railings including all safety switches outlined in section 4.2 of Director’s Order 245/10.

.4 Paint the railing and toe board yellow.

.5 Provide an outline of the top of car refuge area.

2.25 Work Lights and Receptacles

.1 Provide suitable protected light fixtures and duplex receptacle on top of car.

.2 Provide two (2) protected and permanently wired light fixtures on car top. One light to be a moveable unit to be used as a hand-held light.

2.26 Emergency Lighting

.1 Include emergency lighting in the cars, with a minimum of two (2) lamps.

.2 Use battery operated emergency lighting equipment to CSA C22 No. 141-1985, to provide general illumination and 10 Lx minimum illumination at car operating panel.

.3 Include means for convenient manual operation and testing of the unit from within car. Testing means to be spring loaded or self-centring key switch.

.4 Design battery unit of sufficient strength to support 90 KG person without causing malfunction or damage.

.5 Include means of containing any leakage or spillage of electrolyte.

2.27 Car Platform

.1 Provide a structural steel platform, and install a sub floor made of two layer of 19 mm plywood or more rugged as required for class of loading.

.2 Provide a structural steel isolation frame all around platform.

.3 Provide 38 mm thick rubber isolation pads. Vulcanize steel plates to top and bottom of pads. Arrange for fastening top plate to platform and bottom plate to isolation frame.

.4 Provide rubber isolation of car enclosure to sides of uprights.

.5 Provide nickel-silver threshold, with suitable grooves for car door lower guides. Set threshold to accept flooring chosen by Owner.

2.28 Car Frame

.1 Provide a structural steel car frame. Bolt sections together.

.2 Provide reinforcement to relieve car enclosure of undue stress.

.3 Design and install car frame and shell to be free of squeaks and rattling noises when car is in motion.

2.29 Car Cab Enclosure

.1 At shop drawing review provide CAD-generated cab approval drawing, one-file drawing covering all surfaces, to scale and in colour. Provide all necessary samples at this time.

.2 Fabricate cab shell ceiling with sheet steel, minimum of 12 gauge, smooth and free from defects. Finish in white baked enamel colour. Emergency exit to be of same fabrication and finish.

.3 Provide suspended ceiling system finished in brushed stainless steel.

.4 Fabricate front return panel, entrance columns and car doors of matching, integral brushed stainless steel.

.5 Ventilate by an exhaust air handling unit through roof and through concealed perforations at base. Limit total fan noise to 55 dBA, measured on an “S” response scale, measured 0.9 m above floor with fan on high speed. Include two speed operation of ventilation system.

.6 Accommodate weight and space of flooring, plus set, provided by others.

.7 Provide four (4) MR16 fixtures with LED lamps (5W/60 deg/warm white) c/w satin aluminum trim ring and directional gimbal. Design for light intensity measured at car sill of 100 Lx minimum. Totally enclose and conceal wiring and fixtures from view within the car.

.8 Automatically extinguish cab lighting after approximately 120 seconds has elapsed with elevator dormant, when sitting with doors closed. Turn on lights automatically as soon as a hall call or call is registered for the elevator with lights extinguished. Provide a master override switch for the automatic extinguishing of cab lighting, within the elevator cab. Arrange circuits so that any malfunction rendering the elevator inoperable, will disable this feature entirely.

.9 Provide emergency exit on top of the car of suitable size, equipped with an electrical device which will prevent operation of the elevator if the exit cover is open more than 50 mm and designed to comply with elevator code.

.10 Provide flush mounted, hands-free, auto-dial telephone. Program telephone to number provided by owner.

.11 Provide bar type handrail, 6.35 mm x 102 mm solid aluminum on all non access sides of cab with space of 40 mm between rail and cab wall. Mount at 900 mm above floor. Return ends to wall.

.12 Provide rigid structure to cab walls capable of resisting 20 lbs force horizontally at any point without noticeable (temporarily) deflecting and 100 lb force without permanently deforming.

.13 Use bolts fitted with washers and lockwashers and fabric separators, if necessary, to assemble and guarantee entire structure to operate entirely free from squeaks and metallic sounds.

.14 Provide 2438 mm clear height in cab under suspended ceiling for elevators.

.15 Provide clear car entrance height of 2135 mm.

.16 Provide new stainless steel licence holders in cabs sized to fit standard Provincial licenses as issued at time of project completion.

.17 Install new appropriately fire rated, raised, plastic laminate panels on all non-accessible sides of car cab and returns. Install plastic laminate using two (2) coats of solvent based contact cement and "J" trim fastening. Provide panels of equal width on each wall and provide stainless steel reveals between panels. Provide stainless steel trim to protect edges of panels on all sides. Provide choice of the laminate colour and finish to standard range of Formica or Wilsonart 1.6 mm (1/16”) thick. Option – provide reversible panels with alternate plastic laminate choice on rear.

.18 Provide any required assistance with mounting cab signage, advertisement boards or TV screens.

.19 Provide pad hooks around entire perimeter of cab including return panels. Provide one set of protective pads to cover all walls including the front return panel (provide cut-out to accommodate car operating station).

.20 Provide an aesthetically pleasing finished product including square joints, flush surfaces, even finishes and firm bonding/fastening throughout.

2.30 Car Doors

.1 Provide flush steel horizontal-slide doors faced with 16 gauge, matching stainless steel. Wrap stainless steel around doors. Do not use binder angles.

.2 Provide two (2) steel pins, one at each end of each door panel extending from the door into the centre of the threshold grooves to prevent the door swinging into the hoistway, should the lower guides become dislodged.

.3 Install main guides, one at each end of each door panel.

.4 Provide smooth and quiet door operation. Do not employ felt-covered gibs.

.5 Provide an auxiliary closing device for multi-section doors.

2.31 Hoistway Door Hangers, Locks, Tracks and Closing Devices

.1 Use self-lubricating ball or roller bearings sealed to retain grease lubrication and wipers to maintain rollers and track in clean condition.

.2 Include two-point suspension door hangers for each door panel using rollers with resilient sound absorbing wearing surfaces and replaceable hanger tracks.

.3 Absorb upthrust with adjustable eccentric rollers equipped with ball or roller bearings.

.4 Design for replacement of gibs without removing door from hanger tracks.

.5 Provide spring-type, sill-mounted closing devices or alternatively heavy-duty spirator devices.

.6 Provide positive electric interlocks and door closing devices. Provide wiring to door locks including a separate green ground wire back to controller.

.7 Provide door safety retainers to prevent door panel displacement should the replaceable primary guiding means fail.

.8 Dowel all hoistway door pick-up roller assemblies after final adjustments have been made.

.9 Provide auxiliary closing devices on multi-section doors.

2.32 Car and Hoistway Door Operator

.1 Provide a heavy-duty door operator to open and close the car and hoistway doors quietly and smoothly. Provide high speed, electric door operator, with solid state feedback (closed loop) control.

.2 Operate the car door and hoistway doors simultaneously.

.3 Provide a minimum motor power of 1/4 HP.

.4 Provide electrical cushioning at each end of travel.

.5 Provide one (1) gate switch per door panel, operated by a roller attached to the door panel. Provide wiring including a separate green ground wire back to controller.

2.33 Car Door Protective Devices

.1 Provide a three-dimensional, solid state, electronically operated door reversal device on the leading edge(s) of car door panel(s). The device shall contain systems specifically designed for the application and enclosed in an insulated chassis. Arrange the device to:

.1 Provide long term reliable operation, include no moving parts.

.2 Upon failure of the device, shut the car down at the next available floor, with doors in the fully open position.

.3 Provide totally silent operation,

.4 Include visible diagnostics on the device to permit verification that the unit is functioning.

.5 Have all components installed behind the door jamb, so as to provide a clear opening and present a clean architectural appearance.

.2 Design the device to provide a zone of detection a minimum of 75 mm in advance of the leading edge of each car door and arrange the operation as follows:

.1 Trigger the protection system when any object is located in the entrance and cause the door to reopen without engaging the object;

.2 Permit the protection system to be active over the full travel of the doors;

.3 After elapse of the normal door open dwell time, provide a limited door reversal operation. Arrange the operation so that the door retracts sufficiently to permit only the immediate entering passenger to pass. Continue closing of the door after the passenger leaves detection zone.

2.34 Fire Rated Elevator Entrances

.1 Provide at all floors complete elevator entrances.

.2 Construct doors and frames to ULC 1 ½ hours fire rating. Test to CAN 4-S104 sandwich panel construction 25 mm thick minimum.

.3 Finish entrances in brushed stainless steel at all floors.

.4 Provide 1067mm (42") wide, 2134 mm (84”) high One speed side opening doors.

.5 Cushion opening doors and closing doors with rubber bumpers.

.6 Assume complete and undivided responsibility for entire installation including doors, frames, structural supporting angles, headers, fascias or toeguards, hangers, sills and sill support angles. Frames to suit wall thickness dimensions, as shown in drawings.

.7 Include struts, fastened to supports with 12 mm bolts.

.8 Install 50 mm high stainless steel arabic numerals on both sides of entrance frames. Include a “star” at the main egress level.

2.35 Flush Type Hoistway Doors

.1 Construct hoistway doors of two-panel sheet steel, hollow center with internal re-enforcement.

.2 Reinforce doors to withstand strains due to power operation.

.3 Include sight guard finished to match entrances at all floors.

.4 Provide smooth and quiet door operation. Do not employ felt-covered gibs.

2.36 Hall Sills

.1 Include extruded aluminum sills with anti-slip wearing surfaces to ASTM B221-74 alloy 6351-T6.

.2 Grout sills in position providing up to 50 mm thickness as required.

.3 Include channel or angle supports at each sill, fasten to building supports with 12 mm bolts, angles to span full width of entrance.

2.37 Fascias and Toeguards

.1 Provide fascia and toeguards not less than 17 gauge sheet steel from the pit floor to underside of overhead floor, extended a minimum of 75 mm beyond clear opening.

.2 Reinforce to walls where necessary to prevent deflection and securely fasten to entrance arrangement.

.3 Provide final coat of paint for non-galvanized steel fascias and toeguards.

2.38 Identification

.1 Provide 100 mm (4") numerals corresponding to floor level on hoistway side to fascia plates and locate numerals as required by Code.

.2 Provide all bilingual engraving on faceplates in Helvetica medium, upper and lower case.

.3 Provide 50 mm (2") numerals on all elevator equipment.

.4 Identify all elevators at recall level. For this and any other identification of cars and floors at entrances that is visible to passengers, use formed metal or aluminum-coloured plastic numerals 75 mm in height and 10 mm thick. Final location and form to be confirmed at time of shop drawing review.

.5 Provide six (6) keys of each type used with key rings and engraved gravoply discs, identifying use of key.

2.39 Lanterns

.1 Provide translucent, high-impact plastic, flush mounted car riding lanterns in each door jamb (2 per car). Illuminate lantern suitably to indicate direction of car travel to waiting passengers.

.2 Provide illuminated fixture of diameter not less than 70 mm (2.75”) with stainless steel faceplates.

.3 Sound gong or chime with the illumination of direction arrows, one gong for up and two for down. Chime to be adjustable in volume. Provide clear tone at 30 dBA approximately 8 feet from fixture. Time gong so as to be heard by passengers waiting in the hall.

2.40 Hall Button Fixtures

.1 Provide one (1) riser of LED illuminated, stainless steel push buttons (blue illumination). LED’s to be rated for 100,000 hours illumination.

.2 Install at 1066 mm to top of button above floor level.

.3 Provide flush mounted illuminated type push button on a stainless steel, no. 4 finish faceplate. Illuminate buttons when pressed to indicate a call has been registered and retain illumination until the call has been answered.

.4 Provide "UP" pushbutton at lowest landing and "DOWN" pushbutton at top floor and "UP and DOWN" buttons at typical floors.

2.41 Special Operation Fixture(s)

.1 Provide in the ground floor lobby hall station:

.1 A three (3) position fire recall switch, OFF - ON – RESET with pilot light.

.2 Engrave faceplate “FIREFIGHTERS’ EMERGENCY OPERATION” in red lettering 5 mm in height.

.3 Provide engraved instructions adjacent to the switch for the operation of the recall switch.

.4 A three (3) position keyswitch (Auto plus each elevator) for Emergency Power with a jewel for each key position to indicate the presence of emergency power.

.5 Engrave faceplate “ELEVATOR EMERGENCY POWER” in red lettering 5 mm in height.

.6 Provide an audible and illuminated visual signal adjacent to the main lobby “Fire Recall” switch labelled “ELEVATOR COMMUNICATIONS FAILURE” in red letters a minimum of 5 mm in height. Include a keyswitch to reset the alarm.

.2 Provide at recall level near elevator hoistway a box conspicuously located and identified containing the emergency recall service keys.

2.42 Position Indicators and Voice Annunciation

.1 Provide flush mounted position indicators over top of ground floor entrance and include one (1) additional indicator in the car station. Provide LED-illuminated, segmented, digital-display position indicators with stainless steel faceplate.

.2 Use characters at least 38 mm high.

.3 Provide voice annunciation indication of each floor, when served and of car direction. Provide volume control adjustable from behind car station. Provide high-power speakers, minimum of two (2) per car so no distortion is readily noticeable to passengers. Provide sample of annunciations with shop drawings.

.4 Provide in each hall position indicator an "OUT OF SERVICE" sign/indicator.

.1 Whenever service is denied to the particular elevator for any reason, the "OUT OF SERVICE" sign shall illuminate automatically. This includes independent service and inspection operation and an opening in the safety circuit.

.2 Provide an identified toggle switch on the side of the controller that shall illuminate the OUT OF SERVICE sign.

2.43 Car Operating Station

.1 Provide one (1) car operating station in each car.

.2 Provide one (1) service cabinet per car.In cabinet, provide key-operated switches for lighting, emergency light test, 2-speed fan, independent service and out of service. Provide one spare key switch. Provide proper labeling of all switches including the spare key switch. Provide a dimmer switch for control of lighting and a 110 volt, 15 amp duplex receptacle. Provide a lockable flush-mounted door.

.3 Use brush stainless steel cover.

.4 Engrave all wording required on car front - do not use surface mounted plates. Engrave all characters in cover 0.8 mm deep and filled with enamel.

.5 Use Dupar US91 or equivalent LED-illuminated stainless steel floor buttons, one for each floor served. Provide flush mounted tactile identification at side of each button. Include momentary audible signal to indicate call has been registered.

.6 Provide a key operated stop switch and door open and close buttons.

.7 Provide a separate lockable “Firefighters’ Operation” cabinet located at the top of the car operating panel (no higher than 1800 mm from finished cab floor) housing the Fire Operation key switch, Call Cancel button, STOP switch, DOOR OPEN and DOOR CLOSE buttons, additional indicator light and operating instructions.

.8 Engrave identification in upper or lower case, Helvetica medium, at least 9 mm, filled with red or black enamel, as required.

.9 Engrave the car number, government installation number and maximum capacity in kilograms and lbs. and number of persons on each car station. Use wording “MAXIMUM CAPACITY”.

.10 Use international symbols wherever possible.

.11 Provide a speaker and grille with assistance button identified on the car operating panel. Include autodialler and all wiring required to be connected to the Owner's telephone line. Install a metal guard behind the speaker to eliminate interference from car operating panel controls.

.1 Provide an international telephone symbol to identify the assistance button with engraved bilingual signage “HELP”.

.2 Provide an LED visual indicator on the car operating station faceplate to indicate the call for assistance has been acknowledged. Locate button 1220 mm from finished cab floor.

.3 The hands free emergency communications device shall contain an internal speaker and microphone to enable two-way communication with elevator passengers.

.4 The device shall be activated by pressing the assistance button located on the car operating station faceplate and shall automatically dial a telephone number of the Owner's choice.

.5 The device shall contain a ring sensor which shall allow the initiation of a call to the elevator.

.6 Emergency in-car communication system shall have the capability of receiving calls from the main lobby emergency phone and having the in-car telephone forwarded as required.

.7 Provide a wall mounted communications system at the main lobby accessible by emergency personnel. Co-ordinate location with Owner.

.12 Include uninterrupted telephone wiring within elevator hoistway, from car cab to a box located on the outside of controller.

2.44 Terminal Stopping Devices

.1 Provide an automatic stopping device, arranged to bring car to a stop at the terminal landings independent of the regular operating device in the car.

.2 Dowel final limits to main rails.

2.45 Barrier-free Design

.1 Arrange all controls and fixtures to be easily reached and operated by disabled persons.

.2 Unless otherwise specified within, arrange any new controls and fixtures to meet all requirements of Appendix "E" of the ASME A17-2010/CSA-B44-10 Safety Code for Elevators and Escalators.

2.46 Signal Illumination

.1 Illuminate signal fixtures with intensity which produces distinct and well defined indications. All signals to be LED illuminated.

2.47 Fixture Fastening

.1 Fasten all fixture faceplates, including car-operating station, with tamper-proof screws.

2.48 Markings

.1 Engrave identification and instructions at least 0.8 mm deep on operating panels and on all signal equipment in both official languages except where design is such that inference is obvious and readily understood. Submit markings and designs for approval.

2.49 Non-standard Pit and Overhead

.1 Include for working platforms and buffer extensions if required.

2.50 Seismic Design

.1 Meet the safety design requirements for Seismic Risk Zone 2 as outlined in Section 8.4 of the ASME A17.1-2010/CSA-B44-10 Safety Code for Elevators and Escalators including but not limited to:

.1 Prevent hoist and governor cables and travelling cables from snagging on brackets and other protrusions in the hoistway.

.2 Restrain movement of governor tension sheave.

.3 Prevent ropes from being dislodged from sheave grooves.

.4 Arrange the elevator to stop should either the car or counterweight disengage guide rails.

.5 Include adjustable seismic trigger switches to prevent operation of the elevator whenever a predetermined level of seismic acceleration is detected.

.1 Prevent idle elevator from starting.

.2 Stop elevator at the next available floor.

## PART 3 – EXECUTION

3.1 Car Balancing

.1 Before final adjusting commences, statically balance the car so that, at the centre of the hoistway, the car hangs in the centre of the rails with the top roller guides removed.

.2 Carry out this test with the car doors closed and an empty car.

.3 Balanced car using iron or steel weights mounted in a steel frame under the car.

3.2 Inspection

.1 Periodically during construction of hoistway and control room structure, verify that hoistway, pit and control room are proceeding correctly for equipment installation.

.2 Verify shaft and openings are of correct size and within tolerances.

.3 Confirm electrical power is available and of correct characteristics.

.4 Report defects in writing to Consultant.

3.3 Welding

.1 Where welding is used for cylinder and pressure piping, prepare joints and weld in approved manner using welders fully qualified to the requirements of CSA Standard W47-92.

.2 Identify field welds with welder's identification stamp.

3.4 Installation

.1 Place machines as indicated on Architectural drawings.

.2 Provide all necessary fastenings, bearing plates and transfer arrangement to accomplish appropriate tie-down of machines.

.3 Arrange equipment in control room so functioning equipment and other equipment can be removed for repairs or replacement without dismantling or removing other equipment components. Arrange for clear passage to access door. Accommodate equipment in space indicated on Architectural drawings.

.4 Erect guide rails using metal shims with lockwashers under nuts and threaded bolts. Compensate for expansion and contraction of guide rails.

.5 Use splice plates and guide rails with contact surfaces accurately machined to form smooth joints.

.6 Provide inserts for placement in concrete form work or self-drilling expansion shell bolt anchors that will perform to four times rated pull-out load.

.7 Install hoistway door sills, frames and headers in hoistway walls. Grout sills in place. Set entrances in vertical alignment with car openings and aligned with plumb hoistway lines.

.8 Mount copy of master schematic wiring diagrams in framed glass or plastic enclosure on control room wall. If number of wiring drawings exceeds five (5), then mount drawings protected with clear plastic on rack permanently attached to control room wall.

3.5 Storage

.1 Co-ordinate delivery and storage of materials with General Contractor.

3.6 Coordination

.1 Coordinate work with the work of the other trades on the job site. Plan work so as not to hinder other work not included in this contract but which must be carried out at the same time and location. In instances of conflict with other trades, make substantial attempt to co-operate before notifying Owner’s representative of conflict.

.2 Expect to have work interrupted or suspended from time to time because of work which must be performed at the same time by another Sub-contractor. Mutually coordinate with the other Sub-contractor.

3.7 Field Quality Control

.1 Perform and meet tests required by CAN/CSA-B44 Safety Code for Elevators. Supply instruments and carry out these and other tests specified herein.

.2 Provide 2 days written notice to Consultant of date and time of tests.

.3 Have a copy of the Specifications on site and available to the installation mechanic.

.4 Provide Consultant with copy of all speeds and current readings taken at the time of the Provincial regulatory agency inspection.

3.8 Cleaning

.1 Completely remove protective coverings from finished surfaces and components.

.2 Maintain clean work areas and running equipment through the duration of the project.

.3 Provide cleaning throughout construction per General Contractor requirements. Including regular cleaning of hoistways and machine spaces.

.4 Provide one (1) final cleaning of all equipment, elevator related spaces and work areas prior to final completion of project. Co-ordinate final cleaning with the General Contractor.

3.9 Painting

.1 Paint the following equipment in the hoistway:

.1 Car tops and crossheads.

.2 Rails and strut angles and fascia plates.

**.3** Outline of refuge space on the car top.

.4 Pit equipment, including pit floor and 3 feet high on the pit wall.

.2 At the end of the project, touch-up any equipment to provide finished look free of scratches and other blemishes.

.3 Use paint materials listed on the CGSB qualified products list only.

.4 Paint materials for each coating formulae to be products of a single manufacturer.

.5 Prepare masonry, stucco and concrete surfaces to CGSB 85-GP-31M.

.6 Prepare concrete floors to CGSB 85-GP-32M.

.7 For concrete floors apply:

.1 One coat enamel CGSB 1-GP-66M reduced by addition of 1 part CGSB 1-GP-70M thinner to eight parts enamel.

.2 One coat enamel CGSB 1-GP-66M.

3.10 Hoistway Projections and Fascia

.1 Provide bevelling for projections or recesses shown on Architectural drawings in hoistway.

.2 Provide fascia required in hoistway by arrangement shown on Architectural drawings.

3.11 Burning Torches

.1 Do not employ burning torches in the work. Work with burnt-out holes will be rejected.

3.12 Technical Presentation

.1 Provide the services of a mechanic or adjustor who has worked on the project and is thoroughly familiar with the elevator control system and its operation to provide technical training to designated building authorities.

.2 Allow at least 1 day for this training. Training session to cover but not be limited to the following features:

.3 Emergency power operation and emergency recall operation Phase I and Phase II including duplicate switches.

.4 Independent service operation.

.5 Remote video monitoring system.

.6 Voice communication system operation.

.7 Any special features provided on the elevators.

.8 Provide when requested by the Engineer a hard copy of a condensed version of the elevator operational features.

.9 The Elevator Contractor is to provide all information to the Engineer that is required for the safe and efficient maintenance of the elevator equipment, including any solid state equipment or devices supplied under these specifications. The supplier is not to refuse any information, or the supply of parts, at fair market value, that is required by the Building Maintenance Contractor.

3.13 Field Testing and Commissioning

.1 Furnish competent personnel to assist the Engineer during the inspection and testing of the systems should they be required.

.2 The inspections shall be carried out to ensure document compliance.

.3 Prior to Engineer's testing, the Elevator Contractor shall test all systems to ensure proper operation.

.4 Upon completion of each elevator provide all personnel and necessary testing equipment to perform the following:

.1 Test operating times to verify performance requirements.

.2 Test door operating equipment to verify performance requirements.

.3 Test the ride to verify performance requirements.

.4 Test the equipment under full load and no load to verify speed variation performance requirements.

.5 Perform all electrical readings and complete technical data forms required by the specifications.

.5 Upon completion of the group of elevators, furnish technicians, adjusters or engineers fully trained in the equipment installed to test all operating systems included but not limited to, emergency power operation, special emergency service and operation of the group control system to verify the specification requirements.

.6 Attend at job site meetings pertaining to the Work.

.7 After Provincial inspection of each elevator and before turn-over for customer use, test each elevator in simulated automatic operation without passenger access.

.1 Test for three (3) consecutive hours with no load operating from floor to floor, with or without door operation.

.2 Test for three (3) consecutive hours with 100% load operating from floor to floor, with or without door operation.

.3 Test for three (3) consecutive hours operating from floor to floor with door operation. Provide barricades and signage to indicate that an elevator test is in progress.

.8 Before turn-over for customer use, test elevators as following:

.1 Running current in up direction with 42% car load.
.2 Running current in down direction with 42% car load.
.3 Governor overspeed setting.
.4 Safety trip setting.
.5 Door timings and dwell settings.
.6 Operating speed up and down.

.7 Door close force.
.8 Door detector interrupt setting.

.9 During warranty maintenance period closely monitor equipment for malfunctions and track reliability. Achieve a reliability rate of less than 0.6 malfunctions per elevator per month. Not achieving a reliability rate of 1.0 malfunction per elevator per month during the three month period preceding the expiration of the warranty maintenance period will extend the warranty maintenance, including full parts and labour, on the malfunctioning elevator(s) only until the (moving window) 90 day reliability target has been achieved.

.10 Upon completion of the project, arrange with the Engineer to provide a Technical Seminar and demonstration for the Building Operation's staff. The seminar, in both official languages, shall include a review of all documentation, operation of equipment and demonstration of special features. Allow a minimum of eight (8) hours for the technical seminar.

Table 1- Commissioning Data to Be Submitted by Contractor for Each Elevator

| PARAMETER | MEASURED |
|---|---|
| Car speed UP (fpm) | |
| Car speed DOWN (fpm) | |
| Brake to Brake UP (sec) | |
| Brake to Brake DOWN (sec) | |
| Running current full load UP (amp) | |
| Running current no load DOWN (amp) | |
| Running current balanced load UP (amps) | |
| Running current balanced load DOWN (amps) | |
| Door open (sec) | |
| Door close (sec) | |
| Car call dwell (sec) | |
| Hall call dwell (sec) | |
| Governor pull through (pounds) | |
| Governor overspeed switch mechanical (fpm) | |
| Governor overspeed switch electrical (fpm) | |
| Governor overspeed switch mechanical (fpm) | |
| Safety trip speed (fpm) | |
| Door stall force (pounds) | |
| Door timeout (sec) | |

Table 2 – Fire Signal Verification to be Submitted by Elevator Contractor

| | |
|---|---|
| **Recall Test Date:** | |
| **Elevator Contractor:** | |
| **Fire Alarm Testing Contractor:** | |
| **Test Performed By:** | |
| **Signature:** | |

| DEVICES ACTIVATED | B44 CODE REQUIREMENT | B44 CODE COMPLIANT |
|---|---|---|
| Hoistway Detector | All cars in the hoistway returned to the designated level with fire hats flashing inside the car. | YES / NO |
| Machine/Control Room Detector | All cars returned to the designated level with fire hats flashing inside the car. | YES / NO |
| General Fire Alarm Activation Devices from Elevator Lobbies | All cars returned to the designated level. Fire hats in cars stay illuminated but did not flash | YES / NO |
| Dedicated Detector at Designated Level | All cars returned to the alternate floor. Fire hats in cars stay illuminated but did not flash. | YES / NO |
| Recall Switch at the Main Lobby and Remote Switch (if applicable) | Indicator light Illuminated on automatic or manual recall. | YES / NO |