METROLINX

# Elevator

Specification 14 20 06

Revision 01
Date: March 2023

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Metrolinx,

an Agency of the Government of Ontario

# Amendment Record Sheet

| Amendment in Clause No. | Date of Amendment | Description of Changes |
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| Formatting | Mar. 2023 | Reformatted Specification Document |
| Specification Reference Number | Mar. 2023 | Specification number updated from 220152 to 14 20 06 as per NMS |
| 2.1.2 | Mar. 2023 | Clarification of elevator hoistway enclosure fire rating equipment |

**LIST OF CONTENT**

## 1. 14200 GENERAL

### 1.1. GENERAL REQUIREMENT

1.1.1. Scope

a) Provide an elevator as specified in Section 14230 MRL (Machine-Room-Less) Elevator.

b) Provide maintenance as specified in Section 14900 Maintenance for a period of twenty-four months subsequent to the date of the Final Certificate of Completion and including

1) Minimum monthly maintenance inspections

2) Twenty-four-hour call-back service for equipment stoppage or malfunction at all times at no additional cost.

1.1.2. Maintenance extended term

a) Provide full maintenance of the equipment for the time period prescribed in the Contract Documents.

b) Provide this service at a flat monthly price without escalation.

c) Provide this service in conformity with the maintenance Section of the Specifications.

1.1.3. Definitions of the terms

a) For the purposes of this document the following definitions will apply:

1) The term “Owner”, as used herein, refers to Metrolinx/GO Transit

2) The term "Architect", as used herein, refers to as defined in the Contract Documents.

3) The term "consultant", "elevator consulting engineer", "consulting engineer" or "engineer", as used herein, refers to any person, partners, firm or corporation having a contract with the Owner (to provide consulting services).

4) The term "subcontractor", as used herein, refers to any person, partners, firm or corporation having a contract with the contractor to furnish labour and materials for the execution of the work herein described.

5) The term "subcontractor", as used herein, refers to any person, partners, firm or corporation having a contract with the contractor to furnish labour and materials for the execution of the work herein described.

6) The term "inspecting authorities", as used herein, refers to authorized agents of governments and of insurance groups which are charged with the responsibility of carrying out periodic inspections and tests on vertical transportation equipment.

7) The term "provide", as used herein, means to supply and install new equipment.

8) All terms in the specifications that are not otherwise defined shall have the definitions as given in the latest edition CSA B44 code for elevators, dumbwaiters, escalators and moving walks.

1.1.4. Reference standards

a) Perform work to the following minimum standards, whichever is more stringent:

1) GO Transit Design Requirements Manual (DRM).

2) ASME A17.1-2010/CSA-B44-10 Safety Code for Elevators and Escalators or, latest edition.

3) CSA C22. No.77 Motors with Inherent Overheating Protection or, latest edition.

4) CSA C22.2 No. 141 Unit Equipment for Emergency Lighting or, latest edition.

5) Technical Standards and Safety Act 2000, Ontario Regulation 209/01 and Ontario Regulation 223/01 or, latest edition.

6) TSSA Code Adoption Document Amendment 261-13, latest amendment or, latest edition.

7) C22.1 Canadian Electrical Code, particularly Section 38 or, latest edition.

8) O. Reg. 368/13 under the Building Code Act or, latest edition.

9) CSA B651 Barrier-Free Design Guidelines or, latest edition.

10) Canada Labour Code, Part 2, Occupational Safety and Health Regulations including Section 13.13 or, latest edition.

11) Occupational Health and Safety Act including Section 109 of Ontario Regulation 213/91 or, latest edition.

12) CSA Z432-04 Safeguarding of Machinery or latest edition.

13) TSSA document: Elevator Machine Room Equipment Guarding - Best Practices or, latest edition.

14) French Language Services Act (FLSA) latest edition.

b) Where possible, supply equipment and do work in accordance with the American Public Transportation Association standard APTA RT-FS-008-03 or, latest edition.

1.1.5. Bilingual markings

a) Provide text of signage and markings visible to the public in both French and English.

b) Provide internationally recognized icons wherever possible (i.e. no smoking).

1.1.6. Codes and ordinances

a) Supply equipment and do work in accordance with building codes, by-laws, regulations and requirements of the local, provincial and federal authorities in effect at the time of the execution of the work.

b) Supply equipment and do work in accordance with the Code, and any other code which may govern the requirements of the installation.

c) Provide labour and material, where or not that may be necessary to provide an installation conforming to the applicable codes and regulations.

d) Comply with the requirements of the Occupational Health and Safety Act and Workplace Hazardous Materials Information System (WHMIS) regarding employee safety, use, handling, storage and disposal of hazardous materials.

e) All welding of elevator components shall be done by a CWB certified company according to CSA Standards W47.1 and W59.

f) Prior to submission of the proposal and throughout the duration of work, give prompt notification in writing of any regulations or requirements known to be in process which might affect the acceptability of the work.

g) If changes in codes or regulations result in extra costs, those taking effect subsequent to the date of proposal submission shall be treated as an extra to the contract.

1.1.7. Drawing and sample submittals

a) Drawing and sample submittals are required for exposed finishes and fixtures.

b) Submit for review and samples of metals, glass, paint colours, plastic laminates and finishes, of 200 mm (8") by 300 mm (12") approximate size, properly identified as to project, location and material

c) Submit for review, as a minimum, the following.

1) General arrangements.

2) Details of areas where the work joins the work of other trades;

3) Machine room layouts showing the location of the equipment;

4) Hoistway layouts showing the location of the equipment, car platform dimensions, cab interior dimensions and net inside cab area;

5) Hoistway sections showing overhead, pit equipment, car and frame and entrances;

6) Cab details including the cab shell, platform, interior panels, ceiling, entrance, lighting and finishes;

7) Details of control panels such as central control consoles or fire control panels showing the layout and detailing the design of switches and indicator lights;

8) Details of intercom system station types detailing the controls;

9) Details of any display devices complete with examples of proposed displays, symbols and layout;

10) Fixture brochures.

d) Show on the general arrangement or separately, details of frames, doors, sills and supports, lanterns and gongs, including views showing the relationship of hall stations, lanterns and entrances.

e) Reviews do not include the checking of measurements and do not imply approval of variations from the specifications.

1.1.8. Certificates of inspection

a) Obtain and pay for certificates of approval and all other necessary permits and inspections.

b) Prior to commissioning, arrange for and pay for a safety inspection of the equipment by a government authority or, if that is not available, by a recognized independent private professional inspection organization.

c) As a minimum ensure that this inspection includes:

1) Full load overspeed car safety tests if car safeties are provided;

2) Empty car overspeed counterweight safety tests if counterweight safeties are provided;

3) Pressure tests for hydraulic elevators;

4) Full load full speed car buffer tests if oil buffers are provided;

5) Empty car full speed counterweight buffer tests if counterweight oil buffers are provided;

6) Full load full speed down direction brake tests if a traction machine is provided;

7) Electrical safety circuit check;

8) Door pressure tests;

9) Tests of any other safety devices.

d) Submit, prior to commissioning inspection, the approved safety inspection report.

e) Should more than one inspection for a licence or approval be required due to deficient work by others give sufficient advance notice of such deficient work to allow the Work to be completed prior to the time of the subsequent inspection.

f) If sufficient advance notice of such deficient work has not been given, assume the cost of the additional inspections.

1.1.9. Conduits and raceways

a) Provide conduits and raceways in accordance with the GO Transit Design Requirements Manual for Conduit and Raceways.

1.1.10. Coordination with other trades

a) Where the work joins another trade, provide drawings showing the actual dimensions and the method of joining the work to the work of the other trade and information such as anchors, templates and details for cast-ins.

b) Do not place the equipment in operation for the Owner until the work by other trades as listed herein has been completed.

1.1.11. Corrosion resistance

a) Provide equipment as follows:

1) Manufacture gibs and retainers from aluminium or stainless steel.

2) Provide galvanized or bituminous-protected sill support steel.

3) Provide galvanized or stainless steel apron plate and fascia in hoistway.

4) Electrically isolate all dissimilar metals in the construction of the elevator.

5) Provide hollow, two skin landing doors. Clad hoistway doors on both sides and on top edge with stainless steel and minimize edges and crevices that could retain water.

6) Do not employ water absorbing materials such as untreated plywood or felt in the construction of the elevator car, cab or within the elevator hoistway.

7) Provide a waterproof cover over landing door equipment at each floor.

8) Locate conduit or raceways a minimum of 350 mm above the pit floor.

9) Materials and their components, such as fastening devices, shall be of the same material or be provided with a protective coating or cover to ensure corrosion and deterioration does not occur. All materials shall also take into consideration safety, such as the use of non-slip flooring and the selection of non-toxic materials. They shall, as much as possible, be locally sourced or be a certified eco-friendly product.

1.1.12. Defective work and non-performance

a) The Owner will give reasonable notice in writing prior to taking action with respect to defective work and non-performance unless the defective work or non-performance prejudice the safety of people or the installation

1.1.13. Electrical diagrams

a) Supply wiring diagrams and data as required for the execution of the Work including schematics for speed control, dispatching system, interfaces, printed circuit boards.

b) Incorporate, as part of the schematic diagrams, a reference index ('road map') giving the location of electrical components and wiring interconnections for relay coils, relay contacts, field equipment, integrated circuits and other such devices, so that the position on the schematics of any of these items can be readily determined.

c) If changes are subsequently made to the wiring or control, supply an additional two sets of marked-up prints, marked-up set of plastic coated schematics mounted on a rack in the machine room and an additional PDF copy of marled-up prints of the schematics and field wiring diagrams showing the changes in red.

1.1.14. Environmental considerations

a) Where possible, use biodegradable oil in applications.

b) Where practicable recycle material replaced in the course of the work.

c) Provide a list of materials to be removed from site and their proposed recycling or disposal location for approval prior to commencing work.

d) Where practicable provide new materials manufactured by methods that do not adversely affect the environment by, for example, generating residual deposits of heavy elements and greenhouse gases.

e) Use materials on site, such as low VOC (Volatile Organic Compound) adhesives and paint, that will not negatively affect the in-building environment.

f) Use only adhesives that comply with the requirements of SCAQMD Rule #1168.

1.1.15. Equipment moving

a) Provide floor protection and bracing so that the equipment moving causes no damage to the building

1.1.16. Existing conditions

a) Provide additional material and labour necessary to modify the equipment to suit the existing site conditions, in order to complete the Work and to obtain licenses and approvals.

1.1.17. Finishes: stainless steel

a) Provide, unless otherwise indicated in the Specifications or Drawings, stainless steel grade 316 or better for cab interior finishes.

b) Provide, unless otherwise indicated in the Specifications or Drawings, stainless steel number four finish for visible natural metal finishes.

c) Arrange, unless otherwise indicated in the Specifications or Drawings, that the brush or grain direction of finishes of visible natural metals be in the direction of the longer surface dimension.

1.1.18. Finishes: steel

a) Provide hot dipped galvanized sheet steel where formed or sheet steel is used for doors, cabs and other components.

b) Finish other steel (except for machined surfaces) with two coats of rust inhibiting paint applied in the factory.

c) Supply to the installation personnel 8 liters of the rust inhibiting paint to be used for touch-up after installation.

1.1.19. Generic maintenance

a) Arrange that the equipment can be maintained and adjusted by any competent elevator company without the use of proprietary tools, information or equipment.

b) If proprietary tools, information or equipment are required, provide them to the Owner (these shall become the property of the Owner).

c) If required, provide a customer tool or such similar device to carry out full load overspeed safety tests or other similar tests (for temporarily bypassing the appropriate circuits).

d) Offer to the Owner updates to the system software, from time to time as may be required to keep it current.

e) Offer these updates to the Owner at standard market prices such as those charged to United States government agencies.

f) Do not incorporate any running time, cycle counters or trip counters that would cause the equipment to shut down or alter its operation in any way.

1.1.20. Hoistway protection

a) Provide, maintain and, after the Work is complete, remove any partitions required in the hoistway.

b) Provide, maintain and, after the Work is complete, remove protective hoarding required at openings into the hoistway.

c) Submit the design and finish of the protective hoarding for review.

1.1.21. Inspection and acceptance

a) When completed, carry out an inspection, witnessed by the Consultant, to see that the work is in compliance with the Specifications.

b) Furnish a team of competent personnel, for one working day per unit, to assist in making these inspections.

c) If the results of these inspections do not meet the requirements of the Specifications, make the appropriate corrections, and provide, as set out above, for another inspection.

d) Give sufficient advance notice in writing so that the Consultant can arrange for his representative to witness these inspections.

1.1.22. Maintenance and operation manual

a) Supply three copies of the manual, in English bound in separate three 'D' ring binders meant for 212 mm (8.5") by 275 mm (11") size paper. Binders must not exceed 75 mm (3") thick or be more than 2/3 full.

b) Supply two digital copies of the manual on medium acceptable to the Owner, one version in PDF and one version in an editable format.

c) Incorporate in the manual:

1) A description of the controller user interface, fault and error codes, troubleshooting and diagnostic procedures, methods of use and the adjustment of programmable parameters together with their settings at the time of final adjustment.

2) A description of special features, dispatching sequences, and such items as intercom systems and security systems.

3) Set out in step by step form the operation for special features such as Firefighters' Emergency Operation, Independent service and Emergency Power service.

4) As built diagrams and drawings of operating panels (e.g. car panels, central control consoles) with descriptions of the function of switches and indicators.

5) Replacement parts list.

6) All wiring diagrams.

7) A list of recommended spare parts to be maintained on site to ensure optimum efficiency.

8) The equipment specific Maintenance Control Program.

1.1.23. Materials and workmanship

a) Provide all new materials and equipment.

b) Install equipment in a neat, accurate, workmanlike manner.

1.1.24. Materials validity check

a) Perform a general materials validity check of components and fastenings that under failure might create a dangerous situation, including, but not limited to, sheave bolts, welds, car slings, gears, worm shafts, sheave shafts, brakes, safeties, guide rails, car platform and any other retained component.

1.1.25. Measurements

a) In the execution of the Work, verify all dimensions with the actual conditions in order to do a perfect job.

1.1.26. Operation by persons with physical disabilities

a) Ensure that controls and fixtures comply with and/or exceed requirements of Appendix E of the Code, AODA and FLSA/

1.1.27. Operating environment

a) Provide machine and control room material and equipment to function normally within the requirements of the specifications when the ambient temperature is between 3.5 and 36 °C(38 and 97 °F).

b) Provide hoistway material and equipment to function normally within the requirements of the specifications when the ambient temperature is between -25 and 40.0 °C (-13 and 104 °F).

c) Provide material and equipment to function normally and within the requirements of the specifications when the ambient relative humidity is between 25% and 100%.

d) Provide material and equipment to function normally and within the requirements of the specifications when the supply voltage is within minus 15% and plus 10% of the nominal voltage and the frequency is within 5% of the nominal frequency.

1.1.28. Painting

a) Ensure that hoistway equipment, except for machined surfaces and non-rusting surfaces, is protected with two coats of a rust inhibiting primer of a neutral colour, each coat of 25 micron minimum thickness.

1.1.29. Parts and support

a) Supply parts, purchasable by any party, for a period of fifteen years subsequent to Substantial Performance of the project, at then prevailing prices.

b) Where purchased components are used, ensure that the original manufacturer's name and component designation are clearly marked on the part or in the parts catalogue.

c) Provide engineering support and technician training to any service contractor at the same rates as charged to the original equipment manufacturer.

1.1.30. Patents

a) Hold and save the Owner and its officers, agents, servants and employees harmless from liability due to patent or copyright infringement arising from the use of, in the performance of the work or in the completed installation, any invention, process, article, or appliance.

1.1.31. Personnel

a) Supervise your personnel so that they present a neat appearance and their movement in the building is within the requirements of their work.

b) Provide uniforms and photo identification for personnel.

c) The Owner reserves the right to reject or refuse access to personnel or contractors at its sole discretion.

d) Assign and maintain a dedicated service representative to the work, this representative to be responsible for liaison with the Owner and the Consultant.

e) Assign and maintain a dedicated service supervisor to the work, this supervisor to be responsible for technical communications with the Owner and the

Consultant.

1.1.32. Pre-inspection check list

a) Upon completion review each page of the Specifications and initial each page at the bottom left to indicate that the work has been completed in compliance with the Specifications.

b) Submit this initialled copy of the Specifications to the consultant prior to requesting an inspection by the Consultant.

1.1.33. Preliminary information

a) Submit, within 30 working days after awarding of contract, the information and details, including reactions, power requirements, ventilation requirements, cutouts, access requirements, light and outlet locations, quantity, location and size of external wires required to inter-connect the equipment, and all other information required to complete the work to be performed by others in conjunction with the installation of the equipment.

1.1.34. Protection of the Work and property

a) Maintain protection of the Work and protect the Owner's property from injury or loss arising out of the execution of this contract.

b) Make good any injury or loss caused by your agents or employees.

c) Take all necessary precautions to ensure that the Work is done in a manner that does not endanger any person.

1.1.35. Removal of rubbish

a) Remove rubbish, keep the building and premises clean during the progress of the Work, and leave the premises at completion in perfect condition as far as the Work under the specifications is concerned.

1.1.36. Simulation report

a) Complete a computer simulation which models the elevator system including the expected elevator system demand and the call response efficiency.

b) Complete a computer simulation of the various possible configurations.

c) Provide a computer simulation report which supports the equipment selection and outlines the Average Waiting Time for each configuration.

1.1.37. Singular and plural

a) In all cases singular and plural shall be interchangeable and shall be applied as required to meet the sense and intent of the Specifications.

b) Where the singular is employed it shall be interpreted as necessary, unless otherwise indicated, to apply to all equipment and devices required to produce a complete installation.

1.1.38. Special tools and access codes

a) If any special tools (i.e. tools that are not readily purchased from a hardware supplier) are used to maintain or adjust the equipment or are required for any aspect of the work on the equipment, list these tools with details on the proposal form and provide such tools to the Owner prior to Substantial Performance.

b) If any access codes are used to maintain or adjust the equipment or are required for any aspect of the work on the equipment (including the reading and resetting of error codes and logs) list these access codes with details on the proposal form and provide such access codes to the Owner prior to Substantial Performance.

c) Do not change the access codes without the written consent of the Owner and, when changed, provide to the Owner the new access codes.

1.1.39. Subcontractors

a) Bind subcontractors to all applicable portions of the Specifications.

b) The contractor shall be responsible for all actions and all work performed by its subcontractors to the same extent as the contractor is itself responsible under the Specifications.

1.1.40. Submission of proposal

a) Submission of a proposal will be considered presumptive evidence that the proposer is conversant with local facilities and conditions, requirements of the Contract Documents and of pertinent provincial and local codes, state of

labour and material markets, and in the proposal has made due allowance for all contingencies.

1.1.41. System log error codes

a) Provide to the Owner a PDF document listing system error codes complete with a full English description of the meaning of each code.

b) Incorporate as part of the document a description of the procedure for accessing and resetting the codes and demonstrate this procedure to the Consultant.

1.1.42. Test data form: traction

a) After completion of the Work, and prior to the inspection by the Consultant, submit a test data form certifying that the unit is complete and ready for inspection.

b) Arrange that this form be signed by the person responsible for the performance of the Work.

c) Include a check list of the items in the specifications as well as other performance data such as door times, operating times, brake-to-brake times, starting, running, stopping currents and voltages, slowdown and limit switch settings, governor settings, and, in general, settings of any adjustable devices.

d) List on this form safety devices, together with their settings and indicate whether they have been checked and adjusted.

e) Submit a soft copy of the data form in PDF (Acrobat Reader) format.

1.1.43. Trade marks

a) Do not apply trade marks visible to the general public on any piece of equipment.

1.1.44. Unit inspection by the consultant

a) Advise the Consultant in writing two weeks prior to the completion of a unit so as to arrange an inspection by the Consultant at a mutually convenient time.

b) Assist the Consultant in the performance of this inspection to verify that performance figures, workmanship and equipment furnished are in

compliance with the Specifications.

c) Provide the necessary test weights to carry out full load tests and a team of competent persons to assist the Consultant in making the necessary tests and inspections.

1.1.45. Vandal resistant design

a) Provide cab interior finishes that can be readily removed and replaced or refinished.

b) Where specified, provide a rigidized stainless steel cab interior.

c) Provide fixtures that can be readily removed and replaced or refinished.

d) Supply vandal resistant fixtures.

e) Provide concealed stainless steel fasteners with specially designed spanner head or similar type screws (adhesive fastenings are not acceptable).

1.1.46. Withdrawal or rejection of proposals

a) The Owner reserves the right to reject any or all proposals or to waive any conditions.

b) Proposals may not be withdrawn until sixty days after the scheduled date for the receipt of the proposals.

1.1.47. Work completion and maintenance turnover

a) At the completion of the work and prior to turning over the elevator for public use:

1) So as to ensure a smooth and harmonious turnover, arrange a walkthrough of the installation, this walkthrough to be carried out jointly by your new construction/modernization supervisor and the elevator maintenance provider’s maintenance supervisor.

2) Provide to the Owner and Consultant the Test Data Forms signed by both your new construction/modernization supervisor and the elevator maintenance provider's supervisor together with a signed confirmation that the work has been checked by both parties and both parties are in agreement that the work has been completed satisfactorily and poses no problems for ongoing maintenance.

1.1.48. Work site protection

a) Provide, maintain and, after the work is complete, remove protective hoarding around the work site.

b) Arrange the protective hoarding so as to prevent public access to the work site.

1.1.49. Work by other trades

a) In the event that work by other trades is required and work by others as set out herein is in conflict with or inadequate for your equipment or design, so state on the proposal form with all necessary details.

b) If no exceptions are noted on the proposal form, pay the costs of all modifications necessary to suit your equipment and design.

1.1.50. Work under division 3

a) Work required in conjunction with the installation and included in Division 3 (Concrete) will consist of the following items:

1) Properly framed and enclosed hoistways with a variation from nominal hoistway dimensions of not more than ±25 mm (1.0");

2) A floor surface at each hoistway entrance arranged to slope away from the installed height of the entrance sill;

3) Supports for the sill support angles, flush with the inside hoistway wall, a minimum of 150 mm (6.0") in depth, capable of sustaining a minimum unit load equivalent to the capacity of the elevator;

4) Grouting under entrance sills;

5) Suitable pits with drains having a positive means to prevent water, gases and odours from entering the hoistway (sump pump to be located remote from the pit);

6) Pockets, as required, to permit fastening of rail brackets to building structure - pockets to be filled after brackets installed;

7) For the MRL elevators a fire-resistant control space;

8) Gross openings for hoistway entrances exceeding the clear door dimensions by 250 mm (10") on each side and above.

9) A structure designed for the elevator reactions.

1.1.51. Work under division 5

a) Work required in conjunction with the installation and included in Division 5 (Metals) will consist of the following items:

1) In the pit, an access door under lock and key or a fixed metal ladder for access to the pit;

2) For the machine or control rooms, a self-locking and self-closing access door.

3) Hoisting beam in the hoistway located as shown on the Drawings, and capable of sustaining a 3400 kg (7500 pounds) load;

4) Intermediate beams for rail support or other methods of support for the rails for the full extent of the hoistway (between the pit floor and the overhead slab) where the distance between bracket support points exceeds 3.5 metres (11'6");

5) Where applicable, divider beams between adjacent hoistways.

1.1.52. Work under division 7

a) Work required in conjunction with the installation and included in Division 7 (Thermal and Moisture Protection) will consist of the following items:

1) Waterproofing of elevator pits

1.1.53. Work under division 9

a) Work required in conjunction with the installation and included in Division 9 (Finishes) will consist of the following items:

1) For the MRL elevators, initial painting of the control space floor;

2) For the MRL elevators, sealing of the control space ceilings and walls to reduce dust.

3) Tile floor for the elevator cab.

1.1.54. Work under division 15

a) Work required in conjunction with the installation and included in division 15 (Mechanical) will consist of the following items:

1) Elevator pit drains with connection to the building drainage system, drains to have a capacity of 11.3 m3/h (3,000 gal/h) per elevator having a positive means to prevent water, gases and odours from entering the hoistway.

2) A cover for the floor drains secured to and level with the pit floor.

3) For the MRL elevators, heating and cooling for the control space in order to maintain continuously (i.e. 24 hours a day) a temperature of greater than 13 °C and less than 29 °C based on the heat generated in the control space by the elevator;

4) For the MRL elevators, heating and cooling for the hoistways in order to maintain continuously (i.e. 24 hours a day) a temperature of greater than 13 °C and less than 29 °C based on the heat generated in the hoistways by the elevator;

5) Any sprinkler systems employing water, if installed in the machine rooms, controls rooms or hoistway, to be arranged to operate at a higher temperature (approximately 20% higher) than the fire alarm sensors;

1.1.55. Work under division 16

a) Work required in conjunction with the installation and included in Division 16 (Electrical) will consist of the following items:

1) Electric power during erection, for illumination, operations of tools and hoist, starting, testing and adjusting;

2) A main line disconnect, located in view of the elevator controller near the access point to the machine or control room, with correctly rated fuses or circuit breakers, lockable in the off position;

3) An isolated ground in the machine or control room.

4) Wiring between the disconnect and the elevator power input point (elevator transformer or controller).

5) Protection of the feeder cables.

6) An auxiliary contact in the main line disconnect (if the traction elevator emergency power device alternative price is selected), the contact to be positively opened mechanically and not dependent on springs for opening;

7) A power supply capable of supplying for the elevator the required starting and running currents and capable of absorbing regenerated power;

8) An emergency power supply sufficient to start and run one elevator per group at a time at full rated speed and capacity, together with necessary means for absorbing regenerated energy:

   i) The emergency power will be provided on the same lines and the same disconnect as the normal power;
   ii) The emergency power unit will have means for switching between the normal power supply and the emergency power supply including either a centre-off delay position or means of synchronising the power on changeover so as to prevent surges on the electrical supply to the vertical transportation equipment;
   iii) Four wires will be provided to connect two auxiliary contacts of the emergency power transfer switch to an elevator controller of each group;
   iv) One of these contacts will be so arranged that on normal power the two wires associated with it make a closed circuit and on emergency power present an open circuit; the other contact will be so arranged that the two wires associated with it present a closed circuit except for an adjustable period of time (a 5 to 50 seconds adjustment, set initially at 15 seconds) prior to power supply transfer in either direction - from normal to emergency or from emergency to normal;

v) The cab lights to be so arranged as to be functional on emergency power.

9) In the machine room and control space, one 15 amp 120 volt, single phase circuit breaker for the elevator, located adjacent to the lock side of the machine room door, to power cab ventilation and lighting equipment with the power for this circuit derived from the emergency power supply if available;

10) In the machine room or control space, one 15 A 120 V, single phase circuit breaker for each elevator, located adjacent to the lock side of the machine or control room door, to power the cab interior duplex GFCI receptacle.

11) In the machine room or control space, one 20 A 120 V, single phase circuit breaker for each elevator, located adjacent to the lock side of the machine or control room door, to power the cab air conditioning unit (if provided) with the power for this circuit derived from the emergency power supply if available.

12) For each elevator, a supply, complete with disconnect, in the machine or control room for the heat tracing system.

13) In the machine room and control space, LED lights, with guards, located in front of and behind the controller at approximately 2500 mm (8.0') from floor level and such additional LED lights as required to give a minimum illumination at floor level and within the controller of 200 lux with the light switch located adjacent to the lock side of the machine room door and the power for the lighting circuit derived from the emergency power supply if available;

14) In the machine rooms and in the control spaces, duplex GFCI receptacles mounted on the wall and spaced at approximately 5000 mm (16') intervals;

15) In the pit, protected LED lights, located clear of elevator equipment to give a minimum illumination at pit level of 160 lux with the light switch adjacent to the pit entrance and the power supply for the lighting circuit to be derived from the emergency power supply if available;

16) In the pit, duplex GFCI receptacles mounted on the wall, spaced at approximately 5000 mm (16') intervals and located clear of the elevator equipment;

17) In the hoistway, protected LED lights, located clear of elevator equipment to give a minimum illumination throughout the hoistway of 50 lux with the light switch adjacent to the hoistway entrance point and the power supply for the lighting circuit to be derived from the emergency power supply if available;

18) In the overhead, LED protected lights, located in front of and behind the machine and associated equipment and such additional LED lights as required to give a minimum of 200 lux on the equipment. The light switch to be located in the hoistway at the point of entry. The power for the lighting circuit to be derived from the emergency power supply if available.

19) In the overhead, duplex GFCI receptacles mounted on the wall and spaced at approximately 5000 mm (16') intervals)

20) Smoke detectors and heat detectors on the recall floor.

21) Smoke detectors and heat detectors on the alternate recall floor.

22) Smoke detectors and heat detectors on all other floors.

23) Smoke detectors and heat detectors at the top of the hoistway.

24) Smoke detectors and heat detectors in the pit.

25) Smoke detectors and heat detectors in the machine space.

26) Smoke detectors and heat detectors in the control space.

27) A connection from the smoke detectors and heat detectors on the recall floor to the elevator controller.

28) A connection from the smoke detectors and heat detectors on the alternate recall floor to the elevator controller.

29) A connection from the smoke detectors and heat detectors on all other floors to the elevator controller.

30) A connection from the smoke detectors and heat detectors at the top of the hoistway to the elevator controller.

31) A connection from the smoke detectors and heat detectors in the pit to the elevator controller.

32) A connection from the smoke detectors and heat detectors in the machine space to the elevator controller.

33) A connection from the smoke detectors and heat detectors in the control space to the elevator controller.

34) An active telephone line in the machine or control room (or CACF if one is provided).

35) A closed circuit camera system.

36) Conduit between the elevator hoistway, machine or control room and any remote equipment locations to be terminated outside the hoistway at the basement level at a junction box (provided by the elevator contractor).

37) Pulling of wire between the elevator hoistway, machine or control room and any remote equipment locations (wiring to be supplied by the Elevator Contractor).

## 2. SECTION 14230 MRL (MACHINEROOMLESS) ELEVATOR

### 2.1. GENERAL

2.1.1. General Requirements

a) Comply with Section 14200.

2.1.2. Scope

a) Provide a heavy-duty MRL (Machine-Room-Less) elevator(s), meant for a busy transit application with exposure to harsh elements, per the data table below:

| Elevators | | |
|---|---|---|
| Number of units | Per appendix | |
| Designation | Per appendix | |
| Application | Passenger | |
| Rated speed (m/s, fpm) | 1.02 minimum | 200 minimum |
| Capacity (kg, lb) | - | Per appendix |
| Motor power (kW, HP) | - | Per appendix |
| Operation | Simplex or group automatic | |
| Machine type | Gearless machine room-less traction | |

| | | |
|---|---|---|
| Machine location | In hoistway | |
| Drive type | VVVF | |
| Emergency brake | Provide | |
| Car governor | Provide | |
| Counterweight Governor | None | |
| Control system | Provide | |
| Front entrances | Provide | |
| Rear entrances | Provide | |
| Door type | Provide | |
| Hall sill | Nickel silver | |
| Car sill | Nickel silver | |
| Hoistway door fire resistance | Per OBC | |
| Entrance width (mm,") | - | Provide |
| Entrance height (mm, ") | - | Provide |
| Entrance markings | Provide | |
| Cab width | - | Per appendix |
| Cab depth | - | Per appendix |
| Clear cab height (mm, ") | 2440 | 96 |
| Car door restrictor | Provide | |
| Door safety retainers | Provide | |
| Entrance protection | Infrared multi-beam | |
| Door operator | Provide | |
| Interlocks | Provide | |
| Main car station | Per Metrolinx Standard Drawings | |
| Auxiliary car station | None | |
| Button type | Dupar US85 or approved equivalent | |
| Verbal annunciation | Provide | |
| Car position indicator | Digital in car station | |
| Cab emergency lighting | Provide in car station | |
| Cab communication | Hands-free telephone | |
| Car call security | None | |
| Hall call security | None | |
| Hall stations (typical) | Per Metrolinx Standard Drawings | |
| Hall stations (main floor) | Per Metrolinx Standard Drawings | |
| Cab ventilation | Fan | |
| Cab finishes | Provide | |
| Cab air conditioning | Provide | |
| Service cabinet | Provide | |
| Hall door finish (typical) | Stainless steel | |

| | |
|---|---|
| Hall door finish (main floor) | Stainless steel |
| Car door finish | Stainless steel |
| Hall lanterns | None |
| In-car lanterns | Provide |
| Hall position indicator | None |
| Lobby panel | None |
| CACF panel | None |
| Central control monitor | Provide |
| Car top inspection station | Provide |
| Load weighing device | Provide |
| Car guiding | Rollers |
| Counterweight guiding | Rollers |
| Guide rails | T-rail |
| Compensation | None |
| Emergency recall | Provide |
| Firefighter's operation | Provide |
| Emergency power | Provide |
| Car top railing | Provide |
| Equipment guarding | Provide |
| Operating time | Per appendix |

## 2.2. PRODUCTS

2.2.1. Central control: monitor system

a) Provide at the central control console an elevator monitoring system consisting of a video display, keyboard, computer, elevator system interface and appropriate software.

b) Arrange that the data can be accessed remotely via a web based application or program.

c) Monitor continuously the elevator operation and status including, but not limited to, position (with express zone position defined floor by floor), direction, car calls, hall calls, door open, door closed, door protective device actuation, running up, running down, load switch operation, safety circuits, security functions, independent service, emergency power functions, special emergency service functions.

d) Arrange that a safety related signal (e.g. alarm bell button or safety circuit interruption) generates a distinctive audible signal and a flashing display on the monitor, this signal and display to continue until a keyboard acknowledgement is made.

e) Provide a colour monitor video display terminal having a minimum picture size of 555 mm (22") measured on the diagonal and a minimum resolution of 1680 by 1050 pixels.

f) Arrange the system so that the status of project elevators is displayed at the same time in a general display with the ability to switch to a detailed presentation of a group and of an individual elevator.

g) Provide report functions for, as a minimum, the following:

1) Service interruptions;

2) Hall call registrations per floor in each direction and totals;

3) Hall call registration time per floor in each direction and averages;

4) Car call registrations per floor in each direction and totals;

5) Car call registration time per floor in each direction and averages;

6) Car load data;

7) Elevator performance times including door close times, door open times and operating times.

h) Arrange that the reports can be viewed on the screen and, on keyboard command, copied to a flash drive or other suitable media.

i) Arrange that the report periods can be chosen over a range of times varying from 5 minutes to one month.

j) Provide a keyboard to enter commands for selection of the various displays, for the generation of reports and other such directions as well as system commands (e.g. on/off independent service, return to lobby) so as to allow complete control of the elevator and group functions.

k) Provide means to disable and to enable service to any floor by keyboard entries in conjunction with programmable security codes.

l) Provide a hard disk arranged to store the data for a minimum period of one year.

m) Provide for the backup of data through a USB port to a memory stick.

n) Provide means to restore the data from the backup unit so as to allow review of the elevator operation and generation of reports from the backed-up data.

o) Provide means of communication using a local area network with the elevator system by all of the following means:

1) Hard wired RS-232 connections;

2) Hard-wired RS422 connections;

3) Wireless.

p) Supply wiring and devices as necessary to connect the monitor system to the elevator system.

q) If the connecting wiring requires conduit external to the elevator hoistways and machine rooms coordinate with and assist as necessary the trades executing this work (these other trades are responsible for the provision of the conduit and the pulling of the wiring supplied by the elevator contractor).

r) Provide, in conjunction with the video display terminal, a ‘mini’ conventional control console duplicating therein those functions relating to life safety such as fire and emergency power switches and indicators.

s) In the event of a conflict between the function settings as selected from the keyboard and the function settings as selected from the 'mini' conventional control console, arrange that the 'mini' conventional controls take priority.

t) Enclose the video display terminal, the keyboard and the 'mini' central control console in a single enclosure arranged to be integrated into and compatible with the building central control.

u) Arrange the equipment and associated cables to facilitate removal or easy access with the system operational for troubleshooting.

v) Connect all wiring to terminal blocks mounted on the panel.

w) Locate and identify these terminal blocks so that external wiring can be easily

connected to the terminals.

x) Provide standard, readily available hardware components.

y) Submit for review sample displays and reports.

z) Submit for review shop drawings showing the design and finish.

2.2.2. Speed regulation

a) Arrange the equipment to run full load up within 3.0 percent of the rated speed under, and under any other condition of loading, except the case of overload.

2.2.3. Dimensions

a) Provide equipment to suit the control room, hoistway, pit and overhead dimensions shown on the architectural drawings.

2.2.4. LEED

a) Provide a LEED rated installation or components where practical.

2.2.5. Machine: MRL (Machine-Room-Less)

a) Provide a machine of the single-wrap traction type including a permanent magnet AC motor, electromechanical brake, sheave shaft and traction sheave properly aligned.

b) Mount the machine at the top of the hoistway and provide all hardware and support beams for mounting.

c) Provide a support and mounting method approved by a Professional Engineer.

d) Provide a machine with a proven record, over a period of at least seven years, of satisfactory operation on other installations of the same speed, capacity and counterweighting.

e) Provide equipment which will deliver its rated output continuously with a temperature rise not to exceed 50 °C (120 °F).

f) Provide, as a minimum, Class B insulation.

g) Submit with the proposal the horsepower and torque ratings of the elevator motor.

h) Provide a traction sheave to suit the suspension means.

i) Provide a brake actuated switch to indicate to the control system the state of the brake: that is, lifted or applied.

j) Design and adjust the machine so that, when running at full speed, it vibrates no more than 0.025 mm (0.001") as measured at the motor end.

k) Arrange that the sound level in the hoistway at the machine location is not more than 60 dB during an elevator operating cycle, including brake lift and brake application.

l) Provide sound and vibration isolation pads of at least 37.5 mm (1.5") thickness arranged so that there is no solid contact between the machine and the building structure.

2.2.6. Hoist machine guarding

a) Provide a complete guard for each hoist machine to protect against potential pinch hazards.

b) Provide a removable machine guard such that regular maintenance procedures can be performed.

c) Where the status (in motion or stationary) of the lift machine cannot be visually determined as viewed from the disconnect switch, provide at the machine a manually opened and closed stop switch to prevent movement of the elevator.

2.2.7. Elevator suspension means

a) Provide elevator suspension means such that the addition of 50 per cent of the rated load to the car cab will cause no more than a 0.04 per cent elongation in the suspension means.

b) Where multiple suspension elements are used in parallel to share a load, ensure that the elements are all from one manufacturing run.

c) Provide sufficient removable counterweight buffer blocking to allow adjustment for suspension means stretch without requiring shortening of the

suspension means.

d) Where the suspension means is such that measurements of wear cannot be readily made, provide a method to indicate wear of the suspension means such as a marking stripe that will be exposed when replacement is required.

e) Provide suspension means with a minimum life of 10 years and submit a document certifying this.

2.2.8. Emergency machine dual brake

a) Provide an emergency braking device to prevent uncontrolled movement of the elevator.

b) Provide a device separate from and independent of the normal elevator stopping devices.

c) Provide a device combined with and integrated with the normal operating machine brake.

d) Arrange that the braking device applies if:

1) The elevator overspeeds;

2) The elevator moves away from the floor with the doors open.

e) Restrict the deceleration effected by the emergency braking device to between 25% and 75% of gravity.

f) Arrange the device to restrict the distance the elevator is allowed to move away from the floor with the doors open to less than 400 mm (16").

g) Arrange the device so that it is actuated at a sufficient distance from the buffer – relative to the speed of the elevator – so as to prevent the counterweight striking the buffer at a velocity in excess of the rated velocity of the buffer.

h) Provide a manually reset electrical switch arranged to disconnect power to the elevator motor and brake when the emergency braking device is actuated.

i) Provide a device capable of being applied for test purposes without damage to the device or to the other elevator equipment.

j) Arrange the device so that it can be reset and the elevator put back into

service only from the elevator machine room.

k) Arrange that the device and its component parts are readily accessible for maintenance.

l) After correctly adjusting the device, seal it with a numbered seal so as to prevent un-authorized re-adjustment.

2.2.9. Solid state motor drive: regenerative

a) Provide a four quadrant regenerative solid state drive to control the speed of the elevator.

b) Provide circuits to cause the elevator to regenerate power, under negative load conditions, to the building power supply with a minimum 0.95 power factor.

c) Provide a drive system to meet the EN12015 standards and the recommended guidelines of IEEE-519 for generated harmonics and power factor measured at the disconnect switch.

d) Provide pre-torquing.

e) Arrange that the system in responding to a unit step function does not overshoot by more than 21 percent.

f) Arrange that the error signal does not, in normal operation, exceed 2.5 percent.

g) Provide means to shut down the unit in the event that the error signal exceeds 5.0 percent.

h) Provide means to limit the increase in noise level during acceleration to less than 12 decibels (A scale) as measured in the centre of the machine room.

i) Provide electronic feedback circuits to limit the current through the motor and the solid state power devices.

j) Arrange that under low voltage conditions the unit does not exceed the current limits.

k) Provide safety circuits to prevent runaway in the event of closed loop feedback circuit failure.

l) Arrange these circuits so that:

1) With a partial or complete loss of the feedback signal the elevator will come to a stop before the governor jaws are tripped;

2) If the elevator is in the levelling zone with the door interlock circuit open, the elevator will come to a stop prior to leaving the levelling zone.

m) Test these circuits by opening the feedback circuit while the elevator is running at contract speed no load up and while the elevator is levelling into the floor no load up.

n) Provide means for dissipating the heat generated by solid state devices.

o) Provide safety circuits to shut down the unit in the event of overheating.

p) Design the equipment so that power loss or power fade (brownout) does not cause fuses to blow.

q) Provide means to protect the solid state power devices against surge currents.

r) Provide filters and circuits to reduce the line pollution so that the distortion generated by the solid state power device is within the following limits as measured at the disconnect switch:

1) The 5th harmonic voltage does not exceed 6 percent;

2) The 5th harmonic current does not exceed 20 percent;

3) The total harmonic voltage does not exceed 10 percent;

4) The total harmonic current does not exceed 25 percent;

5) Line voltage notching of duration greater than 1 millisecond is less than three per cent of the peak sine wave voltage measured from zero reference;

6) The notch depth is less than 10 per cent;

7) The notch duration is less than 2 milliseconds.

s) Provide filters and circuits to reduce the electromagnetic noise level at any frequency with the elevator running, to not more than 0.1 db above the ambient electromagnetic noise level (with the elevator stopped), as measured

in the centre of the machine room using a calibrated radio frequency receiver designed in accordance with CSA Standard C108.1.1 together with a calibrated rod or loop antenna.

t) Provide filters and circuits to reduce the electromagnetic noise level at 10 KHz with the elevator running, to not more than 0.01 db above the ambient electromagnetic noise level (with the elevator stopped), as measured in the centre of the machine room using a calibrated radio frequency receiver designed in accordance with CSA Standard C108.1.1 together with a calibrated rod or loop antenna.

u) Arrange the equipment so that any vibration generated is not transmitted directly to the building structure.

2.2.10. Speed control: regenerative

a) Provide a closed loop negative feedback control system.

b) Include in the system the following features:

1) A pattern generator to give a velocity input signal modified by position with constant peak acceleration and constant peak change of acceleration;

2) A digital or analog tachometer generator to provide a velocity feedback signal;

3) A digital transducer to provide a position feedback signal;

4) A current transformer to provide a current feedback signal.

c) Provide the following safety devices:

1) Means to stop the elevator in the event the error exceeds five percent of the signal;

2) Means to stop the elevator in the event the acceleration exceeds the normal acceleration by more than fifteen percent;

3) A circuit to cut off power in the event of excessive power module switching time;

4) Means to cut off power in the event of overheating of the solid state components;

5) A circuit to initiate a slowdown and stop at the next floor in the event of a disagreement between the position as derived from the digital transducer and the position as derived from the integration of the velocity feedback signal.

d) Arrange the response of the system so that the elapsed time between the detection of a fault and the cut off of power does not exceed 100 milliseconds.

e) Provide protective devices so arranged that any one fault will not cause risk of injury to the passengers.

f) Arrange that, if a fault occurs such that a subsequent fault could cause an unsafe condition, the fault will be detected and the elevator shut down.

g) Provide invertors and associated controls arranged to return to the electrical supply system the power produced by the machine under negative loads.

h) Arrange the control system so that the power factor is not less than 96%.

2.2.11. Position transducer

a) Provide a position transducer device to transmit to the control system the position of the elevator.

b) Arrange that the device transmit a minimum of 10 counts per 25 mm (1") of travel.

c) Provide a device having an overall precision within ±2.5 mm (±0.1").

d) Arrange the elevator controls so that the output from this device is read at least every 5 ms.

e) Transmit the signal from this device either in serial format using a standard protocol (e.g, CAN) or in parallel format using low impedance (less than 10 kilohms) inputs.

f) If the transducer is a relative (pulse counter) type rather than an absolute encoder type:

g) Provide gray encoding so as to indicate the direction of movement of the car

and to offset 'false' counts caused by vibration;

h) In the event of a counter error reset the position with an accuracy within ±2.5 mm (±0.1") by returning the car at low speed to a fixed point in the hoistway.

2.2.12. Brake spring

a) After the brake spring is adjusted for correct operation and prior to the performance of safety tests and checks by the inspecting authorities, provide means to positively define the length of the brake spring and minimize possibility of future incorrect adjustment using one of the following methods:

1) Measure the length of the brake spring and mark this length on a tag permanently affixed to the machine;

2) Measure the number of exposed threads on the brake spring rod and mark this number on a tag permanently affixed to the machine.

b) Record the details of the brake setting on the test data sheet.

2.2.13. Governor: automatic reset

a) Provide an automatic reset governor located so that it can be maintained from the top of the elevator car and tested without special access arrangements.

b) Arrange that the governor, once tripped, will be reset when the car is moved up off the car safeties.

2.2.14. Controller

a) Provide a micro-processor based controller designed to give the required operation as herein specified.

b) Mount panels securely on substantial, self supporting steel frames designed for floor or wall mounting.

c) Provide completely enclosed controllers with covers and ventilation slots.

d) Do not mount equipment on the covers.

e) Provide a separate identified box for the fire alarm connections.

f) Where relays are used, provide those having a design electrical life and

mechanical life equivalent to thirty years operation in the given application, with their contacts designed for maximum conductivity and wiping action.

g) Provide electronic time delay devices which employ stable capacitors or crystals as the time base.

h) Install wiring on the controller, whether control or field wiring, in a neat workmanlike order and make connections to studs and terminals by means of solder or solderless lugs, or similar connecting devices.

i) Mark relays, contactors, fuses, printed circuit boards and other components clearly and permanently with designations as shown on the schematics.

j) Mount the designations for plug in components on the controller adjacent to the component; do not mount the designation on the plug in component.

k) Provide self-diagnostic capabilities to identify and log (in memory) specific system faults and safety device failures.

l) Provide a controller enabled to communicate in TCP/IP format over ethernet, or an approved equivalent, through SCADA/EMS or BAS to control and monitor the status of the elevator.

m) Provide a written guarantee from the control manufacturer that over the life of the installation software and firmware updates will be provided at no charge to the Owner.

2.2.15. Computing devices

a) Where computing devices are used, such as micro-processors or minicomputers, along with associated devices, design to the following requirements:

1) Isolate the inputs from external devices (such as push-buttons) and isolate the outputs to external devices (such as indicators) by means of relays or optical devices;

2) Provide the control program on read-only-memory with spare capacity to allow for future programming modifications and extensions;

3) Provide crystal regulation of frequency;

4) Provide for separate regulated power supplies to serve each microprocessor system.

2.2.16. Power interruption restart

a) Provide means so that the elevator system will restart automatically in the event of power interruption.

b) Where volatile memories are provided for position and other data necessary to the continuing operation of the elevators, provide means of preserving this data on power failure or fading ('brownout') for a minimum of four hours and means of automatic recovery upon restoration of normal power.

2.2.17. Control circuits grounding

a) Arrange the control circuits so that one side of the control power supply for external circuits is grounded to facilitate testing and trouble shooting.

b) An external circuit is defined as one wired outside micro-processors or solid-state devices, as for example, buttons, relays, lights, limits, locks and such similar devices.

c) Arrange that accidental grounding in the control system will not defeat the safety circuits.

2.2.18. Solid-state hardware

a) Mount solid-state devices, except for high power silicon controlled rectifiers, on removable printed circuit boards.

b) Gold plate the contact points of edge connectors.

c) Use G10 glass epoxy with minimum equivalent 57 gram (2 ounce) copper.

d) Coat the circuits with tin-lead.

e) Provide a solder resist screen.

f) Provide plated through holes for double sided boards.

g) Make all connections to the printed circuits on the printed circuit boards by means of properly dimensioned pads.

h) Do not provide "patched" connections.

i) Design solid-state devices for a high level of noise immunity.

j) Incorporate electrical noise suppression devices in the power supplies and the inputs and outputs associated with the solid-state circuits.

k) Provide filters and circuits to limit the generated electromagnetic noise level at any frequency to not more than 0.1 db above the ambient electromagnetic noise level, as measured in the centre of the machine room using a calibrated radio frequency receiver designed in accordance with CSA Standard C108.1.1 together with a calibrated rod or loop antenna.

l) Provide filters and circuits to limit the generated electromagnetic noise level at 10 KHz to not more than 0.01 db above the ambient electromagnetic noise level, as measured in the centre of the machine room using a calibrated radio frequency receiver designed in accordance with CSA Standard C108.1.1 together with a calibrated rod or loop antenna.

2.2.19. Auxiliary slowdown devices

a) Provide auxiliary slowdown devices compatible with the solid state speed control and so arranged that, if the normal slowdown devices fail to operate correctly, the elevator will be brought to a controlled stop at the terminal landing with an acceleration not exceeding 0.3 g.

b) Arrange the control circuits so that, if the auxiliary slowdown devices were required to act to stop the elevator, the elevator parks at the terminal landing until the system is checked by a maintenance technician.

2.2.20. Parts cabinet

a) Provide a maintenance parts cabinet in the machine room.

b) Provide a cabinet of steel finished in baked enamel and of a minimum 0.15 cubic metres capacity.

2.2.21. Guide rails

a) Provide standard section guide rails with tongued and grooved joints.

b) Provide guide rails of structural strength and rigidity sufficient to limit the

horizontal deflection of the guide at any point to less than 0.6 mm (0.025") under normal conditions of operation.

c) Use substantial machined finished plates to form the rail joints.

d) Erect guide rails with a variation of not more than 1.6 mm (0.06") over any 6 m (20') section and with a maximum variation of not more than 0.8 mm (0.03") in 25 mm (1").

e) Install guide rails in a strong and substantial manner using brackets affixed to the building structure.

f) Clamp the guides to the bracket with clips.

g) Arrange each clip so as to resist a vertical force of less than 4500 N (1000 pounds) and so as to allow the rail to slide if the vertical force exceeds 9000 N (2000 pounds).

h) Arrange the clips to prevent any horizontal movement of the rail.

i) Extend rails to within less than 300 mm (12") and more than 150 mm (6") of the pit floor and to within less than 300 mm (12") and more than 150 mm (6") of the underside of the overhead slab.

j) Use all standard length rails unless shorter lengths are required to avoid bracket locations or to complete the rail run at the top of the hoistway.

k) Install and locate the rails so that joints do not interfere with the supporting brackets and clamps.

2.2.22. Guide rail dowelling

a) After completion of the final adjustment, dowel the rails to the brackets so that the forces exerted during loading and unloading will not move the rails.

2.2.23. Buffer extensions

a) Provide all necessary buffer extensions, supporting brackets, safety platforms and working platforms with ladders as required to suit the pit depth.

2.2.24. Limit switch dowelling

a) After the final limit switches are adjusted and prior to the performance of

safety tests and checks by the inspecting authorities, fasten, by throughbolting or dowelling, the final limit switches and final limit switch brackets so as to minimize the possibility of future incorrect adjustment.

2.2.25. Counterweight

a) Make the counterweight equal to the weight of the complete elevator car plus between 40 percent and 45 percent of the contract load.

2.2.26. Counterweight balance

a) Statically balance the counterweight so that, at the centre of the travel, with the top guiding means removed, the counterweight hangs in the centre of the rails.

b) Arrange the equipment so that there is, in this position, with the guiding means properly adjusted, no pressure upon the guides.

c) Adjust the guiding means so that the pressure upon any guide at any point in the travel does not exceed 110 Newtons (25 pounds).

2.2.27. Car balance

a) Statically balance the car so that, at the centre of the travel, with the top guiding means removed, the car hangs in the centre of the rails.

b) Arrange the equipment so that there is, in this position, with the guiding means properly adjusted, no force upon the guides.

c) Make this test with empty car and car doors closed.

d) Locate and adjust devices such as the compensating devices, travelling cable hangers and cab balancing weights so that the force upon any guide at any point in the travel does not exceed 110 Newtons (25 pounds) with empty car and car doors closed.

2.2.28. Sheaves and supporting beams

a) Provide sheaves, together with supporting beams or channels, necessary to obtain proper lead of the ropes to car and counterweight, accurately machined and grooved for the diameter of the ropes used.

b) Design and arrange the sheaves so that they can be readily serviced or

removed.

c) Provide sound and vibration isolation pads or springs arranged so that there is no solid contact between the sheaves and the building structure.

2.2.29. Floor marking: hoistway

a) Identify each landing by means of markings on the inside of the hoistway.

b) Place these markings so that people in a stalled elevator will be able to readily see the floor marking upon opening the car doors.

c) Use a stencil to ensure that the floor markings are neat and uniform in appearance.

d) Provide numerals and letters approximately 100 mm (4") high and of a clearly contrasting colour to the colour of the doors and fascias.

2.2.30. Entrances

a) Provide entrances consisting of frames, jambs, nickel silver sills with anti-slip wearing, sill support angles and brackets, SEES Enforcer gibs, struts, headers, fascias, toe guards, and sight guards and doors of approved design and size complete with guides and bumpers and all other items necessary to provide a completed installation.

2.2.31. Entrance finish

a) Entrance doors shall be fabricated of laminated glass panels set in brushed stainless steel frames. Glass shall conform to CAN/CGSB-12.1 and complete assembly shall conform to the requirements of the Code. Glass portion shall be substantially flush with framing surface on the corridor side.

b) Provide stainless steel sight guards.

2.2.32. Entrance installation

a) Assume undivided responsibility for the entire installation of the entrances.

b) Handle, store, protect, install the entrances and associated equipment.

c) Set door frames in perfect alignment with the elevator car platform.

d) Fasten frames and headers to structural supports.

e) Set frames and sills in place prior to building walls.

f) Install frames within 1 mm (0.04") of plumb and sills within 2 mm (0.08") of level over the entrance width.

g) Fasten frames securely at the sill and header.

h) Fasten sills securely to the building structure by means of a support angle or substantial brackets.

i) Install struts, fascias, toe guards and other associated equipment required to complete the installation of the entrances.

2.2.33. Entrances: door hardware

a) Supply hoistway door hardware consisting of door hangers and tracks, interlocks, door closers, relating mechanism, operating linkages, gibs, and all other hardware necessary for the installation and operation of the hoistway doors.

b) Supply, for each sliding panel, sheave type, two point suspension hangers.

c) Supply sheaves not less than 75 mm (3") in diameter with ball bearings, properly sealed to retain grease lubrication, and mounted on stands arranged for direct attachment to the panels.

d) Equip hangers with adjustable ball bearing rollers to take the up-thrust of the doors.

e) Arrange the tracks and sheaves so that there is no metal to metal contact, and so that the doors operate properly without any regular lubrication.

f) Design all door hardware for a minimum of noise.

2.2.34. Car door restrictor

a) Provide a car door restrictor to mechanically prevent the opening of the car door from inside the cab unless the elevator is in the door unlocking zone.

b) Provide a device that does not require electrical or electronic components to function.

2.2.35. Car and hoistway door safety retainers

a) Provide safety retainers at the top and bottom of horizontally sliding doors to retain the closed door panel in position if the primary guiding means fail.

b) Provide retainers that will prevent the displacement of the door panel top and bottom by more than 20 mm (0.8") when the door panel is subjected to a force of 5 000 N (1130 lbf) applied towards the hoistway at right angles to the panel over an area of 300 mm by 300 mm (12" by 12") at the centre of the panel.

c) Provide retainers that will withstand, without detachment or permanent deformation, a force of 1 000 N (225 lbf) applied upward at any point along the width of the door panel together with an additional concurrent force of 1 100 N (250 lbf) applied at right angles to the door at the centre of the panel over an area of 300 mm by 300 mm (12" by 12").

d) Arrange that the retaining means are not involved in the guiding of the panel and are not subjected to wear or stress during normal door operation.

2.2.36. Entrance: fire rating

a) Provide entrances bearing a 1.5 hours fire rating approved by authorities having jurisdiction.

b) Provide a closure, including interlock mechanism and associated wiring, capable of operating for a period of at least one hour when the assembly is subjected to the standard fire exposure tests.

2.2.37. Entrance floor markings

a) Provide, on each hall entrance jamb, raised tactile and braille metallic markings to designate the floor and the elevator.

b) Provide markings as selected by the Owner.

c) Provide samples for review.

2.2.38. Main floor elevator markings

a) Provide at the main floor, for each elevator designated as a Firefighter's Elevator, a suitable symbol such as a Firefighter's Hat.

b) Provide at the main floor for each elevator a numeral indicating the number of

the elevator.

c) Review existing site plan to continue sequencing of existing elevator numbers. Elevator numbers are not to be duplicated at a site. Coordinate with the Owner/Chubb as to the numbering sequence in relationship to the existing onsite elevators.

d) Provide markings as selected by the Owner.

e) Provide samples for review.

2.2.39. Keys

a) Provide six keys of each type used with key rings and engraved gravoply discs to identify the use of each key.

2.2.40. Door friction

a) Adjust the doors so that with the door closing device disconnected, the doors can be started into motion, from any position, with a force of less than 25 newtons (six pounds) per door panel applied horizontally at the mid-point of the door in line with the direction of movement of the door.

2.2.41. Fascias

a) Provide fascias from the header of one entrance to the sill of the entrance above for the complete travel of the elevator including any express zone.

b) Provide fascias extending below the sill of the lowest landing and above the header of the highest landing.

c) Provide fascia plates extending on each side at least 80 mm (3") beyond the clear openings.

d) Reinforce fascia plates properly.

e) Provide all necessary supports required to secure fascia plates in place.

2.2.42. Car frame

a) Provide a car frame of steel channels and angles securely welded, bolted or riveted and substantially reinforced and braced so as to relieve the car enclosure of all strains.

2.2.43. Car platform

a) Provide a car platform of sufficient size to accommodate the cab and to give the required inside net area assuming typical 50 mm (2") wall thickness and 180 mm (7") for doors, sill and return.

b) Provide a car platform with a structural steel frame filled with wood, aluminum or steel flooring having a depression to receive the finished floor.

c) Provide marine grade plywood for the sub-floor.

d) Mount the car platform on isolating pads to prevent the transmission of noise and vibration from the car frame to the car platform.

e) Install the equipment in such a way that there is no direct metal connection between the car platform or the car cab and the car frame except metallic flex, where required, run in such a way as to provide vibration isolation.

2.2.44. Cab design

a) Provide a cab in accordance with Owner's standard elevator cab design criteria including:

1) Car enclosure of 12 gauge sheet steel.

2) Stainless steel ceiling.

3) Provide ventilation perforations at the base of the cab.

4) Clad car canopy in stainless steel.

5) LED cab lighting with lighting levels per the DRM requirements.

6) Car doors with clear laminated glass panels (minimum 12 mm thick) set in brushed stainless steel or anodized aluminum framing. Glass shall confirm to CAN/CGSB-12.1 and complete assembly shall confirm to the requirements of the Code. Glass portions shall be substantially flush with the framing surface on the cab interior side. Glass shall have permanent visible markings in accordance with the Code.

7) Stainless steel front return or laminated glass set in stainless steel or anodized aluminum frame. Extend the return panel to the height of the car door.

8) Stainless steel transom.

9) Cab side walls of clear laminated glass panels (minimum 12 mm thick) extending from the top of the handrail to align with height of door level. Set glass in brushed stainless steel or anodized aluminum framing. Glass shall conform to CAN/CGSB-12.1 and complete assembly shall conform to the requirements of the Code. Glass shall have permanent visible markings in accordance with the Code.

10) Stainless steel wall portions above and below the glass assemblies.

11) 37 mm diameter stainless steel handrail on all non-access walls with ends turned back to the walls.

12) Brushed stainless steel kick plate on all non-access walls.

13) Nickel silver car sill with anti-slip wearing.

14) Tile flooring (by others) adhered as per manufacturer specifications.

b) Provide a cab that complies with OBC prone stretcher requirements.

c) Provide durable finishes capable of resisting abuse by vandals, exposure to road salts, human urine, minor flooding, high humidity and temperature extremes.

2.2.45. Cab air conditioning

a) Where glass hoistways are provided, provide means to ensure that the cab interior temperature is maintained to 26 °C (79 °F) or less under all normal operating conditions.

2.2.46. Cab fan and light 'Green Control'

a) Provide a device in the cab to remove power from the cab lights and fan when there is no one in the elevator.

b) Arrange that the cab lights and fan are turned off in five minutes when:

1) No movement in the cab is sensed;

2) The elevator is level at a floor;

3) The elevator doors are closed;

4) The elevator has not been selected to answer a call;

5) The elevator is on automatic operations;

6) The elevator safety circuit (including interlocks) is intact.

c) Should any of the above conditions no longer obtain or when telephone communication is initiated, turn the car lights and fan on.

d) Use a triaxial accelerometer to detect movement.

e) Provide a Henning "Light Watcher" device or approved equivalent.

2.2.47. Cab installation

a) Assume, undivided responsibility for the entire installation of the cab.

b) Handle, store, protect and install the cab and all associated equipment.

c) Install the elevator cab on the platform plumb and in alignment with the hoistway entrances.

d) Sound isolate the cab from the car frame.

e) Provide additional material and labour as required for handling, storing, and installing the cab so as to provide a complete job.

2.2.48. Car door equipment

a) Provide car door header, hangers and tracks, door closers, door electrical contacts, master door operators, and all incidental devices necessary for the correct operation of the doors.

b) Provide, for each sliding car door panel, sheave type, two point suspension hangers.

c) Provide sheaves not less than 80 mm (3.25") in diameter with ball bearings, properly sealed to retain grease lubrication, and mounted on stands directly attached to the panels.

d) Equip hangers with adjustable ball bearing rollers to take the up-thrust of the doors.

e) Arrange the tracks and sheaves so that there is no metal to metal contact, and so that the doors operate properly without any regular lubrication.

f) Design all door equipment and associated components for a minimum of noise.

2.2.49. Door equipment dowelling

a) After the hangers, interlocks, relating devices, door operating clutches, rollers and other door equipment have been correctly adjusted, install dowels or pins to prevent movement or unauthorized readjustment.

2.2.50. Door detector: multiple beams

a) Provide a three dimensional solid state multiple infra-red beam door detector device.

b) Design and locate the receivers and emitters so that the active area of the door opening, i.e. the full width and from within 25 mm (1") of the floor to a height of 1800 mm (6'), is protected, such that a person or object passing through the car entrance causes the doors to re-open.

c) Position the receivers and emitters at least 25 mm (1") back from the leading edge of the door.

d) Provide logic control to ensure that each receiver receives light from every emitter.

e) Arrange that if the system fails to provide protection over the active area of the door opening, the elevator will park at the current floor with its doors open and the lights off, or the system will go over to nudging operation.

f) Provide a signal on the unit or in the machine room to indicate that a failure has occurred.

g) Should a door protective device be operated continuously for more than 20 seconds after the elapse of the normal door open time, cause the doors to go over to nudging operation.

h) Arrange the nudging operation as follows:

1) Cause the doors to close slowly under reduced power;

2) Operate a buzzer in the car panel as a warning to the person obstructing the door;

3) Cause the 20 seconds to be reduced to 6 seconds until a normal door cycle is performed.

i) Supply a device, reliable and consistent in operation, not affected by dust or temperature changes, and having inherent long term reliability with minimum maintenance.

2.2.51. Roller guides: car

a) Equip the car with roller guides mounted at both the top and the bottom of the car frame.

b) Spring load or flexibly mount the roller guides.

c) Provide rollers of 150 (6”) minimum diameter.

d) Provide these rollers with prelubricated sealed ball bearings.

e) Design the roller to secure good contact with the rail.

f) Provide rollers true and free from deformations of the surface so as to provide a smooth and even ride of the elevator.

g) Grind the rollers within a tolerance of 0.05 mm (0.002”) total indicator reading.

2.2.52. Roller guides: counterweight

a) Equip the counterweight with roller guides mounted at both the top and the bottom of the counterweight frame.

b) Spring load or flexibly mount the roller guides.

c) Provide rollers of 70 mm (3") minimum diameter, designed to secure good surface contact with the rail, with prelubricated sealed ball bearings.

d) Provide rollers true and free from deformations of the surface so as to provide a smooth and even ride of the elevator.

e) Grind the rollers within a tolerance of 0.05 mm (0.002") total indicator reading.

2.2.53. Position transducer

a) Provide a position transducer device to transmit to the control system the position of the elevator.

b) Arrange that the device transmit a minimum of 10 counts per 25 mm (1") of travel.

c) Provide a device having an overall precision within ±2.5 mm (±0.1").

d) Arrange that the elevator controls so that the output from this device is read at least every 5 ms.

e) Transmit the signal from this device either in serial format using a standard protocol (e.g, CAN) or in parallel format using low impedance (less than 10 kilohms) inputs.

f) If the transducer is a relative (pulse counter) type rather than an absolute encoder type:

1) Provide gray encoding so as to indicate the direction of movement of the car and to offset 'false' counts caused by vibration;

2) In the event of a counter error reset the position with an accuracy within ±2.5 mm (±0.1") by returning the car at low speed to a fixed point in the hoistway.

2.2.54. Cab certificate frame and license tags

a) Coordinate with the inspecting authorities so as to arrange that all certificate frames and license tags required be installed in the machine room or, if they have to be installed in the cab, that they are mounted in an inconspicuous location in a stainless steel frame.

2.2.55. Car signal lights

a) Provide LED car position indicators and car call registered lights having a minimum contrast ratio of 8:1 throughout a life expectancy greater than 100,000 hours.

b) The contrast ratio is to be determined by subtracting the brightness of the indicator background from the brightness of the marking and then dividing the result by the brightness of the background.

c) Arrange that the variation in intensity and contrast ratio between position indicators within the car does not exceed 5 percent.

d) Arrange that the variation in intensity and contrast ratio between car call registered lights within the car does not exceed 5 percent.

e) All measurements are to be made in the normal ambient light of the cab.

2.2.56. Car top work

a) Provide a pin mechanism to easily suspend the car to the rails at the top floor, to allow repairs to the machine, brake, etc.

2.2.57. Car inspection devices

a) Provide, on the top of the car:

1) A fixed lamp receptacle, with switch, outfitted with wire clamp guards.

2) A moveable lamp receptacle, with switch, outfitted with wire clamp guards.

3) A GFI duplex receptacle with safety ground connection.

4) An inspection station consisting of an emergency stop button, up, down and common inspection running buttons, on-off switch for the door operator and other devices necessary for top-of-car inspection operation.

2.2.58. Cab ventilation

a) Provide an exhaust fan capable of developing 30 pascals (0.1" H2O) static pressure differential with a minimum capacity of 200 litres per second (450 cfm).

b) Provide a two speed motor for the fan with the speed control located in the car operating panel.

c) Arrange that the increase in noise level caused by the fan, measured in the car with the fan running at maximum speed, does not exceed 3 decibels.

2.2.59. Car position indicator: digital readout

a) Provide a digital car position indicator mounted in each car operating panel.

b) Arrange the indicator to display a number or symbol at least 50 mm (2") high.

c) Indicate the position of the car at all times, corresponding to the landing through which the car is passing or at which it is stopped.

d) Provide a segmented display using light emitting diodes with a minimum of 16 segments per character.

e) Arrange the circuits so as to provide continuous indication of car position.

f) Overlapping dual indication, when the elevator is between floors, is acceptable.

2.2.60. Car station

a) Provide one stainless steel car station mounted on the cab side wall, adjacent to the main guide rails, so as to hide the rails from passenger view.

b) Provide in the station the devices required for normal automatic operation, including the following:

1) Floor push buttons;

2) Door open button;

3) Door close;

4) Alarm button.

c) Number the car call buttons to correspond to the floor served.

d) Provide in conjunction with the car buttons a call registered light for each button to be lighted when the button is pressed and extinguished when the car stops at the selected floor.

e) Engrave the car station with markings and signage such as car capacity, elevator number and other markings required by the prevailing codes and local regulations.

f) Provide a new front return panel and pierce the panel for the push buttons and other devices as set out above and use the front return panel in lieu of an

applied face plate.

g) Hinge the front return so that it can swung open to allow servicing the car station equipment.

h) Provide fastenings to lock the front return in its closed position and arrange the fastenings so that a special tool is required to unlock the front return.

i) Arrange the clearances for the swing return so that it can be swung open without interference from the cab flooring, cab wall and other cab appurtenances.

j) Provide a service cabinet, located below the car station containing all those devices, other than those used for normal automatic operation, required for the various control features such as the light key switch, fan key switch, independent service key switch, out of service key switch, emergency lighting test switch and one spare key switch.

k) Provide, only when required by the prevailing codes, a stop switch located in the service cabinet, arranged to stop the elevator and when activated to duplicate the functions of the "Help" button.

2.2.61. Cab: duplex receptacle

a) Provide a GFI duplex receptacle in the cab for maintenance purposes.

b) Run the wires for this receptacle separately from the wires for the other car light and ventilation equipment and connect it to a separate breaker in the machine room.

2.2.62. Car push buttons

a) Provide Dupar US85 Braille or approved equivalent pushbuttons configured in a vertical array.

2.2.63. Car call registration tones

a) Provide an audible tone, arranged to sound when a car call is registered, having an adjustable volume level of between 55 and 70 decibels, as measured from within the elevator cab.

2.2.64. Car position annunciator

a) Provide automatic verbal announcement to announce the floors and to provide floor passing tones.

b) Provide two speakers per car for the voice annunciation system.

c) Provide a unit to meet the requirements of the Code.

d) Provide a key switch in the service cabinet to allow the option of having floor passing tones or verbal announcements or neither one.

e) Provide means in the service cabinet to adjust the volume over a range from 55 and 70 decibels.

f) Use a female voice for the announcements.

g) Verbal announcements to be announced in English, then French.

h) Floor naming to match DRM.

2.2.65. Telephone: hands-free operation

a) Provide a cabinet in the car station for the hands-free telephone that will be provided and installed by GO Transit's Communication Contractor.

b) Elevator contractor to provide a backing box behind the car station and a flushmounted (removable) insert in the COP.

c) Elevator contractor to provide required electrical connections on two terminal strips: one in the machine room junction box and one in the car station.

d) Elevator contractor to provide a drilled hole for the LED light.

e) Communication box to contain a parallelled connection to the intercom button and alarm bell (to activate the phone).

f) Enable the hands-free telephone to communicate with GO Transit's monitoring service central station.

g) Integrate the telephone into the car station.

h) Provide a push button to initiate the telephone connection.

i) Provide a raised, tapered, stainless steel guard around the perimeter of the

push button arranged to prevent inadvertent operation of the push button.

j) Arrange that the telephone connection can be initiated by an external call.

k) Provide an indicator light to confirm that communication has been established.

l) Pierce the car station for the push button and indicator light with the indicator light mounted flush with the panel.

m) Provide a speaker grille perforation pattern and device mounting arrangement to suit the equipment provided by the Communications Contractor.

n) Identify the telephone and the button with a raised symbol and Braille.

o) Provide wiring for the telephone from the cab to the machine room.

p) Provide, in accordance with the Code, a communication station adjacent to or as part of the hall push button station at the main floor together with interconnecting wiring to the machine room.

q) Provide a communications interface box on the side of the elevator controller.

r) Connect the wiring on the car to a terminal block mounted in or adjacent to the telephone box.

s) Terminate the wiring in the machine room at a separate enclosed external terminal block mounted on the controller.

t) Provide the terminal block and its enclosure and locate it so that personnel other than elevator mechanics can easily run their conduit and wiring to these terminals without interfering with or touching the elevator wiring or controls.

u) Where more than one controller is in a common machine room bring wiring to one common terminal block.

v) Clearly mark the terminal block.

w) Provide wiring of the twin conductor shielded type with grounded shields.

x) Provide a battery backup for the communication device capable of operating the communication system for a minimum of eight hours.

y) Provide equipment and wiring compatible with and acceptable to the

Communications Contractor and telephone company providing service to the project.

z) Provide material and labour as necessary so as to ensure a complete functioning communication system and that the communication system meets the requirements of the Code.

2.2.66. Emergency lighting

a) Provide a back-up battery power system for alarm bell operation and emergency cab lighting.

b) Provide lighting in accordance with the DRM requirements.

c) Light levels to meet required light levels for CCTV.

d) Provide a lighting level of at least 11 lux of illumination at the car operating panels for a minimum period of eight hours, using at least two lamps of equal rating.

e) Cause the lamps to be immediately energized in the event of a power failure or electrical fault de-energizing the normal elevator lighting circuit.

f) Provide for the automatic disconnection of the lamps and the automatic recharging of the lighting unit when normal power is restored to the elevator lighting circuit.

g) Provide a rechargeable battery of the hermetically sealed type, or of a type which provides a reserve of electrolyte, capable of operating unattended and requiring no addition of water or electrolyte for a period of not less than three years, with provision for visual checking of the electrolyte level without opening the battery or removing caps or fittings.

h) Arrange the battery charging to operate automatically upon restoration of normal power to the unit, to remain in operation until the battery is fully recharged and to maintain the battery at full rated capacity at all times when the unit is not in operation.

i) Provide a pilot lamp to indicate that the normal power supply to the unit and battery charging is in operation.

j) Arrange that the unit can be conveniently tested and operated manually.

k) Install the unit as part of the car so that it is not readily removed.

l) Do not provide portable equipment.

m) Install the lamp fixture above the car station.

n) Provide an emergency lighting test switch in the car service cabinet or behind the car swing return.

2.2.67. Closed circuit camera security system

a) A closed-circuit camera (CCTV) will be installed in the cab by others.

b) Provide wiring from the camera in the cab to a designated point in the machine room as follows.

c) Provide one RG-59U stranded centre conductor coaxial cable (Belden No. 9259) and one pair 18 gauge stranded conductor cable within an overall braided shield or such other interconnections as may be required by the CCTV contractor.

d) Run the interconnecting wiring from the elevator security interface box in the machine room to the top of the elevator cab.

e) Provide an excess access loop of 3050 mm (10″) of cable at either end.

f) Provide a cable access hole in the top of the cab at the camera location.

g) Provide a 110 VAC power source on the cab to power the camera.

h) Provide assistance to the CCTV contractor for the installation of the camera.

i) Comply with the CCTV DRM requirements.

2.2.68. Door operator

a) Provide a heavy duty door operator to open and close the car and hoistway doors simultaneously.

b) Mount the operator on the cab above the car doors.

c) Provide either one or two permanent magnet synchronous AC drive motors rated at a total of 250 W (1/3 HP) minimum.

d) Arrange that the operator functions on a single phase 110 or 220 VAC supply.

e) Provide a solid state motion control system using a DC link (single phase AC to DC to three phase variable frequency AC).

f) Provide event logging with non-volatile memory so as to retain the event log under power-off conditions.

g) Directly connect the operator motor or motors to a circulating flat belt with integral teeth (power timing belt).

h) Connect the belt to the door panels so as to move the door panels as the operator motor turns.

i) Provide a solid state door operator control incorporating negative feedback circuits for position, acceleration, velocity and torque.

j) Provide fully automatic installation algorithm profiles that self-adjust the motion profile for the relevant parameters.

k) Provide an output from the door control for a pre-start command to the elevator speed control system.

l) Provide optical isolation for input and output signals.

m) Provide signal line short circuit protection.

n) Provide a serial input to the door control to allow adjustment of speed, acceleration, torque and pre-start point using a notebook computer or keypad.

o) Provide the keypad or software for a standard notebook computer.

p) Arrange that the settings for the door operator can be uploaded to the keypad or notebook computer and then downloaded to another identical operator.

q) Provide an average door closing speed of 300 mm (12") per second, respecting the parameters for door force and door inertia as set out in the elevator code.

r) Provide an average door opening speed of 700 mm (28") per second.

s) Provide, either in the door operator control or in the main elevator control,

means to automatically recycle the doors in the event that they stall during the opening or closing operations.

t) Design the door operator and associated components for a minimum of noise.

2.2.69. In car lanterns and gongs: pierced

a) Provide in car lanterns complete with electronic gongs at each side of the elevator cab entrance to indicate the future direction of the elevator.

b) Pierce the cab entrance columns for the lanterns in lieu of applied fixtures.

c) Arrange the lanterns and circuits so that as the car doors start to open in response to a call, the lanterns illuminate and the gong strikes.

d) Sound the gong once to indicate the up direction and twice to indicate the down direction.

e) Maintain the lantern illuminated until the car has stopped and the door open time has elapsed.

f) Do not illuminate the lantern on a door re-open unless the re-open is caused by a reversal of direction of travel of the car.

g) Arrange the operation of the lanterns and gongs to comply with requirements for the handicapped.

h) Provide LEDs for illumination.

i) Design the fixture so that the lamps may be readily changed. Do not mount any equipment to the covers; arrange that the covers can be removed completely without disturbing the electric wiring.

2.2.70. Hall push button stations: single riser

a) Provide a single flush mounted riser of hall push button stations.

b) Provide one station for each floor.

c) Provide Dupar US85 Braille pushbuttons.

d) Provide at the intermediate floors, for each station, up and down push buttons located one above the other and call registered lights.

e) Provide at the upper terminal and lower terminal, for each station, a single button and call registered light.

f) Provide a visual "OUT OF SERVICE" indicator in each hall station as follows:

1) Whenever service is denied to the particular elevator for any reason, the "OUT OF SERVICE" indicator shall illuminate automatically. This includes top of car 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 indicator.

g) Illuminate the call registered light only when there is an elevator in service to respond to the call.

2.2.71. Hoistway access switch

a) Provide hoistway access switches in accordance with the Code.

b) Locate the switches in the entrance frame or in the sight guard in an inconspicuous place.

2.2.72. Load weighing device

a) Provide means to measure the load in the car within an accuracy of ±4% of the elevator capacity.

b) Provide one of the following types of devices:

1) A device consisting of four strain gauge load cells located at each corner of the car platform and supporting a free floating car platform and cab with summing circuits to calculate the actual load under varying conditions of eccentric loading;

2) If a flexible material is used for the car floor covering, a device consisting of membrane or similar switches located under the floor covering so as to indicate pressure at every 150 mm (6") by 150 mm (6") square of the floor with summing circuits to calculate from these switches the actual load in the car;

3) A strain gauge device located on the crosshead arranged to measure the deflection of the crosshead and thus determine the load in the car;

4) A device consisting of four strain gauge load cells supporting the weight of the elevator machine with summing circuits to calculate the actual load under varying load conditions;

5) A device consisting of strain gauges mounted in the brake shoe pins so arranged as to measure the torque acting on the brake with summing circuits to calculate the actual load under varying load conditions;

6) A Hall-effect device to measure the vertical movement of the cab on the supports as the load in the cab changes;

7) A device to measure the tension in the elevator lift ropes and thus determine the load in the car.

c) Arrange that the output signal from the load weighing device be connected as an input to the speed control system.

d) Arrange the speed control system so that the output from this device is read, for purposes of pre-torque, after the doors are sufficiently closed that no further passengers can enter or leave and prior to the interlock circuit closing.

e) Transmit the signal from this device either in serial RS232C or current loop format or in parallel format using low impedance (less than 10 kilohms) inputs.

f) Arrange that the speed control system provide to the elevator motor sufficient torque, immediately prior to and during movement of the elevator, to offset the unbalanced load as determined by the load weighing device.

g) Arrange the speed control so that the elevator when leaving a floor does not move in the reverse direction for more than 3 mm (1/8").

h) Arrange that the load weighing device automatically resets itself when the control logic determines with certainty that the car is empty.

i) Arrange that the automatic reset occurs at least once every 24 hours.

2.2.73. Heat tracing

a) Provide heat tracing for each hoistway sill.

b) Provide wiring from the machine or control room to the heat tracing.

c) Provide heat tracing of sufficient power to prevent freezing and to allow year-

round normal operation of the elevator equipment.

d) Provide to the Owner for review drawings and details of the heat tracing system.

2.2.74. Car top guard

a) For the safety of the technicians working on the top of the car, provide a car top guard consisting of the following.

b) Provide car top guard to meet, as a minimum, the requirements of the Code.

c) Provide a continuous guard around the sides and rear of the car top.

d) Provide a solid kickplate at the bottom of the guard rail extending from the car top to a height of 150 mm to prevent objects on the car top from falling over the side of the car.

e) Bolt the car top guard components together so that, if necessary, the guard can be temporarily removed.

f) Finish the guard with two coats of rust inhibiting primer and one finished coat of enamel.

g) So as to preserve the cab isolation affix the car top guard either to the cab top or to the car sling and frame but not to both.

h) If the car top guard is affixed to the car sling provide, where necessary, supports to the cab using vibration isolated mountings so arranged as to preserve the cab isolation.

i) If the car top guard is affixed to the cab provide, where necessary, supports to the car sling and uprights using vibration isolated mountings so arranged as to preserve the cab isolation.

j) Ensure that the installation of the car top guard does not reduce the overhead clearances to less than allowed by Code.

2.2.75. Hoistway entrance lunar key access

a) Provide lunar key access for each hoistway entrance.

2.2.76. Pit water sensor

a) Provide a pit water sensor in the pit to detect the accumulation of water in the pit.

b) Locate the sensor in the pit to avoid activation by negligible amounts of water.

c) Arrange that the signal from the water sensing device actuates a visible and audible alarm, at a location to be determined by the Owner, to indicate the presence of water in the pit.

2.2.77. Component labelling

a) Label equipment, wiring and conduits per the DRM.

2.2.78. External connections

a) Provide a junction box on the external wall of the hoistway at a point to be designated later for connections for such items as telephones, CCTV, lobby panels, monitor systems, to external locations such as the CACF Room.

b) Locate this box as instructed and provide clearly marked terminal blocks for the wiring connections.

c) Supply the required wiring for the connections from this box to the external locations (provision of external conduit and pulling of wiring by others).

2.2.79. Travelling cable

a) Provide travelling cables with flame-retarding and moisture-resisting outer covers and stranded conductors.

b) Supply cables approved for elevator use.

c) Provide in the travelling cables:

1) 14 AWG (1.5 square mm) conductors for constant current-carrying circuits;

2) 18 AWG (0.75 square mm) conductors for signal circuits;

3) 20 AWG (0.5 square mm) shielded pair conductors with shielding for telecommunications circuits and data circuits;

4) Coaxial cable for closed-circuit television.

d) Provide ten percent additional minimum spare signal and current-carrying wires in each cable.

e) Include spares of at least:

1) Six pairs of shielded wires.

2) One coaxial cable (20 AWG).

f) Terminate cables using terminal blocks or suitable connectors having identifying numbers to facilitate replacement and service.

g) Suspend light weight cables using a wire mesh sleeve to relieve strain in the individual conductors and heavier cables using a steel supporting strand if the suspended weight exceeds 35 kg (seventy-five pounds).

2.2.80. Electric wiring

a) Provide wiring required to interconnect the equipment.

b) Provide copper wire.

c) Provide insulated wiring having a flame retarding and moisture resisting outer cover.

d) Where flexible conduit is used, supply it in aluminium.

e) Provide travelling cable to connect car operating panels and other car operating devices to the controller in the machine room.

f) Where shielded wire is specified, provide wire of not less than 0.52 $mm^2$ area (20 gauge) having individually shielded pairs with 100% shielding.

g) Provide colour or number coded wires in multiwire cables.

h) Provide waterproof terminal labels.

i) Provide stranded field wire except for the individual wires in multiwire cables which may be either stranded or solid.

## 2.3. EXECUTION

2.3.1. Elevator controls

a) For simplex elevators provide a micro-processor based simplex control.

b) For groups of elevators provide a group control dispatching system based on the assignment of calls to an appropriate elevator so as to optimize the elevator system efficiency.

c) Assign a hall call to a car based on optimizing the efficiency of the elevator system using the following guidelines:

1) Calculate for each car in the group the total passenger-second penalty if the call were assigned to that car and make the assignment of the call to car so as to achieve the lowest total calculated system passenger-second penalty;

2) At any one floor, without exceeding the average call waiting time (waiting time is the time from the placing of a call until an elevator arrives to handle that call) by more than 50%, assign coincident calls (calls to the same floor) to one elevator;

3) Adjust the dispatch algorithm and parameters so as to minimize system trap time (system trap time is the time from the placing of a call until the person placing that call arrives at the destination and exits the elevator);

4) Adjust the dispatch algorithm and parameters so as to minimize waiting time to the extent possible without increasing the system trap time by more than 10%.

d) Arrange that in the event the traffic diminishes to the point that elevators have no assigned calls zone the cars in accordance with the following:

1) Divide the floors served by the elevator group into zones with the main floor being one zone and the other floors comprising a number of zones equal to one less than the number of elevators in the group.

2) Park an elevator without prior assignments (i.e. no car calls, no assigned hall calls and no prior zone assignment) in a particular zone with priority being given to the main floor zone and lower priority to the other zones.

e) Provide for system testing as follows:

1) Record in memory for test purposes a preset pattern of calls to be placed over a period of ten minutes such as to verify the operation of the system functions;

2) In response to a command from the user run the elevators by injecting these calls into the system;

3) Provide as many test patterns as necessary to check and verify all of the dispatching system features;

4) At the time the elevators are commissioned run the test patterns and record the results (signature recordings) for reference and comparison to future test results.

f) Submit for review details of the system, samples of fixtures and description of operation.

2.3.2. Operation: front and rear stops

a) Provide selective operation for the front and rear entrances.

b) Provide one door open button arranged:

1) To actuate the front door if the elevator is stopped at a front entrance;

2) To actuate the rear door if the elevator is stopped at a rear entrance;

3) To actuate both front and rear doors if the elevator is stopped at a landing that has front and rear entrances.

c) Arrange that the front door operates only in response to the hall and car calls for the front entrances.

d) Arrange that the rear door operates only in response to the hall and car calls for the rear entrances.

2.3.3. Operation: flow-through

a) Provide "Flow-Thru" Operation: Door operation for elevators with doors at front and rear of the cab with access on one side on each level, description and function as follows:

1) "Flow-thru" operation is multi-directional; flow can be in either direction. Enter on one side of hoistway and exit on the other side of hoistway.

2) Doors occur on only one side of hoistway at each floor level.

3) Doors at each level are to be considered both Ingress openings and Egress openings.

2.3.4. Operation: call initiation

a) Control the elevator automatically by buttons in the car, marked to correspond with the respective landings served, and by the call buttons at the landing stations.

b) Register a call by momentary pressure of a button.

2.3.5. Operation: call response

a) Store all hall and car calls in the control memory until answered.

b) Cancel a call when it is answered by a car.

c) Stop running car at the first landing for which a car call is registered.

d) Stop running car for a hall call registered for the same direction as the car is travelling, subject to higher priority assignments and to load in the car.

2.3.6. Operation: high & low call return

a) Cause the car to proceed to the calls until it has to come to the limit of calls places in the direction in which it is travelling, and having done this, subject to the assignment of the dispatch system to reverse direction

b) Do not stop the car, except in the case of high and low return, for hall calls in the opposite direction to the direction of the car.

2.3.7. Operation: coincident calls

a) Assign a hall call to an elevator with a car call at the same floor if the elevator is travelling in the same direction as the hall call.

2.3.8. Operation: reduced group

a) Should an elevator be taken out of the group automatic operation for any reason, adjust the dispatching system automatically to the new conditions of operation and continue to control the reduced group in substantially the same way as with the full group.

2.3.9. Operation: fault recovery

a) Provide a recovery circuit arranged to take the elevator at low speed to the next floor in the event of an overspeed condition, overload trip, or other similar fault condition.

b) Do not implement the recovery circuit if the movement of the car would endanger the passengers in the car.

c) Provide a circuit separate from the normal speed control circuits, with power derived through separate controls and limited in power by resistance or fixed devices to an appropriate low level.

d) Do not use, in this circuit, any solid state or other device which could fail in a mode that would allow an increase in applied power.

e) Upon arrival of the car level at the next floor, cause the doors to open and remain open, and turn off the car lights.

f) Leave the elevator in this state until the fault is corrected and the car restored to service.

2.3.10. Operation: call behind response

a) If a hall call exists which cannot be answered by a car in its normal line of travel (e.g. a hall call above a down travelling car):

1) Cause another car to be assigned to answer the call;

2) Redistribute the remaining cars as required to service other traffic needs.

2.3.11. Operation: direction reversal

a) Cause a car without registered car calls, arriving at a floor where both up and down hall calls are registered, to initially respond to the hall call in the direction that the car was travelling.

b) If, subsequent to the stop at this landing, there are no car or hall calls registered such as to require immediate travel in the same direction as before stopping at that landing, cause the car to close its doors, immediately reopen them and respond to the hall call in the opposite direction.

2.3.12. Operation: dispatch recovery

a) If a hall call remains registered for longer than 60 seconds and within that period the cars are not running, dispatch all cars and run without dispatch delay or assignment until all registered hall calls are cancelled.

2.3.13. Operation: independent service

a) Provide independent service

b) On independent service:

1) Remove the car from the automatic supervisory control system;

2) Arrange the circuits so that the car does not respond to hall calls;

3) Render the hall lanterns (if provided) inoperative;

4) Cause the car to park with its doors open;

5) 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;

6) Cause the doors to reopen if the button is released at any time up to the point at which the elevator starts to move;

7) Render inoperative the normal door protective devices;

8) Arrange the controls so that the attendant can select direction of travel;

9) Cancel all registered car calls when the direction reverses or a car call is answered.

10) Arrange the independent service operation so that it does not override security features or security systems.

2.3.14. Operation: delay protection

a) Automatically disassociate a car from group service in the event that the car is delayed for more than a given period of time.

b) Restore the car automatically to group service when the delay is corrected.

c) Arrange that the given period of time be approximately one minute but shall be adjustable from 30 seconds to two minutes.

2.3.15. Door operation: advance opening

a) Arrange the levelling and door circuits so that the doors open when the car is levelling into the landing, and are three-quarters open when the car stops level with the landing.

2.3.16. Operation: door protective device

a) Arrange the door protective device so that, should it detect a person or any object in its path, at any point during the door closing operation, it will cause the doors to return to the open position.

b) Adjust both the detection device and the door operation so that an object or person in the way of the door will cause the doors to reverse without the door panel of either hall or car doors actually striking the object or person.

2.3.17. Operation: load non-stop

a) Provide a load weighing device which, when the elevator has more than 35 percent of its rated load, causes it to by-pass hall calls and stop only for registered car calls.

b) Provide a device adjustable over the range of 30 to 60 percent of elevator capacity with a long term accuracy of plus or minus five percent.

2.3.18. Door protective device by-pass (nudging)

a) Should a door protective device be operated continuously for more than 20 seconds after the elapse of the normal door open time, cause the doors to close slowly under reduced power and operate a buzzer in the car panel as a warning to the person obstructing the door.

b) Cause the 20 seconds to be reduced to 6 seconds until a normal door cycle is performed.

2.3.19. Door open pause time

a) Arrange the circuits so that when the car is stopped in response to a hall call the doors remain open a predetermined length [approximately 4 seconds for an elevator whose entrances are within 3 metres (10') of the hall push button and approximately 5 seconds for an elevator whose entrances are further than 3 metres (10') from the hall push button].

b) Arrange that this predetermined length of time is reduced to approximately 0.7 seconds if a person moves through the entrance (as indicated by the actuation of the door protective device).

c) Unless otherwise specified (e.g. to allow for advance hall lantern warning), arrange the circuits so that when the car is stopped in response to a car registered call the doors remain open a predetermined length of time (approximately 3 seconds).

d) Make the times separately adjustable over a range from 0.25 seconds to 15 seconds.

e) Arrange the circuits so that the door open pause time is cancelled if a car call button is pressed or the door close button is pressed.

2.3.20. System clock

a) Where operations or functions are subject to clock control or require clock input, provide a solid state clock.

b) Provide, in the machine room or at the central control console, means to indicate the current clock time.

c) Provide, in the machine room or at the central control console, means to readily reset the clock time.

d) Provide crystal regulation of frequency and voltage control adequate to maintain the time within an accuracy of plus or minus five seconds per month.

e) Provide software to automatically adjust the time for changes from standard to daylight saving time and from daylight saving time to standard time.

f) Provide battery back-up to maintain for a period of at least 24 hours accurate clock time in the event of power loss.

2.3.21. Noise level: door operation

a) Arrange the equipment so that the noise level, as measured within the cab, does not exceed 65 decibels at any time during a full door open, door close and door reversal cycle.

b) Initiate the door reversal by triggering the door protective device.

c) Measure the noise level using an ANSI type 2 sound level meter on the "A" scale with an "F" response.

2.3.22. Noise level: cab

a) Design the equipment so that the noise level with the elevator running, as measured by a meter positioned in the centre of the elevator cab, does not exceed 60 decibels.

b) Arrange that, with the elevator travelling from one end of the hoistway to the other, the noise level as measured within the elevator cab does not vary by more than 3 decibels.

c) Measure this noise level with an ANSI type 2 sound level meter on the "A" scale with an "F" response.

2.3.23. Cab fan: operation

a) Arrange that there is no discernible vibration in the car with the fan operating.

b) Arrange that the noise level developed by the fan, measured in the car with the fan running, does not exceed 55 db.

2.3.24. Noise level: machine room

a) Design the equipment so that the noise level with the elevator running, as measured by a meter positioned in the centre of the machine room, does not exceed 80 decibels.

b) Measure this noise level using an ANSI type 2 sound level meter on the "A" scale with an "S" response.

2.3.25. Car ride

a) Arrange that the horizontal acceleration front to rear or side to side measured in the car with the elevator travelling, with a load of less than 10 per cent of capacity, from top to bottom and bottom to top does not exceed 150 mm per second per second (0.5 fpsps) measured between two consecutive points of opposite value.

b) Arrange that the vertical acceleration measured in the car with the elevator travelling, with a load of less than 10 per cent of capacity, from top to bottom

and bottom to top at contract speed, does not exceed 100 mm per second per second (0.3 fpsps) measured between two consecutive points of opposite value.

2.3.26. Levellinh

a) Cause the car to stop automatically at floor level, without overshoot, regardless of load or direction of travel so that the car sill is level, within 3 mm (1/8"), with respect to the hoistway sill.

b) When the elevator cab is stopped at a floor, correct for over travel or under travel or movement of the cab away from the floor, by returning the car imperceptibly to floor level.

2.3.27. Brake

a) Arrange the brake to stop the elevator with full load in the car from full speed in the down direction with an average deceleration of approximately 1.2 metres per second per second (4.0 f/s/s) without shock or jar.

b) Adjust the brake to hold a minimum of 125 percent of the contract load.

c) Design and adjust the brake so that when it operates no noise can be detected either in the elevator cab, at the top floor landing or outside the closed machine room door.

2.3.28. Transmitted vibration

a) Arrange that the dose value of the transmitted vibration generated by the machine and associated sheaves in the frequency range from 0 to 100 Hz is less than 0.2 in any single axis and that the average of the dose values of the three axes is less than 0.15.

b) Measure the vibration over a period of ten seconds in both directions of travel at contract speed with empty car.

c) Record the vibration using an accelerometer transducer mounted on the machine beam adjacent to the machine.

d) Process the accelerometer output through a low pass digital or analogue filter to delete frequencies above 100 Hz.

e) Record the accelerations from 0 Hz to a minimum 200 Hz in the vertical axis and the two horizontal axes.

f) Calculate the vibration dose value by integrating the fourth power of the acceleration in m/s/s over the ten second period, dividing by the number of samples, and taking the fourth root of the result.

2.3.29. Speed control

a) Design and adjust the equipment so that the average acceleration over the period of constant acceleration is 1.2 metres per second per second (3.9 f/s/s) plus or minus 10%.

b) Design and adjust the equipment so that the average change in acceleration (jerk) is 1.8 metres per second per second per second (6.0 f/s/s/s) plus or minus 10%.

c) Design and adjust the equipment so that the rated speed is maintained with an accuracy of 1.5 percent.

2.3.30. Safety tests

a) Arrange the safety so that the car stops at both no load and full load on a safety test without excessive acceleration and without damage to the equipment.

2.3.31. Speed control

a) Design and adjust the equipment so that the average acceleration over the period of constant acceleration is 0.91 metres per second per second (3.0 f/s/s) plus or minus 10%.

b) Design and adjust the equipment so that the average change in acceleration (jerk) is 1.8 metres per second per second per second (6.0 f/s/s/s) plus or minus 10%.

c) Design and adjust the equipment so that the rated speed is maintained with an accuracy of 3.0 percent.

2.3.32. Cleaning

a) Completely remove protective coverings from finished surfaces and

components.

b) Clean the hoistway and all surfaces and components before project completion so that the installation is turned over in a fully cleaned state.

2.3.33. Operating time

a) Adjust the equipment so that the elapsed time to travel one typical floor does not exceed the time shown in the data table.

b) Measure this time under the following conditions:

1) A typical floor height of less than 4000 mm (13');

2) Floor levelling accuracy of ± 6 mm (1/4");

3) Start time when the fully opened doors begin to close;

4) Stop time when the car is stopped level with the next floor and the car and hall doors are 800 mm (32") open;

5) Time measured with full load in the car and in both directions of travel;

6) Power door operation for the hall and car doors conforms to the elevator code requirements.

c) Adjust the equipment so that the operating time is compatible with dependable, consistent operation without undue wear or excessive maintenance and so that this operating time can be readily maintained over the life of the elevator installation.

d) Adjust the equipment so that, with the control functioning so as to give the required time, the elevator operates under smooth acceleration and retardation and provides a comfortable and agreeable ride.

2.3.34. Firefighters' Emergency Operation

a) Provide Firefighters' Emergency Operation including:

1) Phase I automatic Emergency Recall Operation;

2) Phase II Emergency In-car Operation.

b) Provide control "handshaking" compatible with the building interconnections.

c) Provide switches and indicators in the hall and car stations as required by Code.

2.3.35. Emergency power operation: automatic

a) The supplier of the emergency power system (provided by others) will arrange that:

1) The emergency power source will provide sufficient power to run one elevator per group at its contract speed and capacity;

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

3) Four wires will connect two auxiliary contacts of the emergency power transfer switch to the elevator controllers of the group;

4) One contact ('Emergency Contact') will on normal power make a closed circuit and on emergency power present an open circuit;

5) The other contact ('Delayed Contact') will present a closed circuit except for an adjustable period of time (5 to 50 seconds adjustment, set initially at 15 seconds) prior to power supply transfer in either direction - from normal to emergency or from emergency to normal.

b) Arrange that when the 'Emergency Contact' is open the signal light marked "ELEVATOR EMERGENCY POWER" is illuminated.

c) Arrange that when the 'Delayed Contact' is open, all cars stop.

d) Arrange that when the 'Emergency Contact' is open and the 'Delayed Contact' is closed:

1) All cars are automatically brought to the home floor sequentially one at a time;

2) Any car delayed by a malfunction is by-passed;

3) After all cars of the group are at the home floor with their doors open, an elevator as selected by a manual switch will run normally answering hall and car calls: this elevator to have its home floor hall lantern (if provided) illuminated;

4) The normal safety devices including door open buttons, safety edges and door protective devices, remain operational.

e) Provide the indicators and switches in the hall station and elsewhere as necessary for the emergency power operation.

f) Arrange that, when running on emergency power, the elevator does not generate harmonics that will cause a mis-operation of the emergency power supply when accelerating, running or decelerating.

g) Provide switches and indicators in the hall and car stations as required by Code.

2.3.36. Traction elevator emergency power device

a) Provide a device to automatically move the elevator to a floor in the event of power failure

b) Arrange that when normal power fails, sufficient power is provided by the device to lift the brake, cause the elevator to move to a floor, open the doors and then remove the elevator from service until normal power is restored.

c) Provide batteries complete with charging system to power the unit.

d) Provide batteries having a minimum life expectancy of five years.

e) Provide MCE TAPS or equivalent unit.

2.3.37. Commissioning

a) Designate one staff person as Contractor's commissioning manager for the project. Manager to be of Adjuster, Supervisor or Manager level or higher.

b) Perform and meet tests required by CSA/CAN-B44 Safety Code for Elevators.

1) Furnish test and approval certificates issued by jurisdictional authorities within 24 hours of their being issued.

2) Provide 2 weeks advance written notice of date and time of tests.

c) After Provincial inspection of the elevator and before turn-over for Owner's use, test the elevator in simulated automatic operation without passenger access.

1) Test for two (2) consecutive hours with no load operating from floor to floor, with or without door operation

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

3) Test for two (2) consecutive hours operating from floor to floor with door operation. Provide barricades and signage to indicate that an elevator test is in progress.

d) After Provincial inspection of the elevator and before turn-over for customer use, contact the GO Transit representative to inspect the installation and verify the elevator performance in accordance with the contract documents. Ensure a copy of the design specifications is available on site at the time of the GO Representative's review.

e) Before turn-over for Owner's use, test the following and provide the Owner with a record of the results:

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.

7) Operating speed down.

8) Door close force.

9) Door detector interrupt setting.

10) Verification of alarm contacts to CHUBB system.

f) During warranty maintenance period closely monitor equipment for malfunctions and track reliability. Not achieving a reliability rate of $\leq$ 0.5 malfunctions 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)

until the (moving window) 90 day reliability target has been achieved.

## 3. SECTION 14900 MAINTENANCE

### 3.1. GENERAL

3.1.1. General requirements

a) Comply with section 14200

3.1.2. Scope

a) Provide labour, materials products, equipment and services necessary for the full maintenance of the equipment.

3.2.3. Purpose

a) The purpose of the maintenance program is to maintain the equipment in substantially new condition, to secure the Owner's equity and to provide safe, trouble-free service.

3.2.4. Regulatory authority submissions

a) Complete any submissions to the regulating authorities that may be necessary for the continuing use and operation of the equipment.

3.2.5. Contract duration

a) Provide full maintenance on the equipment to the maintenance procedures set out in the Specifications for such periods as may be defined in the Contract Documents.

3.2.6. Minimum standard

a) As a minimum standard, perform to the Specifications and to the Code.

b) Maintain the equipment at all times in the same or better condition as the commencement of the maintenance work.

3.2.7. Reliability: elevator

a) Ensure that the average number of callbacks does not exceed 4.9 per elevator per year.

b) Ensure that the average number of entrapments does not exceed 0.9 per elevator per year.

c) If there is more than one elevator in the building, average the data over all the elevators.

d) Starting six months after the inception of the maintenance contract, at the end of any given month should either the number of entrapments or the number of callbacks for the previous six months exceed the limits set out above, issue a credit for the elevator maintenance for the current month and continue to credit the maintenance until such time as the callbacks and entrapments are within the prescribed limits for the previous six months.

3.2.8. Maintenance meetings

a) Have qualified and capable representatives attend a meeting with the Owner and the Consultant at least every three months to review work procedures, extra charges, elevator call backs, and any Owner concerns.

b) At the option of the Owner the meetings may be held by telephone conference.

3.2.9. Protection of the Work and property

a) Maintain protection of the Work and protect the Owner's property from injury or loss arising out of the execution of this contract.

b) Make good any injury or loss caused by your agents or employees.

c) Take all necessary precautions to ensure that the Work is done in a manner that does not endanger any person.

3.2.10. Assignments

a) Do not assign nor sublet the contract without the written consent of the Owner.

b) Do not assign any payment due or to become due as a result of this contract without the written consent of the Owner.

3.2.11. Access codes

a) If the Owner provides access codes or access tools, preserve these codes and

tools confidential for use only on the particular equipment for which the Owner has provided them.

b) Change access codes only when authorized in writing by the Owner.

3.2.12. Directives

a) Advise the Owner of directives received from the Inspecting Authorities and from the Regulatory Authorities.

b) Carry out directives from the Inspecting Authorities and from the Regulatory Authorities within the period of time set out on the directives, working in overtime if necessary to meet the required date, except for those items that are:

1) The responsibility of the Owner;

2) Directives resulting from changes to the existing regulations.

3.2.13. Payment

a) Submit invoices at the end of each month for the work performed in that month.

b) Invoices will be paid when the assigned work has been completed and the Consultant has been notified by the Contractor to that effect.

c) The invoice will be paid only if the maintenance work for the month has been executed as confirmed in the report data; otherwise there will be no payment made for the month.

d) The invoice will be paid only if deficiencies outstanding for more than two months have been corrected; otherwise there will be no payment made for the month.

e) The invoice will be paid only if those directives that are the responsibility of the elevator contractor have been addressed within the required time limit; otherwise there will be no payment made for the month.

3.2.14. Maintenance fee reduction

a) If the regular maintenance is not carried out for any unit for any given month issue a credit for the elevator maintenance for that unit for that month.

3.2.15. Delay in making repairs

a) Execute promptly the necessary repairs to a non-functioning unit to service.

b) Should the initiation of corrective measures required to repair a non-functioning unit be delayed beyond one normal working day (i.e. 24 hours) issue a credit for the elevator maintenance for that unit for that month.

3.2.16. Deficiencies not corrected

a) If there is a failure to carry out instructions of the inspecting authorities (except for those items that are the responsibility of the Owner and directives resulting from changes to the existing codes) within the period of time allowed by the authorities issue a credit to the Owner for any costs, including the cost of the inspecting authority reinspection, incurred by the Owner as a result of this failure.

3.2.17. Coordination with Owner

a) Before each routine maintenance visit contact a representative specified by the Owner.

b) Discuss the operation of the equipment with the Owner's representative and take immediate action on problems.

c) Should a problem be of a nature that cannot be satisfactorily resolved during the inspection or trouble call, report back to the Owner's representative to explain why it was not possible to correct the problem and when the problem will be resolved.

3.2.18. Routine maintenance

a) Perform all maintenance testing and inspections required by the Authority Having Jurisdiction at the appropriate intervals.

b) Perform a routine maintenance inspection once a month, as a minimum.

c) In the course of the examination, should faulty parts be discovered replace them at once, and should any unusual operations or noises be found take corrective action immediately.

d) Schedule parts showing excessive wear for replacement on the next regular

examination.

3.2.19. Personnel

a) Supervise your personnel so that they present a neat appearance and their movement in the building is within the requirements of their work.

b) Provide uniforms and photo identification for personnel.

c) The Owner reserves the right to reject or refuse access to personnel or contractors at its sole discretion.

d) Assign and maintain a dedicated service representative to the work, this representative to be responsible for liaison with the Owner and the Consultant.

e) Assign and maintain a dedicated service supervisor to the work, this supervisor to be responsible for technical communications with the Owner and the Consultant.

3.2.20. Repairs

a) For scheduled repair work, outside of the regular maintenance procedure, give the Owner at least two weeks prior notice.

b) For unscheduled repair work, outside of the regular maintenance procedure, give the Owner immediate notice.

c) Communicate, in writing, the status of repairs to the Owner at the beginning and close of the normal working day.

d) Where possible indicate the time required for completion of repairs.

3.2.21. Mis-adjustments

a) Keep the equipment in substantially new condition and maintain its performance as or better than new.

b) Do not change any of the elevator adjustments in such a way as to lead to a derating of the performance.

c) In particular do not:

1) Increase the door open pause times without written instructions from the Owner;

2) Decrease the door operating speed;

3) Change the brake spring setting;

4) Change the brake lift setting;

5) Decrease the acceleration;

6) Decrease the deceleration;

7) Decrease the contract speed.

d) Do not, in the course of routine maintenance or trouble shooting, re-adjust any of those settings which affect the performance of the equipment.

e) Should it appear that some setting has changed or some problem has arisen such as to alter the performance of the equipment, arrange that a qualified adjuster with the appropriate tools, manuals and training make the necessary readjustments in an organized, systematic way.

f) Do not allow ad hoc adjustments to the equipment.

3.2.22. Safety devices

a) At no time permit the equipment to operate while any of the safety devices, mechanical or electrical are in-operative.

b) In the event that any of the emergency safety devices such as final limits, safety operated switches, governor switches, overspeed devices, underspeed devices, car safeties, are activated while the equipment is in use by the public submit within 24 hours of the event a written report to the Owner and the Consultant detailing the incident and the corrective action taken.

3.2.23. Codes and ordinances

a) Supply equipment and do work in accordance with building codes, by-laws, regulations and requirements of the local, provincial and federal authorities in effect at the time of the execution of the work.

b) Supply equipment and do work in accordance with the Code, and any other

code which may govern the requirements of the installation.

c) Provide labour and material, whether or not specifically mentioned in this specification, that may be necessary to provide an installation conforming to the applicable codes and regulations.

d) Comply with the requirements of the Occupational Health and Safety Act and Workplace Hazardous Materials Information System (WHMIS) regarding employee safety, use, handling, storage and disposal of hazardous materials.

e) Prior to submission of the proposal and throughout the duration of work, give prompt notification in writing of any regulations or requirements known to be in process which might affect the acceptability of the work.

f) If changes in codes or regulations result in extra costs, those taking effect subsequent to the date of proposal submission shall be treated as an extra to the contract.

3.2.24. Equipment defects

a) Should a defect in the equipment or the design of the equipment become apparent based on experience with this installation or similar installations elsewhere, advise the Owner immediately in writing setting out the steps to be taken to correct the problem.

b) Forward to the Owner copies of any memoranda, internal or external, published or unpublished, dealing with actual or potential flaws in the equipment and design.

3.2.25. Call-back service: elevators

a) Include, as part of the maintenance program, regular and emergency call-back service.

b) Provide regular and emergency call-back service 24 hours per day, seven days per week.

c) An emergency is a situation such as an entrapment, an incident, an accident, a shut down of more than one elevator in a group or the absence of elevator service to a floor.

d) At the time the call is placed the Owner may choose to indicate that the call

can be handled during regular hours; otherwise, answer the call immediately whether it be in overtime or regular time.

e) Respond only to calls placed by the Owner except in the case of emergency calls.

f) Provide a telephone answering service staffed twenty-four hours per day.

g) Ensure that calls received by the answering service are transmitted immediately to a responsible person for action.

h) Provide regular call-back response within a maximum of two hours from the time a call is placed until the arrival of a maintenance person at the site.

i) Provide emergency call-back response within a maximum of 45 minutes from the time a call is placed until the arrival of a maintenance person at the site.

3.2.26. Maintenance: assistance for inspections & testing

a) Provide all necessary co-operation and assistance to allow inspections of the equipment by the Consultant and by the Inspecting Authorities.

b) Provide all necessary co-operation and assistance, either in regular time or overtime, to allow testing of those systems associated with the equipment such as smoke detectors, fire detectors, heat detectors, emergency power, firefighters emergency operation, communication systems, security systems and other systems ancillary to the equipment.

c) In the event that this requires the supply of one crew for more than an average of three hours per unit per year, submit a request to the Owner for an extra to contract payment.

d) Should the tests fail because of problems with the elevator or escalator equipment provide any necessary additional assistance at no extra charge.

3.2.27. Safety inspections

a) Carry out instructions of the inspecting authorities within the period of time allowed by the authorities or, if no period is designated, 30 days of notice of deficiency except for those items that are the responsibility of the Owner and directives resulting from changes to the existing Codes.

3.2.28. Manufacturers' parts

a) Supply replacement parts identical in make and model to the original parts where at all possible.

b) Where identical parts are not available or a better substitute is available submit the alternative part for the approval of the Owner.

3.2.29. Substitute parts

a) Where items visible to the general public, in particular exposed finishes and fixtures, are to be replaced, submit drawings, photographs or samples, as required, in ample time for consideration and review.

b) Submit samples of metals, plastic laminates and finishes properly identified as to project, location and material.

c) Supply materials in accordance with the reviewed samples.

d) The review does not include the checking of measurements nor the approval of variations from the Specifications or the Contract Documents.

3.2.30. Parts available as required

a) Arrange that the following spare parts are available within 48 hours on site and provide to the Owner, at his request, the methods and procedures used to ensure that this delivery time can be met:

1) A printed circuit board of each type used, completely assembled and verified;

2) One complete door operator assembly;

3) One complete door protective device assembly;

4) One complete roller guide assembly of each size used;

5) Spares for parts used in quantity on the equipment in the ratio of one spare for every 100 such parts.

6) Hall fixtures: two complete hall station assemblies (with call registered light assemblies), four button heads, and a hall lantern of each type;

7) Car operating panel fixtures: three complete car push button switch assemblies (with call registered light assemblies), four button heads, and one position indicator;

8) Car door equipment: two car door sheaves and one set of door gibs;

9) Hall door equipment: one complete hoistway door closer assembly, two interlocks, four hall door sheaves, and two sets of door gibs;

10) Three fuses of each size used in the controller and in the main line disconnect;

11) Relays: one complete relay of each type with spare contacts and coils;

12) An adequate supply of cleaning solvent, wipers, general purpose oil and door operator oil.

3.2.31. Tools maintained locally

a) Arrange that the following tools are available in a service vehicle or from the local maintenance office and allow the Owner, at his request, to inspect these tools:

1) One blower;

2) One door pressure gauge;

3) One rechargeable fluorescent portable light;

4) Signs stating "REGULAR MAINTENANCE BEING PERFORMED";

5) One vacuum cleaner;

6) One step ladder;

7) Twelve cable pullers;

8) Two chain blocks or lift pulls;

9) Two sets of feeler gauges;

10) One sound level meter;

11) A micrometer;

12) One F.E.T. volt-ohm-millimeter;

13) One paging unit for each maintenance mechanic;

14) Four wire rope slings;

15) One stop watch;

16) One tachometer;

17) Test weights totaling 2000 kg (4500 lb) and a hand cart for transportation.

3.2.32. Parts cabinet

a) Provide a maintenance parts cabinet in the machine room.

b) Provide a cabinet of steel finished in baked enamel and of a minimum 0.15 cubic metres capacity.

3.2.33. Building log

a) Complete required entries for building log systems.

3.2.34. Maintenance log book

a) Provide a maintenance log in a permanently bound journal having pre-numbered pages.

b) Indicate in the journal the following information: date, time, name of maintenance technician, regular maintenance, regular time callback, over time callback, action taken, work completed, and further repairs required.

c) The journal is the property of the Owner.

d) Maintain the journal current, on the premises, and available for inspection by the Owner at any time.

e) Make entries in ink, legibly, consecutively and without blanks.

3.2.35. Time tickets

a) Indicate the section of the normal maintenance schedule on each time ticket with details of the portion of the section completed.

b) Submit time tickets for each call-back detailing the cause of the call-back and the action taken.

c) If electronic time tickets are used, make these tickets accessible to the owner through internet at all times.

3.2.36. Monthly data submission

a) Provide data in an electronic format as prescribed by the Owner.

b) In the absence of other requirements, submit data each month for call-backs and maintenance work in a Comma-Separated-Values (.csv) file with each line having the following information: Licence #; Call Time; Response Time; Resolution Time; Problem Description; Corrective Action; Entry Type; Scorecard Exemption; Exemption Reason with each item having the following meaning:

1) Licence #: The licence number assigned to the unit by the Authority Having Jurisdiction (where one has not been assigned, is not unique or is not known please coordinate with KJA).

2) Call Time: Date and time the call-back is reported by the client or date and time the elevating device is removed from service for maintenance or repair in format YYYY-MM-DD HH:MM.

3) Response Time: Date and time technician arrives on site to respond to the call-back or date and time the elevating device is removed from service for maintenance or repair in format YYYY-MM-DD HH:MM (in the event of a deferred call-back, the elapsed time will start based on 07:00 on the first business day following the original Call Time).

4) Resolution Time: Date and time the elevating device is returned to service in format YYYY-MM-DD HH:MM.

5) Problem Description: Description of problem as reported.

6) Corrective Action: Description of work done to correct problem as reported by the technician.

7) Entry Type: Type of call as “C” for call-back, “E” for call-back with entrapment, “D” for call-back with deferred response. “R” for maintenance or repair.

8) Scorecard Exemption: Marked "Y" or "Yes" if the Contractor is requesting an exemption from the scorecard for this call-back (null values or "N" are the only other acceptable values).

9) Exemption Reason: Description of why the Contractor is requesting the call-back or repair be exempted from the scorecard calculations (an entry in this field is required when the Scorecard Exemption field is "Y" or "Yes").

c) Submit the data for the month on or before the fifth day of the following month.

d) The Owner, acting reasonably, may at any point during the contract:

1) Change the format of the data submission.

2) Require a direct electronic exchange of data using standard protocols for data exchange to a Consultant website.

3.2.37. Accidents and claims

a) In the event of an accident causing death, personal injury or property damage, arising out of or in connection with the equipment or the performance of the Work whether on or adjacent to the site advise the Owner immediately giving a verbal report and submit to the Owner within 24 hours of the accident signed written reports from each of the maintenance personnel involved.

b) In the event of an injury to anyone working on or using the equipment, take whatever immediate action is necessary to aid the injured person and to prevent further injury to others.

3.2.38. Maintenance manual

a) Supply to the Owner and the Consultant at the start of the contract a maintenance manual.

b) Incorporate in the manual a description of the controller user interface, fault and error codes, troubleshooting and diagnostic procedures, methods of use and the adjustment of programmable parameters together with their settings at the time of final adjustment.

c) Update the maintenance manual annually and supply to the Owner and Consultant a copy of the updated maintenance manual.

3.2.39. Electrical diagrams

a) Supply wiring diagrams and data as required for the execution of the Work including schematics for speed control, dispatching system, interfaces, printed circuit boards.

b) Incorporate, as part of the schematic diagrams, a reference index ('road map') giving the location of electrical components and wiring interconnections for relay coils, relay contacts, field equipment, integrated circuits and other such devices, so that the position on the schematics of any of these items can be readily determined.

c) Supply, prior to the Substantial Performance inspection, three prints and one reproducible of the wiring and schematic diagrams revised to show changes that have been made.

d) If changes are subsequently made to the wiring or control, supply an additional two sets of marked-up prints of the schematics and field wiring diagrams showing the changes.

3.2.40. Maintenance control program

a) Provide to the Owner and the Consultant a copy of the Maintenance Control Program for each device type.

b) During the course of the maintenance contract update the Maintenance Control Program as necessary and forward to the Owner and the Consultant a copy of the updated Maintenance Control Program.

c) The Maintenance Control Program is the property of the Owner.

d) Store the Maintenance Control Program on site in accordance with the requirements of the Authority Having Jurisdiction.

e) Execute the maintenance in accordance with these specifications and the Maintenance Control Program.

f) As a minimum, perform tasks as required by the Authority Having Jurisdiction at the appropriate intervals.

g) Where maintenance and testing frequencies in the Maintenance Control Program are less than these specifications, these specifications take

precedence.

h) The Owner, acting reasonably, may approve changes to these specifications provided that the minimum requirements of the Authority Having Jurisdiction are respected.

i) Six months in advance of performing any tests that may result in damage to the building or equipment, submit to the Owner and Consultant a written plan outlining:

1) Step-by-step instructions of how the testing will be performed;

2) Names and resumes of qualified personnel selected to perform the testing;

3) Incremental testing procedures;

4) Alternative testing means;

5) Schedules.

j) If testing is performed prior to submitting an adequate plan and receiving approval from the Owner, the Contractor is responsible for correcting damage that may result from the testing.

k) In the event that the plan submitted is unsatisfactory to the Owner or Consultant, the Owner may elect to use another contractor to perform the testing.

l) Where the maintaining contractor is the original equipment manufacturer, installer and has maintained the equipment since installation, the maintaining contractor is responsible for correcting damage that may result from the testing.

m) Where damage results as a consequence of the testing the Owner may elect to have an inspection by the Consultant for the purpose of determining fault and corrective steps.

n) Where the Consultant determines that damage is the result of maintenance deficiencies or improper testing procedures, the Contractor is responsible for correcting damage.

3.2.41. Fire service testing

a) Perform annual testing of the Firefighters' Emergency Operation.

b) Execute the tests, at the option of the Owner, either in regular hours of work or outside of regular hours of work at no extra cost to the Owner.

c) Carry out the testing as required by the regulatory authorities.

d) Record the results of the testing and forward to the Owner a copy of the record.

3.2.42. Annual report

a) Each year, on the anniversary date of the contract, submit to the Owner a report consisting of the following items:

1) A complete summary of the activity for the year including, but not limited to, call backs, repair work, complaints;

2) A certification that the various items listed herein were checked at the specified times and that they were found to be functioning correctly or, if not functioning correctly, notations of the problems and the corrective action taken;

3) An evaluation of the standard of maintenance for the year as compared to prior years and to the standards of the industry for similar installations.

3.2.43. Software and firmware updates

a) Check each January with the control manufacturer for software and firmware updates.

b) Advise the Owner of the status of these updates.

c) Obtain and install updates.

d) Provide an update on regression software testing, in existing functional and nonfunctional areas of a system after changes such as enhancements, patches or configuration changes have been made to them, to the Owner.

3.2.44. Major parts replacement report: elevator

a) Each year, on the anniversary date of the contract, submit to the Owner a report on the anticipated life expectancy of the major equipment components

and the budget provisions for their replacement, including following items:

1) Elevator suspension means;

2) The machine.

b) Six months prior to termination of the maintenance contract, submit to the Owner a report on the major equipment components that will require replacing in the next five years and, if these components will not be replaced before the end of the contract, reimburse the Owner for the usage on a prorated basis based on the expected lifespan of the equipment.

3.2.45. Consultant's reports

a) Carry out such maintenance, repair and replacement, as listed on the Consultant's reports.

## 3.2. MRL (MACHINE-ROOM-LESS) ELEVATOR

3.2.1. The Work includes:

a) Maintenance, repair or replacement of all of the elevator equipment, whether considered obsolete or not, including the following:

1) Machines, solid state drives, controller parts, relays, brake coils, brake linings, door operating equipment, door equipment, elevator intercommunication system, and other mechanical and electrical parts required for the operation of the equipment.

3.2.2. The Work does not includes:

a) Maintenance, repair or replacement of:

1) Cab finishes (including ceiling lights), handrails (except for attachments on the exterior of the cab), flooring hoistway enclosure, and hall door, sill and frame finishes;

2) Electrical conduit and wiring outside the hoistway and control room.

b) Submit to the Owner proposals for repair or replacement of parts damaged by malicious action of others.

c) Submit to the Owner proposals for alterations and additions required by newly

imposed regulations of the inspecting authorities.

3.2.3. Monthly checks

a) Check the following elements at least once a month:

1) Car ride and general operation;

2) Levelling;

3) Hall and car door operation;

4) Alarm bell;

5) Communication system;

6) Door open button;

7) Door force (maximum of 135 Newtons [30 lb]);

8) Door protective devices;

9) Position indicators;

10) Car operating panel devices.

3.2.4. Quarterly checks

a) Perform the following duties at least once every three months:

1) Clean pits;

2) Clean tops of cars;

3) Clean the motor with vacuum and blower;

4) Check and lubricate the governor tension sheave;

5) Check and lubricate the governor;

6) Check the buffer oil (where applicable);

7) Check compensating chains (where applicable).

3.2.5. Semi-annual checks

a) Perform the following duties at least once every six months:

1) Check the door open pause times to ensure that they are consistent from one car to another in a group;

2) Check the door open pause time cancellation (i.e. monitor) circuit;

3) Check the load weighing devices;

4) Check the governor ropes and lift suspension devices.

3.2.6. Yearly checks

a) Perform the following duties at least once every year:

1) Clean the machine with vacuum and blower;

2) Check the tachometer mechanical drive linkage;

3) Check the tachometer electrical connections;

4) Check rotating electrical equipment connections;

5) Clean the suspension means by washing with soap and water or by such means as recommended by the manufacturer;

6) Remove the covers of the car operating panels and check the internal components and connections;

7) Lubricate and clean car door tracks;

8) Clean control room and control room floor;

9) Check the car door contacts;

10) Check the hoistway door interlocks;

11) Check the car door rollers and eccentrics;

12) Check the car door clutch assembly;

13) Check door operator, clean and lubricate pivot points;

14) Clean guide rails and guide rail fastenings;

15) Vacuum hoistways from top to bottom;

16) Replace the filters on the controller air inlets;

17) Check suspension hitches;

18) Inspect suspension means for wear in accordance with the manufacturer's standards;

19) Check suspension means stretch and remove buffer blocks if required;

20) Clean and check safety mechanism;

21) Perform a safety test and forward to the Owner a declaration certifying the successful completion of the test;

22) Check sheaves and shafts for soundness and wear;

23) Check the terminal slowdown device;

24) Strip, clean and lubricate the brake;

25) Check that the brake stops the elevator with full load in the car from full speed in the down direction with an average decelaration of approximately 0.1g without shock or jar;

26) Check to ensure that the brake holds a minimum of 125 percent of the contract load;

27) Ensure that the brake operates quietly so that no noise can be detected either in the elevator cab, at the top floor landing;

28) If the oil buffers are provided, check the buffer oil levels, check for water in the oil and test the buffers;

29) Check travelling cables for wear;

30) Check hangers and junction box connections;

31) Check guide rail fastenings;

32) Check the speed, acceleration and jerk profiles and if necessary adjust the drive parameters;

33) Measure performance parameters (noise levels, vibration, operating times) and re-adjust if required;

34) Check components and fastenings that under failure might create a dangerous situation (e.g. sheave bolts and welds, gear bolts, car slings etcetera);

35) Submit a report to the Owner confirming that the annual checks have been carried out and listing the items checked and the measured performance parameters.

3.2.7. Motor repair

a) When repairing or replacing a motor:

1) Ensure that the unit has the same characteristics and performance as the original equipment.

3.2.8. Elevator suspension means: replacement

a) When replacing the elevator suspension means:

1) Provide suspension means of size and characteristics to suit the equipment in accordance with the manufacturer's requirements;

2) Ensure that devices are all from one manufacturing run;

3) Provide sufficient removable counterweight buffer blocking to allow adjustment for suspension means stretch without requiring shortening

**END OF SECTION**