

5.15 Elevators

5.15.1 General

5.15.1.1 Guidelines for All Elevator Devices

1. Any deviation to the items in this section are to be reviewed and accepted in writing by FM&D.
2. Do all work in compliance with latest edition of the CSA B44, Safety Code for Elevators including Appendix E (Barrier Free Access).
3. Comply with Alberta Building Code, latest edition.
4. The decision as to the type of elevator equipment provided must be arrived at through a thorough load analysis and traffic study. This study and all of the information used to generate it must be reviewed with the University of Calgary Elevator coordinator before approval of the type(s) and quantity of Electric Elevator that will be used for the particular application. Under-elevating or proposing equipment which must operate at or near its maximum potential is not acceptable.
5. Only elevator mechanical installers, approved by the elevator equipment manufacturer and licenced by all necessary bodies in the province of Alberta are to install elevating devices.
6. Only allow elevator equipment to be installed that can be maintained by any competent and licenced maintenance provider (select non-proprietary equipment).
7. The approved installer is to be experienced in the installation of elevators and is to furnish proof of at least five (5) years experience with elevators similar to these specified for this project.
8. Include selective collective automatic operation of elevating devices.
9. Selected Elevator Contractor to pay all patent licence fees and royalties necessary for the completion of the contract. The UofC shall not be held responsible for infringements of patents of the elevator subcontractor in the completion of his contract.
10. Selected Elevator Contractor to obtain and pay for certificates of approval and all other necessary permits, inspections, and re-inspections, if necessary, due to failure of any elevator equipment.
11. Where practical and subject to approval provide concealed fastenings hidden from public view and designed to withstand normal use.
12. Provide building emergency power to elevators as required by code. Unless required by code for the installation it is acceptable to provide battery lowering for hydraulic elevators.
 - a. Provide an advance transfer signal from the transfer switch to the elevator controller in all cases where building emergency power is used for the elevators. Install four #12 conductors in 19 mm conduit from auxiliary contacts on the transfer switch in the

- emergency switchboard to the elevator controller to signal the elevator controller that the power system is in emergency mode and that retransfer is imminent.
- b. All feeders from emergency power source to the elevator equipment room shall be enclosed in a one hour fire rated enclosure.
13. At the time of final acceptance, arrange with the UofC to provide a seminar for the UofC's staff and delegated representatives.
 14. Include in the seminar a complete review of the documentation, operation of the equipment and demonstration of any special features.
 15. All stainless steel provided is to be brushed finish #4.
 16. Connection to building Fire Alarm for phase 1 and phase 2 recall operation.
 17. Ensure Logbook is available in the machine room and filled out for all calls, repairs, maintenance, and upgrades. The logbook is to be updated and available in the machine room at all times. Provide a copy of the proposed logbook for approval prior to completing the installation.
 18. Install self-leveling feature which will automatically bring car level with floor landings regardless of load or direction of travel. Correct for over-travel or under-travel, independent of operating device.
 19. Maintain car floor level within 5mm of landing floor regardless of load condition.
 20. Provide Firefighters Emergency Operation for all elevators as follows:
 - a. Include recall function (sequential recall of multiple elevators in a group is acceptable in accordance with code requirements) as "Phase 1" operation.
 - b. Include in car operation controls in accordance with code requirements for "Phase 2" operation.
 21. Include governor switch set to trip at no more than 90% of governor tripping speed activated by overspeed in both directions.
 22. Arrange equipment in machine room so that rotating elements, sheaves and other equipment can be removed for repairs or replacement without dismantling or removing other equipment components.
 23. Halfway boxes shall not to be used.

No equipment shall be mounted within the hoistway except that which must be in the hoistway. In no case are auxiliary brakes for unintended motion allowed to be mounted in the hoistway.

5.15.1.2 BMS Monitoring

1. Provide the following alarm points from the elevator controller for use by the U of C BMS:

- a. Elevator independent service
- b. Elevator fire service
- c. Elevator overloaded
- d. Elevator up motion
- e. Elevator down motion
- f. Elevator door lock failure
- g. Elevator failed to start
- h. Elevator normal operation
- i. Elevator door time out
- j. Elevator emergency power

5.15.1.3 Construction Requirements – Work by Other Trades

1. A properly framed and enclosed hoistway. Do not construct front hoistway entrance partition walls until after the hoistway entrance frames and sills are in place. If front partition walls are poured concrete load bearing walls, provide rough openings to accept hoistway entrance frame and infill after the frames and hall call buttons and hall indicators are set in final position. Provide a vertical surface immediately below the finished floor level and flush with the hoistway face of the corridor wall, suitable for fastening of sill support.
2. Access to the machinery space and pit as required by the governing authority and code.
3. Suitable machine room with legal access and ventilation, sealed concrete floor, temperature maintained between 5°C and 35°C with a humidity of up to 95% (non-condensing).
4. Adequate rail bracket supports. Maximum bracket spacing as required by elevator contractor.
5. Provision of rough opening in poured concrete shaft walls to accept hoistway entrance frames and building-in of these frames.
6. Recesses as required to accommodate hall call buttons and signal fixtures.
7. A dry pit, reinforced to sustain normal vertical forces from guide rails and impact loads from buffer and cylinder.
8. A well lit and painted (walls and floor) elevator machine room.
9. Any cutting, patching and painting of walls, floors, or partitions together with finish painting of hoistway and cab entrance doors and frames if specified to be supplied shop primed.
10. Necessary electrical power for lights, tools, hoists, etc. during erection as well as electrical power for starting, testing and adjusting the elevator for correct operation.

11. Holes and access as needed for elevator equipment in floors and walls (e.g. hydraulic cylinders, wire ropes).
12. Venting of the hoistway as required by code and the authority having jurisdiction.
13. All fixed conduits, wiring and fittings for remote systems (telephones, cameras, remote position indicators, intercommunications, alarms, emergency power, etc.) with feeders terminating at the elevator controller in the machine room.
14. Communications equipment (telephone, intercommunications, remote position indicators, alarms, etc.).
15. Floor finish in elevator cabs except aluminum checker plate in service cars to be low flame spread, high commercial traffic, low slip hazard.
16. Division 16 - Electrical service as follows:
 - a. Fused lockable main line switch or circuit breaker for each elevator in the machine room including conduit and conductors from main line switch to controller or starter. Switch to be labeled to indicate source and load (panel, circuit # and load and panel location). Provide an auxiliary disconnect if there is no direct line of sight to the elevator machine from the main line switch.
 - b. Separate 120 V, 15 Amp light and fan supply, for each elevator, in the machine room including lockable switches or circuit breaker and connected to terminal connections on each controller. Switch to be labeled to indicate source and load (panel, circuit # and load and panel location).
 - c. Separate 120 V, 15 Amp car convenience outlet supply, for each elevator, in the machine room including lockable switches or circuit breakers and connected to terminal connections on each controller. Switch to be labeled to indicate source and load (panel, circuit # and load and panel location). Outlet to be the GFCI type.
 - d. Permanent lighting system in the machine room, the pit and the secondary level.
 - e. Telephone conduit, wiring and connections to the controller for the elevator cab.
 - f. Empty conduit for elevator devices located outside elevator machine and elevator hoistway.
 - g. Fire alarm signal wiring to elevator controller(s).
 - h. Security conduit, cable and connections to the elevator controller.
 - i. Empty coax conduit to the elevator controller for a future camera.
 - j. A full set of spare fuses of each type and amperage used.
 - k. Suitable light and GFCI convenience outlets in the elevator pit and the elevator machine room, with light switches located within 457mm of lock jamb side of machine room door.

5.15.1.4 Related Work Specified Elsewhere

1. Section 01500 - Construction Facilities
2. Section 03300 - Cast in Place Concrete (Grouting of sills, equipment bases)
3. Section 04220 - Concrete Masonry Units (Frame infill, etc.)
4. Section 05121 - Structural Steel
5. Section 05500 - Metal Fabrications (ladders, sill supports)
6. Section 07120 - Bituminous Dampproofing (Waterproofing of pit)
7. Section 09651 - Resilient Flooring

5.15.1.5 Elevator Information Submittal Requirements

1. Submit to the UofC/Consultant shop drawings in accordance with Section 01300, Submittals.
2. Provide detailed layout drawings for all areas where elevator equipment is to be installed including:
 - a. All machine room dimensions and component details noting areas where elevator trade work joins that of another trade. Include reaction loads where applicable.
 - b. All hoistway dimensions and component details including weights, reaction loads and required work by other trades to complete the installation
3. Indicate on general arrangement drawings:
 - a. Hoistway entrances and doors showing method of operation, details of construction and method of fastening to structural members of building.
 - b. For the cab design specified show details of construction, fastening to platform, lighting, ventilation and location of car equipment.
 - c. Include catalogue illustrations of vandal proof operating and signal fixtures.
4. Provide equipment data including:
 - a. Description of elevator system's method of operation and control, including group supervisory control system, motor control system, door operation, signals, Phase I, Phase II and Emergency Power Recall sequence of operation and special or non-standard features provided including PVC evacuation testing.
 - b. Parts catalogues giving complete list of repair and replacement parts with cuts, identifying numbers and exploded views of all major components.
 - c. Legible matte faced Mylar schematic wiring diagrams covering electrical equipment as supplied and installed, including changes made in final work, with symbols listed



corresponding to identity or markings on both machine room and hoistway apparatus. Cover one copy in plastic laminate and mount on wall in machine room.

- d. Operation and maintenance requirements of PVC evacuation and pressurization system.
 - e. Lubrication chart, plastic or glass-covered, framed and mounted on wall in machine room.
 - f. Adjusting procedures, settings and other pertinent information on solid state components.
 - g. For solid state portion of the controls, provide lists of replacement boards, logic diagrams, and component lists, and any other technical information requested by the UofC to enable any licensed elevator technician to fully adjust the logic and maintain the system..
5. Provide the UofC with three complete sets of keys for elevator and elevator equipment (other than Best key for independent service).

5.15.1.6 Elevator Use for Construction

1. The UofC reserves the right to refuse use of the elevator for construction purposes (where the UofC has made substantial payments for the elevator) unless and until certain conditions have been met. These conditions are as outlined below:
 - a. If the General Contractor requires the use of the elevator prior to Substantial Performance and Acceptance, it shall be inspected by the enforcing authorities for safety and, if passed, will be taken over by the General Contractor, who will take all responsibility (liability and financial commitments) for the elevator. The General Contractor is to arrange and pay for a third party inspection to document condition of the elevator prior to its use as a construction elevator.
 - b. When this temporary arrangement is terminated the elevator will be put into "as new" condition, by the elevator subcontractor, at no cost to the UofC, before being accepted as substantially complete.
 - c. Temporary use shall have no bearing on the terms of the Warranty, nor upon the period of the Maintenance period included in the main elevator contract.
 - d. The elevator subcontractor is not obligated to provide this temporary service, and any agreement between this subcontractor and the Contractor must cover the elevator subcontractor for costs of Government inspections, any involvement by the UofC / Consultant, the maintenance of the equipment during this period, and all final cleaning and repairs or replacements of damaged or worn parts which are necessary to return the equipment to the "as new" condition.
2. The general contractor shall provide without expense, if required, temporary car enclosures, requisite guards or other protection for elevator hoistway openings, main line switch with

wiring, necessary power, special labor or equipment needed to permit this temporary usage. The general Contractor shall pay for the cost of power and operations.

5.15.2 Elevator Equipment Requirements

5.15.2.1 Fixtures and Finishes

1. All exposed finished metal surfaces are to be stainless steel #4 with a brushed finish.
2. U of C Standard Telephone - AdamsA940P3.
3. U of C Standard independent service key - Best A4 (key and lock supplied by U of C).
4. Provide three sets of keys for each elevator; keys must match existing keys in use at the U of C (list available upon request).
5. Vandal proof pushbuttons in COP and Hall call stations c/w Red LED illumination.
6. The Dupar US100 button or equivalent in vandal resistance is acceptable.
7. Ceiling - Install stainless steel panels to the roof of the cab. No suspended ceilings are allowed unless approved in writing by the U of C.
8. Lighting - Install one light trough on each side of the car cab (total of two light troughs). Wrap the lighting troughs in stainless steel. The stainless steel is to wrap under and on the exposed vertical side of the light source to allow light out the top of the fixture.
9. Handrails shall be provided on all non-access walls.
10. Each car operating panel is to include:
 - a. Pushbuttons to correspond with landings served
 - b. A lockable service cabinet containing switches and key switches for cab light, fan, independent service (BEST A4 with key and lockset supplied by UofC), emergency stop keyswitch, 15A receptacle and hoistway inspection access.
 - c. Engraving shall include car capacity, building name, car number.
 - d. Fire service controls as required by code.
 - e. All switches and keyswitches to meet code requirements for security and be Dupar brand or equivalent.
11. Each hall station is to include:
 - a. Single pushbutton at each terminal landing.
 - b. Two buttons at each intermediate landing.
 - c. Controls for fire service and emergency power as required by code.

5.15.2.2 Minimum Maintenance Requirements

1. Include complete maintenance of elevator equipment for a period of 12 months from date of Substantial Performance.
2. During the twelve month period carry out the following duties in addition to the requirements of a complete maintenance program:
 - a. Once a month:
 - i. Report to the UofC's representative (phone or email is acceptable) to determine if any minor problems have occurred which were not the subject of a call-back. Address any noted issues immediately.
 - ii. Perform the following: Ride elevator and check it for general operation, including quality of ride, quality of door operation, quality of levelling. Check for correct operation of all buttons and door detector. From the cab, check the door operation including the door dwell times and the door open and closing timing. Check the general noise level of the ride and door operation. Take immediate corrective measures where performance is not correct. Check and replace lamps as necessary, in the position indicator and in the call registered lights. Change failed components as required.
 - b. Every Two Months:
 - i. Check all safety circuits for general operation. Check all door interlocks for adjustment. Check governor tension sheave, and lubricate governor.
 - ii. Check the limit and over-travel switches in actual running conditions. Check all roller guides.
 - iii. Check the flight time of the elevator.
3. Repair or replace electrical and mechanical parts of elevator equipment as required due to defect and normal wear and tear.
4. Use only genuine standard parts of product line of manufacturer of equipment.
5. Perform work by competent personnel under supervision and in direct employ of elevator manufacturer or manufacturer's licensed agent. This service shall not be subcontracted.
6. Schedule work during regular trade working hours with UofC.
7. Include 24 hour call-back service due to equipment related problems at all times at no additional cost to the U of C. Response time not to exceed 1.5 hours. Call-backs which are determined to be caused by vandalism shall be recognised as an extra to the contract.

8. Assist the UofC or his representative with a total inspection one month in advance of completion of the one year warranty period. Confirm the proper operation of all components. All deficiencies to be immediately repaired at no cost to the UofC.

5.15.2.3 Elevator Warranty Minimum Requirements:

1. Provide written guarantee signed and issued in name of the UofC stating that the materials and workmanship of the apparatus furnished under these specifications is guaranteed for one (1) year from date that the UofC has exclusive use of the elevator for the purposes intended. This warranty is in lieu of any other warranty thereof, either expressed or implied and whether imposed by law or otherwise. This warranty shall include coverage on or for, but not be limited to, the following:
 - a. Blistering, spalling or peeling of factory applied paint due to improper surface preparation or material application.
 - b. Opening of joints due to improper design or use of ineffective fastening devices.
 - c. Any defects not due to ordinary wear and tear or improper use of all components.
 - d. Repairs, replacement or equipment part failure made necessary by reason of negligence, misuse, accident, or improper or inadequate maintenance, all on the part of the installing contractor.
2. In the event of an emergency failure of any products, materials, or systems during the warranty period, and the issuer of the warranty is unable to or chooses not to respond to a request by the University of Calgary for immediate emergency repair/replacement of the affected items, then the University of Calgary may recover from the issuer of the warranty all costs incurred by the university for the immediate repair/replacement required.

5.15.2.4 Products

1. Use major elevator components from standard product line of one manufacturer unless otherwise approved. These products shall be used unless written permission is obtained from the UofC.
2. Use major components only which have performed satisfactorily together under conditions of normal use in not less than two other elevator installations of similar design and duty and for a period of at least one year. Provide references to confirm this requirement is met.
3. 'Major components' means Controller, Motor, Machine, Cylinder and Plunger (incl. PVC), Power unit, Muffler, Positioning and Door Operator systems.
4. U of C standard products:
 - a. Controllers provided by Otis Canada Inc., ThyssenKrupp Elevator Canada Ltd., Motion Control Engineering.

- b. GAL MOVFR11 door operator
 - c. Door Detector: Janus (Pana40)
 - d. Keys - only keys presently in use at the U of C may be used
 - e. Lamps - only LED illumination may be used
 - f. Position Indicators - 2in. 16 segmented LED
5. Include basic materials as follows:
- a. Steel sheet metal: to ASTM A366-72 cold-rolled sheet, commercial quality: to ASTM A525-77 with wiped zinc coating.
 - b. Stainless steel sheet metal: to CSA G110.6-1968, type 304 with No. 4 finish.
 - c. Stainless steel bars, wire and shapes: to CSA G110.4-1968, type 304 with No. 4 finish.
6. Include manually reset integral overheating protection to CSA C22.2No.77-1976 on motors subjected to elevator service.
7. Use hoisting ropes, installed on any one elevator, from same factory production run.
- a. Hoist ropes shall be traction steel of size, construction and number to ensure proper operation of the elevator and give satisfactory wearing qualities.
 - b. Governor ropes shall be steel.
8. All ropes shall consist of at least eight strand wound about a hemp core center. Use steel compression type fittings where electrical metallic tubing is used. Fittings with set screws are not acceptable unless a separate identified grounding conductor is also installed in raceway. Minimum conduit size to be 20mm (3/4"). Provide the following as it relates to electrical wiring within the elevator system:
- a. Include at least 10% spare conductors and three (3) spare pairs of shielded audio cables in travelling cables and one (1) coax for future camera. These spare conductors to be isolated and tagged as to the location of the other end.
 - b. Do not parallel conductors to increase current carrying capacity.
 - c. Do not use armoured flexible metal conduit as grounding conductor. Provide ground wire.
 - d. Travelling cable shall be continuous from the controller to the C.O.P. 'Halfway' boxes are not permitted.
 - e. Include wiring and connections to elevator devices remote from hoistway (ie: lobby panels).

9. Provide sound isolation between elevator components and building structure where necessary to eliminate transfer of noise or vibration outside of the machine room and hoistway areas.
10. Paint machinery equipment with oil resistant machinery enamel, grey in color, unless otherwise specified. Finish the equipment according to the following, where applicable:
 - a. Free structural parts of rust. Paint with rust resistant paint.
 - b. Thoroughly clean and bonderize or equally prepare steel other components other than stainless steel in baked enamel.
 - c. Apply sufficient number of mineral filler coats, each baked and sanded perfectly smooth, to provide flat even surface.
 - d. Apply heavy coat of baked enamel primer sanded and rubbed smooth.
 - e. Finish in plain colour baked enamel consisting of two colour coats of high grade synthetic material baked on and brought to semi-gloss finish.
 - f. Do not use manufacturing techniques such as spot welding which may cause visual imperfections or visual distortion of exposed stainless steel surfaces.
11. Include means of lubricating bearings, requiring periodic lubrication.
 - a. When used, provide grease fittings which fit same gun.
 - b. Where grease cups are provided, use automatic feed compression type.
 - c. Provide visible and easily accessible lubrication points.
12. Roller guides shall be 6" minimum on passenger cars and 10" minimum on service and freight cars.
 - a. Provide each guide with, durable oil resistant, resilient tired ball bearing rollers running on three finished rail surfaces.
 - b. Do not lubricate guide rails. Maintain each roller on its respective guide in uniform contact with rail surface at all times by means of substantial springs or by resilient mountings.
 - c. Provide guide operation which is inaudible to passengers in car or outside hoistway with car operating at rated speed and car fan turned off.
 - d. Use tire material which will not develop flat spots after standing idle for 24 hours under average environmental conditions.
 - e. Statically balance the car by removing the guide rollers on top of the car and adding the necessary balancing weights to allow the car to float upright without the top roller guide assembly contacting the guide rails.
13. Include car platform as follows:

- a. Fabricate car platform of two layers of wood flooring supported on structural steel framing. Provide sheet steel sheathing at underside of steel framing.
 - b. Provide threshold plate of aluminum to ASTM B221-76 alloy 6351-T6.
14. Design floor to accept the specified flooring, flush with sill, with minimum fastenings and with securely held front edge. Refer to Section 09651, Resilient Flooring, for details.
15. On service and freight type cars the elevator manufacturer shall include and install the aluminum checker-plate floor (minimum 6mm (1/4") thick).
16. Include passenger car enclosure as follows:
- a. Car Enclosure: fabricate car enclosure on 3 sides of minimum 1.9mm thick steel, smooth and free of defects, with spaces between and adjacent to removable panels finished in stainless steel. Construct of one piece panels from floor to soffit, securely bolted together and to adjoining members with light proof joints and reinforced to provide rigidity.
 - b. Wall Panels: install removable panels retained securely with hidden fastenings. Allow for removal of panels from inside car. Trim edges of wall panels with stainless steel and provide stainless steel reveals.
 - c. Ceiling: install brushed stainless steel ceiling panels to roof of cab. Suspended ceilings are not acceptable. Provide two stainless steel light troughs along the sides of the cab. Provide perforations in ceiling on four sides to allow air to circulate as car travels through hoistway.
 - d. Lighting: include surface mounted fluorescent ceiling lighting using rapid start, electronic high power factor ballasts, sound rated 'A'. Design for illumination of 215 lux maximum measured 0.75m above floor and 50 lux minimum at car sill with doors open or closed. Totally enclose and conceal wiring and ballasts from view within the car. Fixture shall be complete with vandal proof polycarbonate lens with mechanical fastening; Lumark RW Linear by Halo or approved equal.
 - e. Front Return Panels: fabricate front return panels and entrance columns of integral stainless steel.
 - f. Ventilation: by an exhaust air handling unit through ceiling and through concealed perforations at base. Limit fan noise to 55 dB on "A" scale of General Radion Sound Level meter type 1551A from reading 0.9m above floor with fan on high speed. Mount air handling unit on top of cab and effectively sound isolate system from cab to prevent transmission of vibration to cab structure. Include two speed operation of ventilation system. Fan to start when activated by car hall call.
 - g. Base and Recesses: finished in stainless steel , located under removable panels on two sides and back. Base height 150mm.
 - h. Cab Doors: 1.6mm thick Type 304 #4 satin finish stainless steel, flush face construction, 32mm thick, rigid core, seamed and sealed edges, suitably reinforced to receive

- operating mechanism and to withstand all strains of power operation. Provide clear car entrance height of 2.1m.
- i. Operating Panels: one flush mounted vandal proof operating device in car with stainless steel face plate as described in Clause 1.5.1.1. Panel shall be reviewed and be approved by U of C prior to fabrication/installation. Provide Dupar vandal resistant controls or equal.
 - j. Car Flooring:
 - i. Passenger cars - allow for 2mm thick sheet vinyl flooring as specified in Section 09651, Resilient Flooring
 - ii. Service and freight cars - include 6mm / ¼ inch thick aluminum checker plate flooring, one-piece where practical, maximum three piece.
 - k. Car top mounted emergency light and alarm unit with battery back up.
 - l. Emergency Exit: provide an emergency exit of a suitable size equipped with an electrical device which prevents operation of the elevator if the cover is open more than 50mm and so designed that it can be opened only from the top of the cab, and which must be manually reset from the cab top after the cover is within 50mm of the fully closed position.
 - m. Cab Top Inspection: provide a cab top inspection station with in "inspection" switch, and "emergency stop" switch and with constant pressure, "up - down" direction buttons which shall make the normal operating devices inoperative to permit operation of the elevator for inspection purposes. Panel shall be complete with 15 amp power receptacle and light switch, light socket and protective lamp cages.
 - n. Furnish 200mm wide stainless steel handrails on three sides of cab with ends returned close to panels and removable from inside car. Set top of handrail at 810mm above floor with 40mm clearance between rail and wall panels.
 - o. Capacity Plate: provide a capacity plate permanently secured in place in a conspicuous place inside the cab indicating the rated load of the elevator.
 - p. Data Plate: locate on the cab crosshead or, if there is no crosshead, inside the cab. Permanently secure using mechanical fasteners. Indicate on data plate, cab weight, rated load and speed, wire rope data, manufacturer's name and date of installation.
 - q. Provide and install monitoring connections, as outlined in the U of C BMS – Hydraulic Elevator monitoring points list, for remote monitoring to indicate elevator power status and car operation status. Must connect to the U of C BMS system.
 - r. Use bolts fitted with washers and lock washers and fabric separators, or other means to eliminate squeaks and metallic sounds.
17. Include two-point suspension door hangers for each door panel with resilient sound absorbing wearing surfaces and replaceable hanger tracks.

- a. Use ball or roller bearings sealed to retain grease lubrication and wipers to maintain rollers and track in clean condition.
 - b. Absorb up thrust with adjustable eccentric rollers equipped with ball or roller bearings.
 - c. Design for replacement of gibs without removing door from hanger tracks.
 - d. Use top and bottom door retainers to limit the ability of the hoistway doors to be removed or knocked off inadvertently by excessive force.
18. Construct doors with stainless steel skin on lobby side of all floors.
- a. Reinforce hall doors to receive attachments and to withstand strains due to power operation.
 - b. Include sight guards.
 - c. Provide 100mm high reflective numbers on the hoistway side of all hall doors.
19. Construct door entrance frames for all floors of stainless steel 1.9mm thick Type 304, #4 finish, brake-formed to required profile combining rough buck, jamb and casing in one piece bolted construction.
20. Include extruded aluminium sills with anti-slip wearing surfaces to ASTM B221-74 alloy 6351-T6.
- a. Grout sills in position providing up to 50mm in thickness as required.
 - b. Include sill supports, where required and design for class of loading.
 - c. Do not use exposed fastenings.
21. Include emergency lighting in each car as follows:
- a. Use battery operated emergency lighting equipment, to CSA C22.2No.141-1972, to provide general illumination in car and 10 lx minimum illumination at operating panels and telephone cabinet for 4 h minimum.
 - b. Include means for convenient manual operation and testing of each unit from within car.
 - c. Design battery unit of sufficient strength to support 90kg person without causing malfunction or damage.
 - d. Include means of containing any leakage or spillage of electrolyte.
 - e. Battery to be located on the car top with install date labelled on battery.
22. Provide a position transducer device to transmit to the control system the position of the elevator.
- a. Arrange that the device transmit a minimum of 10 counts per inch of travel.



- b. Provide a device having an overall accuracy of +/- 5mm (0.2 inches) or better.
 - c. Arrange the elevator controls so that the output from this device is read at least every 200ms and at least every six inches of travel.
 - d. Transmit the signal from this device either in serial RS232C format or in parallel format using low impedance (less than 10 kilohms) inputs.
 - e. If the transducer is a relative (pulse counter) type rather than an absolute encoder type provide grey encoding so as to indicate the direction of movement of the car and to offset 'false' counts caused by vibration. In the event of a counter error, reset the position with an accuracy of not less than +/- 0.1 inch by returning the car at low speed to a fixed point in the hoistway.
 - f. Design the device so that the parts are readily accessible for adjustment.
23. Where computing devices are used, such as micro-processors or mini-computers, along with associated devices, design to the following requirements:
- a. 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.
 - b. Provide the control program on read-only memory with spare capacity to allow for future programming modifications and extensions.
 - c. Provide crystal regulation of frequency.
 - d. Provide for separate regulated power supplies to serve each micro-processor system.
24. Mount solid-state devices, except for high power silicon controlled rectifiers and rectifiers on removable printed circuit boards.
- a. Gold plate the contact points of edge connectors.
 - b. Use G10 glass epoxy with minimum equivalent 2 ounce copper.
 - c. Coat the circuits with tin-lead.
 - d. Provide a solder resist screen.
 - e. Provide plated through holes for double sided boards.
 - f. Make all connections to the printed circuits on the printed circuit boards by means of properly dimensioned pads.
 - g. Do not provide "patched" connections.
 - h. Design solid-state devices for a high level of noise immunity.
 - i. Incorporate electrical noise suppression devices in the power supplied and the inputs and outputs associated with the solid-state circuits.

5.15.2.5 Operational Requirements:

1. Include automatic emergency power operation for all elevators as follows:
 - a. Provide an advance warning signal to indicate when power switches from main (normal) supply to Standby (emergency) supply, or when switching back to normal power. Alternately, when switching back only, provide a suitable time delay between the interruption of standby power and the return of main supply.
 - b. Automatically start and return one elevator at a time to main floor at rated speed if there is failure of normal power supply and park with doors open with exception of cars that are out of service.
 - c. After all cars have returned to main floor, retain preselected car on emergency power operation.
 - d. Provide selector switch in central control room arranged for restricted use by authorized persons only marked 'Emergency Power' in sixteen point red lettering to override automated operation after all cars have been returned to street floor level.
 - e. On return of normal power supply, arrange for all available elevators to be returned automatically to normal operation.
2. Provide 'Phase I' recall and alternate floor recall as required by local authorities. Confirm with U of C Elevator coordinator and to obtain job-specific details.
3. Provide 'Phase II' firefighter's operation as required by local authorities. Include independent service to allow removal of a car from automatic service and to operate independently in response to car calls only and as follows:
 - a. Open doors automatically upon arrival
 - b. Render door protective devices inoperative.
 - c. Render hall signals inoperative.

5.15.3 Hydraulic Elevators – Service & Passenger**5.15.3.1 Cylinder and plunger for jacks**

1. Only direct acting holeless or direct acting buried hydraulic cylinders are permitted. Each plunger shall be manufactured of selected steel tubing machined true and finished to surface finish of 0.0008mm roughness height rating or better. Telescopic plungers are not acceptable.
2. At top of cylinder include stuffing box and packing gland with seal or self-adjusting packing which does not require external adjustment.

3. Include means to automatically return oil which leaks past packing, to storage tank. Filter oil if exposed to atmosphere.
4. Include safety bulkhead on cylinder to rule 302.3g of ANSI A17.1.-1971.
5. Design and install cylinder and plunger plumb and to allow operation with minimum friction.
6. Do not use a plunger follower guide.
7. All hydraulic elevators with buried piping or cylinders must have a sealed PVC encasement surrounding all buried sections of piping or cylinders.
 - a. There must be a positive means of confirming the presence of water in the sealed PVC encasement.

5.15.3.2 Pumping unit

1. Design pump and motor to be installed outside of the hydraulic tank.
2. Reduce airborne noise with sound deadening material on inside of enclosure.
3. Provide swing panels or panels equipped with quick release fasteners for convenient access to parts of equipment requiring adjustment.
4. Use positive displacement screw-type pump, with direct connection between drive motor and pump through flexible coupling, specially designed for quiet service.
5. Install oil tight drip pan beneath unit to retain leakage of hydraulic fluid. Provide drain plug in accessible location.
6. In machine room located on exterior walls, install thermostatically controlled heaters or other means to maintain fluid viscosity within limits necessary to provide consistent, reliable operation at all times. Install thermostatic protection of oil temperature in reservoir where pump or motor is submerged in reservoir.

5.15.3.3 Motor

1. Do not exceed EEMAC design B locked rotor current.
2. Design for minimum locked rotor torque of 150% and minimum breakdown torque of 200% at normal voltage.
3. Provide data plate on motor showing motor connections.
4. Where reduced voltage starting is provided, switch to full voltage not more than 1.5 seconds after interlock circuit is established.
5. Limit starting current of elevator motor to not more than 4 times full load running current.
6. Include class B motor insulation.

7. Include manually reset integral overheating protection to CSA C22.2 No.77-1976.
8. Size motor and pump to be rated for 80 starts per hour minimum.
9. Minimize transmission of fluid pulsations in pipeline between pumping unit and cylinder head with blow-out proof muffler.

5.15.3.4 Piping

1. Use threaded couplings or mechanical couplings which mechanically prevent separation of adjoining members.
2. Welding is permitted providing interior of pipe is thoroughly cleaned after welding or where welding method prohibits introduction of foreign material into interior of pipe.
3. Provide sound isolation couplings in pipeline between pump and cylinder.
4. Locate piping where it can be serviced.

5.15.3.5 Oil storage tank

1. Provide oil storage tank capacity equal to volume of oil required to lift elevator to top terminal plus reserve of not less than 45 litres.
2. Clearly indicate minimum permissible oil level.
3. Include gauge glasses to indicate oil level if top of tank is more than 1200mm above floor level.

5.15.3.6 Low oil control or high oil temperature

1. Provide low oil control feature designed to automatically cause up-travelling car to descend to lower terminal landing if reservoir oil level is insufficient.
2. Arrange control so that the oil reservoir is refilled before elevator can be returned to service.
3. Open car and hoistway doors automatically at lower terminal landing. De-activate control buttons in car operating panel, except door-open button, and close hoistway doors.

5.15.3.7 Cylinder protection

1. Protect cylinder against corrosion including chemical and electrolytic corrosion with installation of a PVC encasement around all buried cylinder sections.
 - a. Provide a means to monitor the space between the PVC liner and the cylinder and to evacuate any contaminants from the interior of the PVC liner.
 - b. Provide a twenty (20) year written guarantee on the hydraulic cylinder assuming proper maintenance and testing of the space between the PVC liner and the cylinder is completed according to manufacturer's instructions.

5.15.4 Electric Elevators – Service & Passenger

1. General Include compensating ropes with guided and weighted tension sheave and frame in pit to compensate weight of hoisting ropes and traveling cables for travel greater than 100 feet.
2. Provide counterweight of structural or formed metal frame type with metal filler weights equal to the mass of complete car and approximately 45% of the rated load.
3. Provide extended toe guards for all units. The toe guard(s) shall be 1220mm (4'-0") minimum in height.
4. Design circuitry with redundant systems to fail safe.
5. Use automatic closed loop control system.
6. Automatically re-start equipment which has stopped due to ac power failure.

5.15.4.2 Motor

1. Include direct current or AC reversible type motor designed for elevator service as follows:
 - a. Conform to most current NEMA Standards.
 - b. Impregnate windings with insulation and bake to prevent absorption of moisture and oil. Include overtemperature sensors in the windings.
 - c. Provide not less than one mega-ohm insulation resistance between motor windings and motor frame.
 - d. Arrange end of motor shaft to receive crank or provide other similar means to permit turning motor shaft by hand. Supply one crank or other means for this purpose and protect end of shaft during normal operation by means of removable cover.

5.15.4.3 Solid state feedback speed control

1. Provide a closed loop negative feedback control system.
2. Include in the system the following features:
 - a. A pattern generator to give a velocity input signal modified by position with constant peak acceleration and constant peak change of acceleration;
 - b. A digital or analog tachometer generator to provide a velocity feedback signal;
 - c. A digital transducer to provide a position feedback signal;
 - d. A current transformer to provide a current feedback signal.
3. Provide the following safety devices:

- a. Means to stop the elevator in the event the error exceeds five percent of the signal.
 - b. Means to stop the elevator in the event the acceleration exceeds the normal acceleration by more than fifteen percent.
 - c. A circuit to cut off power in the event of excessive power module switching time.
 - d. Means to cut off power in the event of overheating of the solid state components.
 - e. 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 integration of the velocity feedback signal.
4. 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.
 5. Provide protective devices so arranged that any one fault will not cause risk of injury to the passengers.
 6. 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.

5.15.5 Wheelchair Stair Lift

5.15.5.1 General Requirements

1. Do platform lift work to CAN/CSA B355, local codes and regulations except where specified otherwise. Arrange and pay for all required tests and inspections.
2. Installer's qualifications: Installation shall be carried out by manufacturer's approved installers.
3. Acceptable manufactured wheelchair stairlift units:
 - a. Garaventa (Canada) Ltd.
 - b. Savaria

Revision History

Revision Date	Version	Description
Feb 2014	1.0	Baseline version
August 10, 2023	1.0	Added Revision History table to end of document and reset to Version 1.0.