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# APPENDIX C - ELEVATORS

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The following outline specifications supplement BSRV 6.2 ELEVATORS, and are to be incorporated into specifications for new and replacement hydraulic elevator work contracted by the University of Virginia.

## C.1 GENERAL REQUIREMENTS FOR ALL ELEVATOR INSTALLATIONS

Under no circumstances will manufacturers or suppliers of proprietary equipment, systems, or software, other than those specifically noted in this Appendix, be accepted. The requirements of this appendix shall apply to both new construction projects and to the modernization of existing elevators. The A/E is encouraged to consult with the Elevator Department Manager by arrangement with the Project Manager. Compliance with requirements for non-proprietary components is mandatory and essential for the safe and expedient operation and maintenance of elevators throughout the University. Recommendations may include proven manufacturers to be included in specifications.

The following types of elevators shall not be installed without written approval from the Elevator Department Manager:

- Machine room less (MRL) type elevator machinery, controls, related equipment.
- (Underslung elevators) Elevators that have sheaves mounted under the elevator for hoisting purposes.
- Traction elevators that utilize a basement machine installation.
- Roped Hydraulic elevators.
- Two-stage and three-stage hole-less elevators, including the inverted type.

### C.1.1 GOVERNING CODES

All work shall be comply with VUSBC and ASME A17.1. Electrical work shall conform to NFPA – 70. Smoke and heat detector installation shall comply with NFPA – 72. In the performance of the work all personnel shall comply with all VOSHA safety regulations as well as with all specific safety regulations required by the University. Installations must adhere to all requirements noted in this Appendix, in addition to complying with the governing codes.

### C.1.2 ELEVATOR MACHINE ROOM REQUIREMENTS

1. An elevator machine room must be provided for each individual elevator or elevator group. The elevator machine and controller must be located in the elevator machine room.
2. For facilities not located in a flood zone, locate hydraulic elevator machine rooms on the lowest landing served by the elevator. Electric traction elevator machine rooms shall be located above the elevator hoistway.
3. When possible, locate machine room and hoistway on the same side of any building expansion joint and adjacent to the elevator hoistway.
4. Design all machine beam support with hoistway wall beam-pocket construction.

5. In traction elevator machine rooms, install a beam above the elevator machine and motor that is sufficient in size and capacity to support the removal of elevator equipment.
6. Size and configure the elevator machine room so that there is a minimum clearance of 18" between any building component and a traction elevator drive machine.
7. Size and configure the elevator machine room so that there is a minimum clearance of 12" between any building component and an over-speed governor.
8. Size and configure the elevator machine room so that there is a minimum clearance of 6" between any building component and a hydraulic elevator pump unit.
9. A stairway with a maximum inclination of 45° must be provided for vertical access to an elevator machine room. Vertical ladders, ship ladders, and alternating step-tread designs must not be used for access. Steps must be designed with a maximum riser height of eight inches (8") and a minimum step-tread depth of 8" as measured from each adjoining step, nose to nose. The height of the access stairs may not exceed a rise of 10' without an intermediate landing.
10. Elevator machine rooms shall not be used for access to roofs or other parts of the building unless elevator equipment is fenced or walled.
11. Provide a proper means for elevator machine equipment to be removed or replaced. If equipment cannot be removed easily without dismantling the machine or motor, an access trapdoor or other similar means shall be installed for equipment removal.
12. Machine room walls shall be painted bright white, and floor to be painted with high gloss epoxy, light gray paint.
13. Proper heating/cooling shall be provided to meet operational requirements of equipment and maintain elevator machine rooms at a maximum of 76° F.
14. HVAC equipment shall not be located above elevator equipment.
15. Air conditioning condensate lines must drain to a location outside of the elevator machine room and hoistway.
16. Locate the elevator disconnecting means on the wall inside the machine room, on the strike jamb side of the door, within sight of the elevator equipment that it controls. Provide a Lockable shunt trip, breaker type over-current disconnect. The disconnect must be properly labeled to the identifying number of the driving machine that it controls and have proper signage that identifies the location of the supply side over-current protective device.
17. When a hydraulic elevator is installed and equipped with auxiliary power lowering operation, the main line disconnect must be designed with an auxiliary contact to prevent automatic lowering operation when the mainline disconnect is in the open position.
18. Provide a Lockable disconnect switch with breaker type over-current protection for car lighting, located on the wall inside the machine room, on the strike jamb side of the door. The disconnect must be properly labeled to the identifying elevator that it controls and have proper signage that identifies the location of the supply side over-current protective device.
19. The machine room lighting shall not be equipped with automatic controls.
20. A minimum of two 2 tube, 4', T8 LED lighting fixtures shall be installed for the elevator machine room lighting. Provide proper protection against bulb breakage/damage.

### **C.1.3 ELEVATOR HOISTWAY REQUIREMENTS**

1. For multiple elevators in the same hoistway, provide divider beams for guide rail support brackets.
2. Provide a lifting beam at the top of the hoistway for each elevator for the installation of elevator equipment.

3. Hollow concrete block, if used, must be filled solid with concrete or grout.
4. Install proper lighting with a 3-way switch located at the pit ladder and adjacent to the opening jamb of the top hoistway door inside the hoistway. Vertically install 2 tube, 4', T8 Led lighting fixtures and mount them on the side hoistway wall, centered on the door headers at each landing. In the case of multiple hoistways, there shall be a 3-way/4-way switch mounted beside each bottom or top hoistway door opening, inside the hoistway.
5. All conductors and optical fibers in the hoistway, except traveling cable, must be in conduit or liquid-tight flexible metal conduit.

#### **C.1.4 ELEVATOR PIT REQUIREMENTS**

1. Provide continuous, non-slip, horizontal rungs every 12" for the full height of the pit ladder.
2. All elevator hoistways must be equipped with a sump pit located at the rear of the elevator pit. Metal grating shall be installed over the hole that sits flush with the pit floor.
3. Elevator pits for hydraulic elevators shall have sump pits for use of a portable sump pump by Facilities Management personnel. Drainage from the elevator pit shall not be connected to any building drainage or sewer system.
4. For the modernization of existing facilities that are not equipped with a sump pit, the sump pit is not required to be installed
5. Provide a water sensor in sump pit to detect any fluid that may accumulate and send an alarm signal back to Facilities Management Systems Control.
6. Provide a single non-GFCI receptacle located at the pit ladder, above elevator sill height, for evacuating fluid from the elevator pit.
7. When a sump pump is necessary on hydraulic elevator installations, it must be designed with a sump pump oil sensing control system to allow water to be pumped out without pumping oil/hydraulic fluid from the elevator hoistway pit. The sump pump control system must include an audible alarm and visual indicators for water and oil. The alarm indicators and controls must be installed in the elevator machine room.

#### **C.1.5 ELEVATOR FIRE PROTECTION REQUIREMENTS**

1. Smoke detector at pit level for Hydraulic elevators.
2. Smoke detectors in machine room.
3. If sprinklers are provided, locate heat detectors within 24" of sprinkler head.
4. To prevent people from being trapped in an elevator when power is automatically disconnected, a pre-action system shall be installed with the controls necessary to accomplish the following: Heat detectors shall provide a signal to initiate Phase 1 Fireman's Service Emergency Recall Operation. Provide an elevator travel time delay, equivalent to the elapsed time for an elevator to travel from its farthest stop to the designated recall level plus ten seconds before power to the elevator equipment is disconnected and pre-action sprinkler is activated. (Elevator Travel Time Delay = the time for an elevator to close its doors, under Phase I conditions, return to the designated recall level and open its doors. If there are multiple elevators, the elevator having the greatest travel time shall be used in determining the time delay.)
5. Pre-action system with timer shall be furnished and shall be located outside of the elevator machine room.
6. Provide a type ABC-10lb fire extinguisher mounted on the elevator machine room wall, adjacent to the entrance.

### **C.1.6 ELEVATOR EQUIPMENT AND COMPONENTS**

1. **Guide Rails:** T-section type guide rails must be used for all car and counterweight guide rails.
2. **Roller Guide Assemblies:** Install and adjust guide assemblies to provide a smooth, quiet ride, and to limit lateral movement of the car or counterweight within the rails. Furnished by ElSCO, Inc.
3. **Car Door Operator:** The type shall be MOVFR and shall be furnished with adjusting tool. Door operator shall be furnished by GAL Mfg. Corporation.
4. **Car Door Restrictor:** Shall be furnished by GAL Mfg. Corporation.
5. **Hoistway Sills:** For every landing, a one-piece nickel-silver, stainless-steel, or nickel-bronze entrance sill must be installed. The top of the landing sill must be flush, within 1/16" with the top of the finished floor. The same material and design must be used for all hoistway landings and elevator cab entrance sills.
6. **Hoistway Door Equipment:** Escutcheon tubes shall be installed on all hoistway doors for emergency access and top and bottom retaining devices shall be provided on all doors. All door equipment shall be manufactured by GAL Mfg. Corporation.
7. **Hoistway Access Switches:** Provide hoistway access switches at the top and bottom landings. Switches shall be the key-operated type, continuous pressure, and spring return with key removable only in the "off" position.
8. **Traveling Cables:** Provide a minimum of seven shielded pair wires to accommodate future security options.
9. **Landing Control System:** The landing control system shall be provided by Motion Control Engineering (MCE), G.A.L. Mfg. Corporation, or SmartRise Engineering, Inc.
10. **Elevator Controller:** All control equipment shall be provided by Motion Control Engineering (MCE), G.A.L. Mfg. Corporation, or SmartRise Engineering, Inc.
11. **Electronic Door Detector:** A Tri-Tronics Edge 4 electronic door detector shall be installed
12. **Lift-Net:** Lift-Net is provided by Integrated Display Systems, Inc and shall be installed and operational.

### **C.1.7 ELEVATOR CAB**

1. All illuminating fixture components must utilize LED lighting for energy efficiency
2. Pads and hooks conforming to the following shall be provided: Pads shall be fire resistant quilted vinyl, provided for all interior cab walls, and the protective pads hooks shall be #4 brushed stainless steel and permanently mounted at the sides, rear and fronts of the car enclosure.
3. Provide handrails on top of car where necessary to protect workers from the excessive distance from top of car to shaft walls.
4. Provide car top inspection station complete with light and GFCI protected outlet.
5. Interior elevator cab panels that utilize adhesives for mounting/installation shall not be permitted.

6. In Health System buildings that have non-tile flooring installed, install 1/8" metal sheet on top of plywood sub-floor to increase floor wear.

## **C.1.8 ELEVATOR FIXTURES**

All fixtures and devices must be engraved to identify function and operation instructions, and back-filled with a contrasting color. All fixture voltage is to be 24vdc and fixtures shall be provided by PTL Elevator Equipment or Innovation Industries, Inc. The use of digital/touch-screen type fixtures will be considered with the approval of the Elevator Department Manager.

### **C.1.8.1 CAR OPERATING PANEL**

The car operating panel shall be vandal-resistant and comply with all ADA requirements, and have LED car position indicators as an integral part of the panel assemblies. **The car-operating panel shall be mounted so that no button shall be higher than 48" above the finished floor. Emergency controls, including the emergency alarm and emergency stop, shall be grouped at the bottom of the panel and shall have their centerlines no less than 35" above the finished floor.**

As part of the car operating panel also provide the following wording etched into the main panel:

1. Elevator Inspection Certificate Can Be Obtained From UVA Facilities Management
2. Elevator capacity pounds
3. Phase II operating instructions
4. No smoking

Behind a locked service panel shall be the following:

1. Toggle type cab lighting on/off switch
2. Toggle type two-speed cab fan on/off switch
3. Key operated "Hoistway Enable" switch for Hoistway Access Operation
4. Key operated "Independent Operation" switch
5. Push button to test Emergency Car Lighting operation
6. 120vac GFCI duplex receptacle
7. The fixtures shall be provided by PTL Elevator Equipment or Innovation Industries, Inc. If the fixtures are provided by PTL, the C.O.P should be fastened using three cam locks that use PTO1 Northeast key.

### **C.1.8.2 CAR POSITION INDICATOR**

The indicator shall be installed as an integral part of the car operating panel assembly and utilize LED lighting.

### **C.1.8.3 HALL LANDING FIXTURES**

1. All elevator hall call fixtures must be flush mounted and engraved with the ASME A17.1 “Elevator Corridor Call Station” pictograph. Pictograph must be engraved and backfilled with a contrasting color.
2. Elevator call buttons must be vandal resistant.
3. Phase I instructions shall be engraved on the station at the designated landing, and a fireman’s service Phase I key switch provided.

#### **C.1.8.4 HALL POSITION INDICATORS**

Direction position indicator and directional arrows shall be integrated into the hall button fixtures at each floor.

#### **C.1.8.5 FIREFIGHTERS EMERGENCY OPERATION**

Firefighter’s Emergency Operation shall be provided in compliance with the latest revision of the ASME/ANSI A17.1 and Phase 1 and Phase 2 operating instructions must be engraved and backfilled with a contrasting color.

#### **C.1.8.6 CAR TRAVELING LANTERN**

The car-traveling lantern shall be installed to comply with ADA requirements.

#### **C.1.8.7 EMERGENCY CAR LIGHTING**

An emergency power unit employing a six-volt sealed rechargeable battery shall be provided to illuminate the elevator car and provide current to the alarm bell in the event of power failure. This lighting shall be provided as an integral part of the car operating assembly

#### **C.1.8.8 BRAILLE JAMB PLATES**

Provide and install zinc die-cast raised Braille jamb plates on both sides of the hoistway entrance frame at each landing. Securely fasten the plates using tamper-proof fasteners (adhesive shall not be the primary attachment means for the jamb plates).

#### **C.1.8.9 ELEVATOR EMERGENCY PHONE**

A hands-free ADA compliant telephone shall be provided as an integral part of the operating panel assembly. The telephone shall be built into the car-operating panel, with a clearly identified button provided for telephone activation. This button shall be located so that there shall be no confusion with door open, door close, or emergency alarm buttons. Phone shall be furnished by Talk-a-Phone Co.

#### **C.1.8.10 EMERGENCY HOSPITAL SERVICE**

When required, new controllers shall be provided with emergency hospital service and USE #4 key switches shall be installed. Key switches for hospital emergency service shall be provided at all floors and be the spring-return type. The key switch inside the elevator shall be the on-off type and all key switches shall be removable in the off position only.

#### **C.1.8.11 ELEVATOR KEYS**

All elevator keys shall be provided by PTL Elevator Equipment or Innovation Industries, Inc. Fire service switches shall be operated by a FEOK1 key.

### **C.1.9 FINAL ACCEPTANCE**

Include the following statement in elevator specifications:

“As a part of final acceptance of the project and in accordance with the contract general conditions, the contractor shall have a qualified elevator inspector (QEI) conduct a full acceptance inspection and test in accordance with ASME/ANSI A17.1 before final acceptance by the owner. The contractor shall obtain from the elevator contractor and/or manufacturer and furnish to the owner all data affecting the elevator installation or modification, including ‘as-installed’ circuit and control wiring diagrams and maintenance manuals.”

Any equipment that receives technical bulletins, software updates, and manufacturer directed engineering modifications, etc. must be included and/or shared with the University as this information becomes available for the lifetime of the equipment.

#### **C.1.10 TECHNICIAN TRAINING**

Provide instructions and training for the owner’s “Operations and Maintenance” personnel in the proper operation and maintenance of the equipment and related controls provided or altered in the work. The construction project shall provide a line-item elevator training allowance of \$1,200 to be used by the Elevator Department to attend off-site elevator equipment training.

#### **C.1.11 PROJECT CLOSE-OUT**

Upon completion of the installation, the Contractor shall provide the following:

1. Two complete hard copy sets and one electronic copy of all Adjuster manuals, user’s manuals, maintenance manuals, logic diagrams, computer software, access codes, password, wiring diagrams, electrical drawings, drive manuals, and all other materials required for on-going maintenance and use of the system.
2. If required, interface tools may be hand held or built into the control systems and shall function for the lifetime of the equipment without recharging or reprogramming. Contractor shall provide any special tools, prints and technical operation of equipment that cannot be obtained from multiple suppliers to the University upon completion of the project. Specifications shall be explicit that all tools, adjusters, manuals and schematic wiring diagrams

become the property of the University to be used at their discretion related to installed elevators.

### **C.1.12 WARRANTY AND MAINTENANCE**

All equipment shall carry a warranty period of one full year from the date of the University's acceptance. Defects or equipment failures occurring during that one year period shall be promptly corrected at no cost to the University. The contractor shall provide one full year of complete maintenance service as part of this warranty. This service shall include monthly maintenance inspections and emergency call-back service 24 hours a day, seven days a week. A fire service check chart will be kept in the machine room and fire recall will be tested once a month and recorded on this chart.

The service technician will be required to check in with the elevator maintenance supervisor and to check out leaving a copy of the time sheet showing all work performed.

Prior to the end of the warranty period, the elevator contractor shall readjust the elevator as required to meet all performance parameters specified. A written report shall be submitted by the elevator contractor to the University Elevator Manager.

## **C.2 REQUIREMENTS FOR TRACTION GEARED/GEARLESS ELEVATORS**

Traction-type elevators shall have machinery located overhead.

### **C.2.1 HOIST MACHINE**

1. The elevator hoist machine, including hoist motor and assembly, must be located within the elevator machine room.
2. Provide an AC hoist motor that is properly sized to meet the speed and capacity requirements of the elevator service.
3. Machine, sheaves, and motor to be furnished by Hollister Whitney Elevator Corporation.

### **C.2.2 HOIST ROPES**

Only stranded steel wire rope may be used for elevator suspension and counterbalance. Aramid fiber ropes, coated steel ropes, and non-circular coated steel belts shall not be used for elevator suspension and counterbalance without written approval from the Elevator Department Manager.

1. All elevator ropes/cables shall be elevator traction grade, pre-stretched and pre-formed, fiber core, right hand/regular lay, and fastened with shackles using wedge sockets. Springs and bushings shall be installed on the car shackles.
2. The elevator contractor shall include any necessary shortening of ropes during the warranty period. It will not be permitted to run up the nuts on the shackles for this shortening.
3. All hoist ropes shall be tensioned at least once before the warranty period is over.
4. The minimum diameter of hoisting and counterweight ropes shall be 3/8").



5. Ropes shall be Bethlehem Wire Rope, manufactured by Wire Rope Works, Inc.

### **C.2.3 OVERSPEED GOVERNOR/SHEAVES/SAFETIES**

1. Only stranded steel wire rope may be used for over-speed governor applications.
2. All equipment to be furnished by Hollister Whitney Elevator Corporation.

### **C.2.4 EMERGENCY BRAKE**

1. The emergency brake shall be designed to decelerate the car by acting directly on the elevator hoist ropes.
2. Furnished by Hollister Whitney Elevator Corporation.

### **C.2.5 CONTROLLER REQUIREMENTS AND COMPONENTS**

The controller shall be a fully programmable microprocessor based controller that provides selective collective simplex operation. All field controller and drive parameters shall be documented and given to Elevator Department Manager. All control equipment shall be provided by Motion Control Engineering (MCE), G.A.L. Mfg. Corporation, or SmartRise Engineering, Inc.

#### **C.2.5.1 CONTROLLER REQUIREMENTS**

1. The car shall not be permitted to start or run if any hoistway door or gate interlock is unlocked or if any hoistway door, car door or gate contact is not in the made position due to the following:
  - Failure of any single magnetically operated switch, contact, or relay to release in the intended manner
  - Failure of any static control device, speed measuring circuit, or speed pattern generating circuit to operate as intended
  - The occurrence of a single accidental ground or short circuit
2. While on car top inspection, the car shall not be permitted to start or run even if any hoistway door lock or car door contact is in the closed or made position due to the following:
  - Failure of any single magnetically operated switch, contactor or relay to release in the intended manner
  - Failure of any static control device to operate as intended
  - The occurrence of a single accidental ground
3. Dedicated permanent status indicators shall be provided on the controller to indicate the following:
  - When the safety circuit is open
  - When door locks are open
  - When the elevator is running at high speed

- When the elevator is on independent service
  - When the elevator is on firefighters' service
  - When the elevator out of service timer has elapsed
  - When the elevator has failed to successfully complete its intended movement.
4. The car shall be equipped with two-way leveling to automatically bring the car within 1/4" of floor level regardless of load.
  5. Provide a test switch. In the test position, this switch shall allow independent operation of the elevator without door open functioning for the purposes of adjustment or testing the elevator. The elevator shall not respond to hall calls in this mode of operation.
  6. The power control shall be arranged to continuously monitor the performance of the elevator such that if the car speed exceeds 150 fpm during access, inspection, or leveling the car shall shut down immediately, requiring a reset operation.
  7. A means shall be provided in the controller to register calls without the use of jumpers.
  8. The elevator installer shall add additional car call buttons in the controller, furnished by the controller manufacturer.
  9. Elevator control voltage shall be 24vdc.
  10. Provide an arc flash guard in the controller.
  11. Provide hinged access doors on controller.
  12. The elevator controller shall provide building security options and features that will allow all or individual floor landings to be locked out and secured.

#### C.2.5.2 OPERATION REQUIREMENTS

1. **Independent Service:** The car shall be provided with a switch to remove it from operation, and shall operate in response to car calls only in an in car independent mode of operation.
2. **Door Nudging Operation:** Should the doors be held open due to a stuck call button or the failure of an electronic door reopening device for a predetermined adjustable time, a buzzer shall sound and the doors shall close at a reduced torque of 2-1/2' per pound or less, permitting the car to run.
3. **Emergency Power Operation:** When emergency power is detected, cars shall return to the main lobby one elevator at a time, and remain there with doors open. As each car returns, the other cars shall be shut down so as not to overload the emergency power generator. Once all cars have returned to the lobby, one or more cars may be selected to run under emergency power, depending on the capability of the emergency power generator. Selection of the cars that run under emergency power shall be done automatically by the group system, and may be overridden through manual selection. The actual number of cars allowed to run under emergency power shall be a preprogrammed value and the number of cars allowed to run shall not exceed this value. The panel for the manual selection switches for each group of elevators will be installed at a location determined by the University.

#### C.2.5.3 MICROPROCESSOR

The microprocessor board shall be equipped with on-board diagnostics for ease of troubleshooting and field programmability of a minimum of eight specific control variables.

Field changes should be stored permanently using non-volatile memory. The microprocessor board shall provide the following features:

- On board diagnostic switches and alphanumeric display which provide user-friendly interaction between the service person and the controller.
- On board Real Time Clock displaying date and time, able to be reset using on board switches.
- Display of calls on a per floor basis with all types of calls entered and displayed using on board switches and buttons. The elevator installer shall add additional car call buttons in the controller.
- Field programmability of specific timer values which may be viewed and altered through use of the on board switches and buttons.
- Display of the status of all of the inputs, outputs, internal control variables and flags, listed in order of their mnemonics.

#### **C.2.5.4 EXTERNAL DEVICES**

Provide comprehensive means to access the computer memory for elevator diagnostic purposes without the need for any external devices, and provide permanent indicators to show important elevator status as an integral part of the controller. Systems that require attachment of external devices for troubleshooting must be submitted for approval before bids are submitted for review. Should a system requiring an external device be accepted, a minimum of one external device, including any/all software, passwords, parameters, etc. needed for the operation of the device, shall be provided to the Owner. External devices that require recharging and/or periodic reprogramming are prohibited.

#### **C.2.5.5 TIMERS**

1. Provide an out of service timer which automatically takes the car out of service if the car is delayed leaving the landing while there are calls existing in the building. The car shall not respond to hall calls while in this mode of operation, and the detector screen input shall be unresponsive in the event that a faulty screen unit was delaying the car.
2. Provide door protection timers for both open and close directions that protect the door operator motor and prevent the car from being "stuck" at a landing. The door open protection timer shall cease attempting to open the door after a predetermined time in the event that the doors are prevented from reaching the open position. The door close protection timer shall reopen the doors for a short time in the event that the door-closing attempt fails to make up the door locks after a predetermined time.
3. A minimum of four different door standing open times shall be provided:
  - A car call time value shall predominate when a car call only is canceled.
  - A hall call time value shall predominate whenever a hall call is canceled.
  - In the event of a door reopen from the detector screen, a separate short door time value shall predominate.
  - If the doors are prevented from closing for longer than a predetermined time, door-nudging operation shall cause the doors to move at slow speed and reduced torque in the close direction. The detector screen shall stop the door but not reverse it. A buzzer shall sound while nudging operation is activated.

4. Provide separate adjustable timing to establish independent minimum passenger transfer times for car stops, hall stops, main lobby stops and door reversal protection. A timer shall be provided to limit the amount of time a car is held at a floor due to a defective hall call or car call including stuck pushbuttons. Call demand at another floor shall cause the car to ignore the defective call and continue to provide service in the building.

#### **C.2.5.6 CAR CONFIGURATION**

For both duplex (two car) operation, and for group (multiple car) configurations, with a computer for each controller, operation shall assign cars on a real time basis using estimated time of arrival (ETA). Should one computer lose power or become inoperative in any way, all other computers shall be capable of accepting and answering all hall calls. When all computers are in operation only one of them shall assume the role of dispatching the hall calls to both elevators.

#### **C.2.6 VARIABLE FREQUENCY AC DRIVE UNIT**

New and replacement controllers shall include installation of a compatible variable frequency AC drive. Acceptable drive manufacturers are General Electric Company, Mitsubishi Electric, or approved equal. The variable frequency drive shall incorporate the following:

1. Three phase, full wave rectifier and capacitor bank to provide DC for the solid-state inverter. The solid state inverter shall utilize power semiconductor devices and a duty cycle modulation fundamental frequency of not less than one kilohertz to synthesize three phase, variable voltage, variable frequency output to operate the hoist motor in an essentially synchronous mode.
2. Provide a means to remove regenerated power from the drive DC power supply. This power shall be dissipated in resistors or returned to the three-phase AC power line. Failure of the system to remove the regenerated power shall cause drive output to be removed from the hoist motor.
3. Provide a contactor to disconnect the hoist motor from the output of the drive unit each time the elevator stops. This contactor shall be monitored and the elevator shall not start again if the contactor has not returned to the de-energized position when the elevator stops.
4. Acceptable ambient temperature extremes for the drive unit are negative ten degrees Celsius to forty degrees Celsius (-10° C to +40° C), and relative humidity (non-condensing) extremes are twenty percent to ninety percent (20%- 90%) RH.
5. The drive shall be capable of providing an adjustable DC current to the AC motor for an adjustable time in order to provide a braking pulse to use in the stopping sequence.
6. The drive shall have the ability to adjust or program the voltage/frequency curve as necessary to properly match the characteristics of the existing elevator hoist motor.
7. The drive shall not create excessive audible noise in the elevator motor.
8. The unit shall be self-cooling.
9. Standard functions shall include: slip compensation, current limiting, restart after instantaneous power failure, multi-speed, jump frequency, automatic acceleration/deceleration, 2-wire/3-wire control selection, high or low limiter, bias frequency, pattern operation, selection of terminal function, terminal link.

10. Standard protection shall include: stall prevention, over current, over voltage, under voltage, instantaneous power failure, inverter overload, inverter overheating, motor overload, CPU error, and short circuit for input terminal.

## **C.3 REQUIREMENTS FOR HYDRAULIC ELEVATORS**

Hydraulic elevators that utilize the direct bore type assembly (holed elevator) is the preferred installation type and shall be installed with a sealed PVC liner and monitoring system. Single stage hole-less hydraulic assemblies are also acceptable.

### **C.3.1 HYDRAULIC PUMPING UNIT**

1. The pump shall be manufactured by IMO Industries, Inc.
2. The pump motor shall be manufactured by Imperial Motor Co.
3. The hydraulic valve shall be manufactured by Maxton Manufacturing Co.
4. The motor starter shall be a Siemens A/C Semiconductor Motor Starter.
5. The pumping unit shall have the valve, pump, and motor located within the reservoir and the unit must be mounted on sound isolation pads.
6. Provide a hydraulic muffler in the machine room.
7. A means of lowering the elevator when generator power is unavailable shall be provided when there is a power failure. This operation shall bring the car to the lowest landing and allow passengers to exit the elevator. This operation requires a separate battery-operated power supply system.

### **C.3.2 OVERSPEED VALVE**

Provide an overspeed valve located in the pressure piping within twelve inches (12") of the hydraulic jack..

### **C.3.3 HYDRAULIC OIL SUPPLY, PIPING, AND FITTINGS**

1. All piping for the hydraulic system shall be schedule 80 and have at least one isolation coupling installed in the oil line.
2. Grooved fittings shall be installed for the hydraulic oil supply line piping that is located in the elevator hoistway and machine room. Welded piping and fittings shall be used outside of the elevator hoistway or machine room.
3. Piping buried in the ground shall have a protective casing.
4. Manual shut-off valves shall be provided in the elevator machine room and in the elevator hoistway pit. Shut-off valves must be full flow, ¼ turn ball valves.

### **C.3.4 CONTROLLER REQUIREMENTS AND PROGRAMMABLE OPTIONS**

All control equipment shall be provided by Motion Control Engineering (MCE), G.A.L. Mfg. Corporation, or SmartRise Engineering, Inc.

#### **C.3.4.1 REQUIREMENTS**

1. Elevator controls shall be solid-state “selective collective automatic operation,” as defined in ASME/ANSI A17.1. Controller shall be non-proprietary and shall not require a battery to maintain programming. Control system shall be microprocessor based for dispatch and motor control, capable of computer-based monitoring with terminals for connection.
2. For microprocessor-controlled systems, specifications shall require that diagnostic tools be functional for the lifetime of the equipment without requiring recharging or reprogramming. The use of proprietary equipment shall be prohibited by the specifications.
3. The controller shall provide means to access the computer memory for diagnostic purposes without the need for any external devices or connections.
4. The elevator shall not require the functioning of the microprocessor to operate on car top inspection to provide a reliable means of moving the car if the microprocessor fails.
5. A motor limit timer function shall be provided which, in case of the pump motor being energized longer than a predetermined time, shall cause the car to descend to the lowest landing and park, open the doors automatically and then close them. Car calls shall be canceled and the car taken out of service automatically. Operation may be restored by cycling the main line disconnect switch or putting the car on access or inspection operation. Door reopening devices shall remain operative.
6. A valve limit timer shall be provided which shall automatically cut off current to the down valve solenoids if they have been energized longer than a predetermined time. The car calls shall then be canceled and the car taken out of service automatically. Operation may be restored by cycling the main line disconnect switch or putting the car on access or inspection operation. Door reopening devices shall remain operative.
7. Hydraulic elevators that are not designed for emergency power operation must be designed and equipped with an auxiliary power operating system that will, at a minimum, run the elevator to the lowest landing, open and close the doors, and shut the elevator off at that landing. If the lowest landing is not the “Fire Emergency Operation Designated Landing”, the elevator must stop at the appropriate fire response floor and open the cab doors prior to proceeding to the lowest landing. The auxiliary power supply must be of adequate supply to open and close the elevator cab doors as often as necessary to complete this operation.
8. There shall be a means provided that will allow a call to be registered at the controller without means of a wire jumper. The elevator installer shall add additional car call buttons in the controller, furnished by the elevator controller manufacturer.
9. Elevator control voltage shall be 24vdc.
10. Provide an arc flash guard in the controller to isolate high voltage.
11. Provide hinged access doors on controller.
12. The elevator controller shall provide building security options and features that will allow all or individual floor landings to be locked out and secured.

#### **C.3.4.2 PROGRAMMABLE OPTIONS**

All available options or parameters shall be field programmable, without need for any external device or knowledge of any programming languages. Programmable options and parameters shall be stored in nonvolatile memory. As a minimum, there shall be a 32-character alphanumeric display used for programming and diagnostics. Programmable parameters and options shall include, but not limited to, the following:

1. Number of stops/openings served (each car)
2. Simplex/duplex
3. Single automatic push-button
4. Selective collective/single button collective
5. Programmable fire code options/fire floors (main, alternates)
6. Floor encoding (absolute PI)
7. Digital PIs/single wire PIs
8. Programmable door times
9. Programmable motor limit timer
10. Nudging
11. External car shutdown input (e.g. rescuvator)
12. External Low Oil Sensor Input
13. External viscosity control input
14. Parking floors
15. Hall or car gong selection

#### **C.4 REQUIREMENTS FOR FREIGHT ELEVATOR DOOR EQUIPMENT**

1. Lock boxes for hoistway access shall be installed at each hoistway landing and shall be keyed with a "CH751" type key.
2. Freight door package, including door controller, shall be provided by EMS GROUP Incorporated.