



University of Edinburgh

Engineering Services

Guidelines

Section 7: Lift Engineering Guidelines

The University of Edinburgh
Estates and Buildings
Works Division

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7.00 LIFT INSTALLATIONS

7.1 DESIGN CRITERIA

The following design criteria are considered appropriate for the majority of projects. The engineering services shall be designed in accordance with the following :-

- the requirements of the Project Brief.
- the needs of the occupiers/users.
- flexibility in use.
- compliance with an agreed set of technical criteria
- systems reliability, maintainability and cost in use

Each project shall be assessed under the Building Research Establishment Environmental Assessment method – BREEAM.

If it is deemed impractical to pursue a BREEAM accreditation then the design team shall ensure that all relevant good practice design guides and procedures are followed as far as is reasonably practicable to achieve an energy efficient and sustainable development.

Designers must exercise care in ensuring that all operational requirements are met. Where the University considers that it has relevant experience for specific installations, these are detailed elsewhere in this specification.

The following information is primarily intended to provide guidance to those responsible for the design of lift engineering services within the Estate of the University of Edinburgh. It is not intended to be exhaustive or definitive, and it will be necessary for users of the guidance to exercise their own professional judgement when deciding whether to abide by or depart from it. For this reason also, departure from the guidance contained in this document should not necessarily be regarded as a departure from best practice and should always have the written approval of the supervising officer.

The designer is encouraged to address all the issues relevant to energy efficiency in buildings and to adopt sensible integrated strategies. Whether designing new buildings or refurbishing existing buildings, designers should adopt an approach which recognises the need to:-

- Reduce the demand for energy and materials.
- Provide the residual requirements in an environmentally friendly way including, where practical, the use of renewable energy sources.
- Adopt tried and tested good practices to achieve energy consumption benchmarks such as the Building Research Establishment's (BRE) performance targets.

The lift works shall provide a reliable, high quality installation, engineered for an economical long term life cycle of 25 to 30 years, to comply with the requirements of this specification and the following:-

- Statutory UK & EC Regulations, Directives and Instruments
- Building Standards (Scotland) Regulations
- Health and Safety Executive Guidance Publications
- HSE Memorandum of Guidance on the Electricity at Work Regulations
- British Standards and Codes of Practice

- (B.S. 7671) 16th Edition of the I.E.E. Wiring Regulations
- The Construction (Design & Management) Regulations 2007
- EN81-1 or - 2 as applicable
- EN 81/70
- EMC Regulations
- The Lift Regulations 1997

Designers shall undertake a traffic analysis to establish the optimum number of lifts, their capacity and speed to provide an agreed average passenger waiting time to suit the anticipated traffic pattern.

The University's preferred arrangement shall incorporate an electric traction arrangement with the plant room above the lift well. Hydraulic drives may be considered as an alternative where the rated speed is not required to exceed 0.63 ms^{-1} and where the travel distance does not exceed 12m. It should be noted that machine-room-less installations should be considered the option of last resort and designers are expected to make every effort to accommodate a separate lift plant room within the overall design.

Where it is established that lift service is to operate as an Evacuation Lift relevant sections of these Guidelines identify applicable requirements.

7.2 CONTROLLERS, CONTROL EQUIPMENT & WIRING

Wherever practicable the controller shall be located within a separate lift plant room and shall be floor or wall mounted with a lockable cabinet incorporating IP54 protection and forced air anti dust filtration system. Where a separate lift plant room cannot be provided the control cabinet shall be built into the top floor landing entrance and shall otherwise comply with these Guidelines.

It is a fundamental requirement that all control systems shall utilise "open protocol" technology. Where the ability to interrogate and/or modify any of the control parameters requires the use of any hand held or demountable Man Machine Interface any such components not permanently fixed to the controller shall form part of the lift installation with title to same passing to the University upon completion of the works.

Internal components such as contactors, relays, solenoids, timers rectifiers and other discrete equipment shall be identified by permanent labels which shall bear the same designation as the schematic wiring diagrams and record information and a chart shall be permanently affixed to the inside of the controller's door to provide a key of abbreviations used.

The controller shall be provided with an incoming mains filter to protect against spikes and with suitable fuse and MCB protection to ensure that all circuits affecting all electrical equipment are suitably protected against short circuit, overload and/or reverse current.

The input/output structure of the controller shall be provided on separate input/output printed circuit boards. The status of each input and output shall be indicated by dedicated LEDs or via LCD diagnostic display.

The input/output structure of the controller shall be flexible with the option to increase the capability by the introduction of further input/output boards at a later stage or, alternatively, via distributed intelligence network.

Fault Diagnostics

The controller shall have a Man Machine Interface (MMI) mounted within the control panel cabinet for fault diagnostics and event display incorporating the following Features and Modes of Operation:-

- 200-event fault logging facility indicating event, Elevator position at time of event, status, time and date. Once 200 events have been recorded each new event shall cause the oldest event to be deleted. There shall be no facility to manually delete events.
- Car and landing call input.
- Display of car and landing calls latched.
- Elevator position, direction and status.
- Time and date adjustment.
- Site identification code input.
- Battery back up memory.

To facilitate remote access in the future, the controller shall incorporate provisions to readily accept the later addition of a modem.

All aspects of the installation shall be in compliance with Electromagnetic Compatibility per BS EN 12015 : 2004. The system shall:-

- Provide full collective control with smooth acceleration, running and deceleration characteristics in both directions of travel. The equipment shall be quiet in operation and shall be installed to avoid transmission of vibration to the building structure meeting or improving on the minimum criteria given in Appendix 12.A1.2. of the Chartered Institution of Building Services Engineers Guide D.
- Provide an accuracy of levelling +/- 5mm under all conditions of load and in both directions of travel.
- Incorporate a non-resetting counter recording motor hours run fitted within the control panel.
- Incorporate a signal in the lift machine room during hand winding to indicate when the car is at a landing level to allow trapped passengers being released from the car.
- Cause the lift car to return and park at a designated level after an interval of 15 minutes when no car or landing calls have been made.
- Incorporate an ultimate limit reset within the lift control system.
- Cause the lift car lighting & any mechanical ventilation to turn off after an interval of 30 minutes when no car or landing calls have been made with both being turned back on immediately a call is made.
- Where the lift is intended to serve as an Evacuation lift it shall, in the event of failure of the primary power supply, automatically reset once the secondary power supply has been energised regardless of whether the Recall switch has been operated. Where the Recall switch has not been operated the lift shall continue to operate normally until such time as that switch is operated.
- On operation of the Recall switch, where fitted, the lift shall enter Evacuation mode whereupon the lift shall cancel any pre-existing car or landing calls and home to the designated Evacuation level. No further landing calls shall be accepted and the lift shall only respond to calls entered on the car operating panel. Once the Recall switch has been returned to the normal position the lift shall return to normal service.

The following other control features shall be included as a standard within the control system:-

- Thermistor protection relay.
- Double journey timer.
- Homing to a specified floor.
- Car and landing call acceptance.
- Load weighing 110%.
- Provision for digital position indicators.
- Provision for direction indicators.
- Provision for arrival gong.
- Panel test buttons (duplicate of car top control functions).

Where the output of the selected inverter requires to be damped to suit the rise time characteristics of the selected motor the control system shall incorporate a suitable motor choke.

The control system shall support lift door operation when not under key control as described hereunder:-

- On arrival at a landing in response to a landing call, the car and landing doors shall open automatically and remain open until a car button is operated. If the lift has no other calls registered, priority shall be given to car calls for an adjustable period of between 3 & 10 seconds after the doors have reached the fully open position. If during this period no car calls are registered, the doors shall start to close automatically. Adjustment of this facility shall not require the need for external tools or hand held device.
- On arrival at a landing in response to a car call, the car and landing doors shall open automatically and remain open for an adjustable period of between 5 & 12 seconds after the doors have reached the fully open position when they will start to close automatically. Adjustment of this facility shall not require the need for external tools or hand held device.
- Operation of the door open, or the corresponding floor selection, button shall cause a closing door to re-open automatically or prevent an open door closing so long as pressure is maintained on the button.
- Operation of a floor selection button (other than that for the floor the lift is at) shall instigate immediate door closure irrespective of unelapsed time remaining on normal closure or from prior use of the door open button so long as pressure is not still maintained on such button.
- Operation of the door safety edge device shall override door closure.
- With the doors fully closed and the lift car parked within the door zone, operation of the door open button or the corresponding landing level button shall instigate automatic door opening.

The control system shall be configured such that under Attendant's key control (captive key) the lift shall be removed from normal service and lift door operation shall be as described hereunder:-

- On arrival at a landing in response to a car call, the car and landing doors shall open automatically and remain open until the key switch on the car operating panel is deactivated after which time the doors shall remain open for an adjustable period of between 5 & 12 seconds when they shall start to close automatically.
- Irrespective of the key switch status, operation of the door open, or the corresponding landing level, button shall cause a closing door to re-open automatically or prevent an open door closing so long as pressure is maintained on the button.
- Operation of the door safety edge device shall override normal timed door closure.

Six copies of the attendant's key shall be handed over on completion of the works.

Electrical Safety Mat

An approved electrical safety mat of minimum 9mm thickness and rated to a minimum of 15kV shall be provided adjacent to each piece of control equipment. The mat shall be compliant to B.S. and marked as such.

Speech Synthesiser

A speech synthesiser shall be installed to interface with the controller complete with all necessary connections to a discrete speaker in the lift car. The system shall incorporate a compatible hearing aid induction loop system.

Inclusion shall be made for the incorporation of messages announcing arrival at each floor, together with:-

- Doors Opening
- Doors Closing
- Going Up
- Going Down
- Lift Overloaded, Last Passenger Please Leave the Car

Each message shall be initiated automatically by the controller for announcement over the car speaker in sequence with other messages or individually as appropriate to the car's programmed operation. The system shall incorporate a means to turn off messages and also to adjust the volume of messages on site without the need for special tools or new components.

Drive System

An elevator drive shall be contained within the controller cabinet. The drive shall be fully compatible with the selected control system and shall be configured for use in Closed Loop operating mode. The following functions shall be incorporated as standard within the elevator drive:-

- S-ramp (jerk) with separate acceleration rounding
- Brake controller
- Velocity thresholds interfaced to the control system
- Integrated brake chopper

Control Wiring

Other than the trailing cables, all cables shall be enclosed in galvanised steel conduit or trunking. Conduit entry and exit points shall be protected with male and female brass glands as appropriate. Trunking and conduit shall be run on the plant room walls only to eliminate their constituting a tripping hazard. Trunking shall be provided with external copper earth link points at each joint and shall incorporate cable strainers at no greater than 3m intervals in vertical runs.

Where the use of flexible conduit is unavoidable it shall be metallic and shall be terminated in suitable couplings which shall positively grip the flexible conduit. An additional earth continuity conductor shall be run outside such flexible conduit between lengths.

An additional earth route shall be provided for all components and equipment including guards, ladders and landing door frames.

The Installer shall utilise multi-strand 600/1000V grade control wiring having low smoke and fume insulation. All terminations of cables shall be at designated points. Where cables are interfaced these points shall be marked and identified with DIN rail mounted screw terminals.

Volt free contacts from Fire Alarm system shall be provided adjacent to lift controller position. Inclusion shall be made for liaison with the University's Fire Alarm Contractor to ensure compatibility between the control system and a fire alarm signal such that in the event of a fire alarm situation the lift shall home to a designated floor level where it shall park until the fire alarm has been cleared.

Inclusion shall be made for liaison with and attendance on the University's Fire Alarm Contractor to accommodate their installation of any necessary automatic fire detection components and/or cables at the well top or within the lift plant room.

7.3 LIFTING MACHINE

Wherever practicable the winding unit shall be located within a separate lift plant room above the lift well. Where a separate lift plant room cannot be provided the winding unit shall be erected within the lift well and shall otherwise comply with these Guidelines.

The motor shall be matched to the Vector Drive and shall be suitable for the specific duty demands placed on the system.

The lifting machine shall consist of an AC gearless lifting machine incorporating a 3 phase synchronous motor, traction sheave, double disc brake, encoder matched to the Vector Drive and control arrangement and frame with drive and non-drive ends of the shaft being carried in self-aligning roller bearings with each bearing being sealed with internal and external shaft sealing rings.

The lifting machine shall incorporate a low-noise cooling fan which shall be separately driven.

Rope retainers shall be provided at the main sheave and at all pulley wheels.

The brake shall be mechanically applied and electrically held off and be capable of stopping the machine when the car is travelling downward at the rated speed and with the rated load plus 25%.

Brake linings shall be incombustible and shall contain no asbestos.

Pulleys shall have machine grooves, be smoothly finished and have rounded edges.

Emergency Release System

An emergency release system to facilitate brake release and powered movement by battery back up under power loss conditions shall be incorporated for the gearless lifting machine.

A switch to instigate the emergency release system shall be mounted on the controller cabinet door. Upon operation the switch shall isolate the lift car from normal usage, isolate the car from controlled movement and override car top control or panel test.

The switch will also operate a control circuit with battery back up to indicate when the lift car is within a door zone. The method of signalling this arrival at the required level will be via an electronic sounder fitted to the control cabinet door.

7.4 HYDRAULIC DRIVE

Where the designer identifies that a Hydraulic arrangement is the optimum solution, the hydraulic pump unit shall be selected to provide the required contract speed and shall incorporate an electronic valve block, pressure gauge, hand pump and device/s to detect both high and low pressure. The pump unit shall be located within 6m from the hydraulic ram. The system shall include an anti-creep device and an oil filter accessible for inspection and cleaning.

The designer shall establish whether oil cooling equipment is necessary to facilitate the required number of motor starts per hour without overloading the motor or adversely affecting hydraulic oil viscosity. Oil cooling equipment shall be located so as to preclude the dissipated heat causing excessive plant room temperatures.

Inclusion shall be made for the provision of a suitable bund around the pump unit the internal surfaces of which shall be treated to prevent penetration by oil spillage. The external and top elements of the bund wall shall be highlighted by the addition of painted alternating yellow and black hazard stripes which shall be at an angle of approximately 45⁰ in compliance with the Health and Safety (Safety Signs and Signals) Regulations 1996.

The hydraulic connection between the pump unit and the ram shall be undertaken by hydraulic hose which shall be installed so as to avoid twisting, sharp bends and chaffing and shall be effectively isolated from the building structure to minimise the transmission of vibration. Where the hose may cross the pit floor, it shall be routed so as to minimise tripping hazard to service personnel.

Prior to commissioning and again 6 months after completion of the installation the main ram oil seals shall be replaced.

Where ground conditions permit the creation of a suitably lined borehole, a direct-acting central hydraulic ram shall be connected directly below the lift car. Alternative single-acting or twin cylinder arrangements shall provide a 2:1 ratio of car travel to piston stroke by means of a rope or chain arrangement with suitable pulley/ies. Where an indirect acting arrangement is adopted inclusion shall be made for appropriate safety gear.

Inclusion shall be made for the incorporation of a compatible rupture valve/s and for the provision of appropriate collection vessel/s fitted to the bottom of the ram cylinder to collect oil as naturally dissipated from the ram.

7.5 SAFETY GEAR

Safety gear shall be mounted on the lift car to prevent uncontrolled descent, and additionally for traction lifts uncontrolled upwards movement. Every effort shall be made to avoid the possibility of accessible space below lift well at the counterweight's position. Where this cannot be achieved separate safety gear shall be mounted on the counterweight.

Instantaneous or progressive safety gear as appropriate to the speed and rated load of the lift shall be selected to work in conjunction with suitable overspeed governor/s.

7.6 ROPES, SUSPENSION & GOVERNOR

The selection of the size, construction and lay of ropes shall be the responsibility of the manufacturer and/or the Installer to suit the characteristics of the lift installation. Inclusion shall be made for checking all ropes and undertaking any necessary adjustments following completion of the installation and having given time for rope stretch.

7.7 GUARDING & INGRESS REDUCTION

Guarding shall be provided to protect all rotating machinery other than, where fitted, the hand winding wheel. All guarding shall be of close constructed weld mesh design and off site painted orange reflective to BS4800. Access to service points shall be via hinged panels with wing nut locking. Fitting of any guard shall protect each individual component and not whole areas such as winding units and diverters. Additional bracing and support points shall be used to minimise deflection.

Ingress into the lift well or plant room shall be minimised to allow equipment access only. Where ropes enter the well, rope-reducing plates shall be fitted at each individual point of ingress with a minimum of a 50mm upstand. These shall be painted orange reflective to BS4800 to identify. The overspeed governor shall be provided with upstands as well as guarding.

7.8 PLANT ROOM SUNDRIES

An information board shall be erected in the plant room. The board shall incorporate the following information and equipment:-

- Service log card
- Details of suspension and governor ropes
- Door release key
- Labelled keys for any attendant control
- Labelled key for emergency lighting test switch
- Labelled key for padlock on main isolating switch

A landing entrance barrier shall be provided in the building at a location to be agreed with the University. The barrier shall incorporate a permanent legend identifying it as being the property of the University and shall be capable of being securely fixed to landing architraves.

Appropriate and site specific emergency hand lowering procedures shall be displayed adjacent to the lifting machine or pump unit.

Treatment for Electric Shock and Electricity at Work posters shall be displayed in a prominent location in the plant room.

Permanent labels shall be added and secured to each item of switchgear or outlet to identify their function.

A sign bearing the inscription "LIFT MACHINE – DANGER. ACCESS FORBIDDEN TO UNAUTHORISED PERSONS." shall be fixed to the outside of the plant room door.

7.9 LIFT CAR & EQUIPMENT

A steel sling shall be installed which shall be of robust construction to withstand normal operation, buffering or operation of safety gear without any damage or deformation and which shall incorporate:-

- Safety gear complete with actuating mechanism and rope hitch
- Welded or bolted steel channel construction
- Centrally located buffer plate
- Crosshead construction with self-locking bolts
- Rope-hitch plate
- Guide shoes with lubricating system
- Car anti-vibration mountings
- Primed anti rust finish and painted two coats of matt black paint

A car cabin shall be installed to interface with the sling assembly and the interior shall be installed with walls vertical and floor & ceiling level. A toe guard shall be fitted to the car sill. The lift car shall be statically balanced such that the car hangs centrally within the existing guide rails without the use of guide shoes.

The whole assembly shall be constructed and shall incorporate sufficient isolation material such that in-car noise and vibration meets or improves on the minimum criteria given in Section 12.12 of the Chartered Institution of Building Services Engineers Guide D : 2005. Particular care shall be exercised in the installation of anti-vibration mountings and isolation between the car frame and the car enclosure. Additional sound insulation in the form of fire-retardant anti-drumming compound shall be applied externally to the car enclosure.

Internal car finishes shall be selected in conjunction with the University and/or the Design Team to suit the environment. Cabin lighting should be designed to provide at least 300 lux at the car floor level and to facilitate re-lamping from within the lift car and incorporate emergency lighting to provide at least 10 lux at the car floor level. Emergency light/s shall not be mounted within the car operating panel.

The lift car design shall incorporate mechanical ventilation or natural ventilation slots in the side walls which shall provide an effective area of at least 1% of the car floor area. Ventilation openings shall be fitted with baffles to preclude the insertion of objects.

The lift car design shall incorporate discreet hooks to allow protection of the car finishes by the installation of heavy duty drapes which shall include transparent section to facilitate use of the COP with the drapes in position. One full set of drapes shall be provided to the University for each lift car.

Car Operating Panel (COP)

A COP shall be installed in the lift car which shall include a satin stainless steel face plate and incorporate features in line with EN 81-70 and include the following equipment:-

- Elevator load in kg and persons
- LCD position indicator
- Tactile LED illuminated floor selection buttons
- Alarm button interfaced to emergency communication system
- Door open button
- Door close button

- Attendant's key control switch

Inclusion shall be made for audible feedback of all push buttons operation per EN81-70. This shall be facilitated by the control system network with a dedicated CAN node for connection of the COP.

The Installer's name and contact details shall be incorporated on a removable plate mounted on the COP.

Guide Shoes

Guide shoes shall be installed to interface with the sling assembly and shall be provided with integral lubrication devices. Guide shoes shall be provided in primed anti-rust finish and shall be self adjusting with renewable liners and adjustable stops.

Load Weighing Device

The lift car shall be fitted with an electronic load weighing device complete with sensors to interface with the control system to prevent an overloaded car from leaving a landing and to bypass landing calls when loaded to an adjustable percentage of rated load.

The device/s shall be capable of having all adjustments undertaken from the car top area. A certificate of completion and compliance shall be incorporated in the O&M manual.

Car Top Controls

A car top control station shall be installed on the lift car to interface with the control system and shall be complete with integral or adjacent metal clad 13A RCB protected socket outlet; self contained maintained emergency and mains luminaire.

The unit shall comply with BS 7255 : 2001 requirements incorporating Run, Door Open and Door Close buttons and facilities.

The car top control station shall incorporate an emergency stop button switch positioned within 1m from the landing threshold.

An additional well terminal switch shall be installed and interfaced with the car top control station such that when under inspection control the ascending lift will stop with its roof not less than 1.8m from the nearest obstruction. In addition, a notice shall be fitted bearing the legend WARNING – DO NOT MOVE UP TEST SAFETY LIMIT.

Car Top Balustrade

The car roof shall be provided with a balustrade where the free horizontal distance from the roof edge exceeds 300mm.

Where a balustrade is so required, it shall comply with the requirements of EN81. In addition, a notice shall be fitted bearing the legend DO NOT LEAN OVER HANDRAIL.

Car Door Operator

A door operator of VVVF design shall be installed at the lift car to interface with door equipment. The operator shall facilitate individual adjustment of parameters independent of external hand held or semi-permanent programming devices.

In the event of detector or door open button failure, an internal closing force detection system shall be permanently incorporated to afford passenger protection.

The door operator shall include facility for selecting from three opening and two closing speeds and each speed shall have separate torque adjustment to enable adjustment to suit site conditions.

Skate assemblies shall be included to operate correctly the landing locks.

Reduced speed door nudging shall be incorporated which shall include the sounding of a warning buzzer in operation and which shall be capable of being selected and deselected by the University's maintenance engineers.

Car Doors

Power operated car doors shall be fitted to the lift car to provide a clear opening of not less than 800 mm width and 2000 mm height. Car door panels shall be finished with linen pattern stainless steel and shall incorporate full height electronic safety edges the power for which shall be from a dedicated supply from the elevator controller and not from the car top light supply.

Emergency Communication System

An auto-dial handsfree two-way communication system shall be mounted on the lift car incorporating communication to and from the lift car, the car top, the lift pit and a 24 hour call out facility. Inclusion shall be made for remote monitoring. The system shall incorporate battery back up to facilitate full functionality in the event of mains failure for a period of up to two hours. The system shall incorporate a compatible hearing aid induction loop system.

Visible components, i.e. pictograms, shall be integrated into the COP and shall not be mounted on a separate plate.

Inclusion shall be made for all necessary power supplies, interconnections, trailing cables, anchorages, power supplies and marshalling boxes.

Inclusion shall be made for co-operating with the University's telephone service provider to ensure the compatible interface of telephone equipment and connections.

Evacuation Intercom

Where the lift is intended to serve as an Evacuation lift an Evacuation Intercom system shall be integrated within the lift cabin. Inclusion shall be made for all liaison with the University's specialist intercom Contractor to ensure compatibility with existing systems installed at other lifts throughout the Campus.

A master Intercom panel shall be installed adjacent to the Evacuation floor landing doors and speaker boxes installed adjacent to all other landing doors and the lift plant room.

The Evacuation Intercom system shall enable communication between any of the speaker boxes and the master intercom panel at the Evacuation floor.

Each speaker box shall incorporate a CALL button, microphone and speaker and the master intercom panel shall incorporate also flashing buttons for each speaker box to enable the Evacuation Manager to enable two way communication with any speaker box and to terminate such calls on completion of that call. The master Intercom panel shall include visual and audible indication of incoming calls from speaker boxes.

Lift Alarm System

Operation of the push button on the COP by persons trapped in a lift car shall cause a 100 dB sounder to operate. A sounder shall be installed within the lift well at the main entrance floor at the header level. The designer shall specify the sounder so as to avoid any possible confusion with other sounders for other purposes within the building.

The system shall incorporate a mains failure battery of 3 hours duration with trickle charger.

The system shall be configured such that pressing the alarm button continuously for three seconds shall initiate the Emergency Communication system's autodialler.

Car Apron

An apron manufactured from 16th gauge sheet steel shall be fitted to the car sill across the full width of the clear landing entrance. The apron and any supports shall be primed and finished with two coats of matt black paint.

Trailing Flexes

Trailing flexes shall have a cross sectional area of not less than 0.5 mm² and shall be installed in round or flat form as fits the project requirements. On completion of all car terminations an additional 10% flex allocation shall be provided. All spare flexes shall be terminated at a designated earth point within the termination housing.

Halfway Box

Where the termination of connections to the lift car requires to be via a halfway box, the box shall be metal clad in design with a hinged lid for access and a termination legend shall be affixed to the underside of the lid to identify all terminations. High and low voltage shall be separated as to preclude damage by short circuit. Reduction of conductor size will not be permitted.

7.10 LIFT WELL & PIT

Shaft Signal Device

A shaft position system shall be provided. A high resolution encoder shall calculate the cabin position via suitable mounting on the overspeed governor. This device shall be connected to the control system via the CAN network.

Guide Rails and Brackets

Drawn steel T-section car and counterweight guide rails with machined running blades shall be installed. The size, profile and fixing method shall be selected to suit the total load, the selected arrangement of equipment within the well and the backgrounds available for fixing. All guide rails shall be aligned to the following tolerances:-

- Distance between guides -0mm + 1mm
- Accuracy of angular alignment +/-0.5mm
- Accuracy of vertical alignment over any 5 metre vertical length +/-1mm

A purpose designed oil collection device shall be fitted to collect used lubricant at the bottom of each guide rail where lubricant is used.

Counterweight

The counterweight shall be designed to suit the plant with the fillers selected and clamped in line with the project requirements to balance the car at 50% of the contract load during erection and

prior to running the new gear in out of balance condition and the entire assembly shall be cleaned and painted with two coats of yellow reflective paint to BS4800.

Guide shoes to match the guide rails shall be fitted and the counterweight shall be statically balanced such that the counterweight hangs centrally within the existing guide rails without the use of shoes.

Limit Switches

Lift well limit switches shall be installed in the proximity of terminal floors and selected to interface with the control system and the lift well signal device. The final position of limit switches shall be determined by liaison with the control system supplier.

The fixing of limit switches may be on individual brackets or frames. At the point of contact to the guide rails and after final test all brackets shall be through bolted with a minimum of a M8 machine screw, complete with locking washer or nut.

Dedicated galvanised trunking shall be routed as close as practically possible to the limit switches as to minimise the use of flexible conduit A dedicated earth connection shall be routed to each limit switch.

Pit Mounted Buffers

Energy Accumulation or Energy Dissipation type buffers as appropriate to the speed and rated load of the lift shall be selected shall be installed in the pit below the car and the counterweight to arrest either should one or other overtravel into the pit.

Inclusion shall be made for any necessary plinths and/or steelwork which shall be of robust construction and securely fixed.

Pit Stop Switch

An emergency stop button switch shall be installed in the lift pit to work in conjunction with the emergency stop switch in the plant room, the car top and to interface with the control system.

The stop button shall be installed directly adjacent to the pit access ladder at waist height or, where a removable ladder is required, a specific location shall be identified. Where the pit depth necessitates, a second pit stop switch shall be installed within easy reach of the pit floor.

Lift Well Lighting

Lift well lighting shall be provided by surface mounted luminaires having impact resistant controllers. Luminaires shall be positioned such that there shall be a minimum of one luminaire per landing level to provide sufficient illumination to allow detailed inspection of the whole landing entrance unit. Luminaires shall additionally be positioned above and below the top floor level and at the pit area.

Emergency lighting shall be provided in the pit and lift well at intervals of not less than every fourth floor by either conversion packs within general luminaires or by surface mounted, self contained, non-maintained luminaires with 3 hour emergency mode duration. An emergency lighting test switch shall be erected adjacent to the pit light switch which shall incorporate a key switch.

The switching arrangement of the lift well lighting shall provide two way and intermediate switching with switches installed in the plant room, in the pit adjacent to the emergency stop button and at the lift car top control station.

Counterweight Screens

A counterweight screen shall be installed in the pit and, where space permits, at the mid well point to protect the front and two sides of the counterweight.

The screens shall be manufactured from weld mesh with rolled angle frames, primed and painted off-site with two coats of orange reflective paint to BS4800.

The bottom of the pit screens shall cover the lowest projection of the counterweight under buffer compression and shall extend to a minimum height of 3m above the base of the pit.

A hinged access panel secured with wing nuts shall be provided to afford access to buffer units.

Pit Access Ladder

A ladder shall be installed in the pit, within safe reach from the landing and extending from the pit floor to 1.5m above the bottom floor sill level. Pit ladders shall be manufactured from square section tubular steel, designed to accept 180 kg load and shall be provided with an integral handrail.

To enable mounting direct to the lift well wall the rungs of the ladder shall provide full application of the foot and a textured finish will be provided to offer a grip finish for each rung.

If due to insufficient running clearances a fixed ladder cannot be installed, then the ladder shall be removable. The ladder shall have permanently mounted fixings at the bottom and top of the position and shall have an electrical interlock so as to prevent any movement of the car on normal or test when the ladder is in position. The contact shall be by either a position switch or a safety switch.

Lift Shaft Painting

The pit area shall be cleared of all debris and dust. Cracks and other defects shall be stopped. Stopping shall be allowed to dry out and shall be rubbed down prior to painting.

The pit floor and shaft walls up to a height of 600mm shall be cleaned and painted using Amtred Ltd. Drycote or similar in full accordance with the manufacturer's instructions.

The application of paint shall not cover any conduits or trunking or degrade in any other identification of services or tripping hazards.

Lift Well Fascias

Sheet steel fascia plates, primed and painted, shall be fitted between each floor from the top track and the sill of the floor above and between the sill of the lowest level served and returning at an angle to the pit wall at the lowest limit of car travel.

Fascia plates shall be manufactured from 16th gauge sheet steel to full architrave width and shall flex no more than 5mm at any point with the force of 75 kg applied.

All frames and supports shall be manufactured from rolled channel.

All fascias, frames and supports shall be provided and be finished with two coats of matt black paint or bare galvanised steel.

7.11 LANDINGS, DOORS & DEVICES

Landing Door Equipment

Landing door equipment shall be installed to interface with the door operator drive and shall be supplied with a clear opening of not less than 800 mm width and 2000 mm height. Exposed door and architrave finishes shall be linen pattern stainless steel. Entrances shall include the following components:-

- Hanger mechanism
- Door mechanical and electrical interlocks
- Door panels
- Bias weights to close the doors
- Tubular frame architraves
- Landing sills and door shoes
- Emergency lock release device (unlocking triangle)
- Wrap round architraves and header

Where appropriate to the building layout, landing entrances shall have a minimum of two hour fire resistance. Inclusion shall be made for the permanent marking in paint neatly applied of each floor level on the inner face of each landing door set.

Landing Call Stations

Each landing call station shall comprise of flush mounted stainless steel face plate, compact tactile LED illuminating call button/s, network PCB (node) & sounder. Landing call buttons shall not be heat activated touch sensitive type and shall not operate as a result of conditions resulting from the effects of fire.

Landing call stations shall include illuminating Up & Down buttons at intermediate floors and have a single directional button at each terminal floor. Inclusion shall be made for audible feedback of push button operation per EN81-70. This shall be facilitated by the control system network with dedicated CAN nodes for connection per call station.

Position Indicators

LCD position and direction of travel indicators shall be installed above or adjacent to each landing entrance. The mounting height and style of indicators shall be compliant to EN81-70 and shall be complete with stainless steel back plate.

Inclusion shall be made for the incorporation of a quiet tone audible signal which shall emit before the car arrives at the landing. To assist the sight impaired, the signal shall sound once for upwards travel and twice for downwards travel.

Evacuation Recall Switch

Where the lift is intended to serve as an Evacuation lift, an Evacuation Recall Switch shall be mounted at high level beside the Evacuation floor landing doors. The Recall Switch shall comprise of a flush mounted stainless steel face plate incorporating a key switch (trapped key pattern) and including the permanently engraved legend EVACUATION LIFT. Operation of this switch shall instigate the Evacuation mode as described under the Control & Control Equipment section of the Specification.

7.12 MAINTENANCE SERVICE CHECK SCHEDULE

The designer of the lift installation shall allow for all costs associated with the provision of maintenance of the lifts. This is in accordance with current legislations during the twelve months following the date of the practical completion of the lift(s) installation. The maintenance regime shall include for the monthly, 3 monthly, 6 monthly and annual check outlined below.

The following check schedule is the minimum acceptable check for remedial action. The Contractor shall, however, undertake all additional checks and corrective actions as may be determined necessary to ensure the lifts are maintained to the highest standard.

All checks are to be undertaken at the frequency indicated or more regularly if deemed necessary by the Contractor, unless identified as having a different interval for checking and maintenance.

MONTHLY

- 1.1. Check operation of car top control station.
- 1.2. Clean car top and pit.
- 1.3. Clean and lubricate guides and sheaves as necessary
- 1.4. Ride in lift car & check starting and stopping, response to car and landing calls, floor levelling, operation of doors, alarm bell, indicator function and door protective device/s.
- 1.5. Check illumination within cabin and replace lamps as necessary, check operation of cabin emergency lighting.
- 1.6. Check door and door lock operation, clean and lubricate, check speed settings, keys, set screws, contacts, cams etc, together with belts and pivot points and emergency release mechanisms. Report any damage noted to doors for subsequent remedial action.
- 1.7. Check all safety guards are secured in location.
- 1.8. Inspect brake of winding gear, adjust as necessary, check brake liners are free from contamination by oil and/or grease and lubricate all pivot points.
- 1.9. Generally inspect the lift plant room equipment, remove any spillage, check and lubricate bearings and remove surplus grease. Leave plant room clean and tidy.
- 1.10. Check level of illumination in plant room and advise University of any deficiency.
- 1.11. Check plant room ventilation and advise University of any deficiency.
- 1.12. Check operation of plant room emergency lighting and advise University of any deficiency.
- 1.13. Test plant room emergency stop button and check main switch by manual trip.
- 1.14. Check rubber mat in location at controller.
- 1.15. Check that hand lowering instructions, electric shock notice and all tools are in place in the plant room.
- 1.16. Check operation of emergency release system.
- 1.17. Ensure that plant room is lock fast and locked.
- 1.18. Check operation of pit stop and pulley room switches.
- 1.19. Check shaft lighting and replace faulty lamps.
- 1.20. Check operation of communication systems.
- 1.21. Check that signs and notices are provided at appropriate locations, add signs and notices adjacent to each hazard area where deficiency or omission noted.
- 1.22. Report any defects or remedial actions to the University and enter in the Log Book.

3 MONTHLY

Carry out all Monthly maintenance tasks and in addition:

- 2.1. Check main fuses of main switch.
- 2.2. Examine motors, renew or re-bed brushes as necessary. Check and clean brush gear armature and motor.
- 2.3. Check all limit switches, proximity switches, vanes, safety gear, governor, tapehead, etc and undertake adjustment, lubrication or other remedial action as necessary.
- 2.4. Check all ropes for wear, stretch, clearances and lubrication, check all clips and anchorages.
- 2.5. Check that buffers are secured in place and in good condition.
- 2.6. Carry out low speed safety gear operation test by manual tripping of the governor or manual operation of the tripping rope. Examine actuating rods, shafts, cams, wedges or rollers for free movement by hand. Examine safety line to confirm it is intact and has free action. Clean and lubricate as necessary. Check normal running clearance between each guide surface and safety gear gripping face are equal. Check switch operation.
- 2.7. Clean car light fitting and check wiring.
- 2.8. Check closing force of car/landing doors.
- 2.9. Check wear and adjustment of car guide shoes.
- 2.10. Check controller, replace pitted or defective contacts, lubricate sliding contacts & moving pivots, main breakers should be checked and maintained as necessary. Remove all dust from controller.
- 2.11. Report any defects or remedial actions to the University and enter in the Log Book.

6 MONTHLY

Carry out all Monthly and 3 Monthly maintenance tasks and in addition:

- 3.1. Check all door locks, contacts and lock fixings.
- 3.2. Check car and landing top and bottom rails of door gear for wear and remove dust and debris, clean, check and lubricate roller tracks, hangers and pick ups.
- 3.3. Check governor tension device.
- 3.4. Check controller overloads for oil, operation and setting.
- 3.5. Report any defects or remedial actions to the University's Managing Agent and enter in the Log Book.

12 MONTHLY

Carry out all Monthly, 3 Monthly and 6 Monthly maintenance tasks and in addition:

- 4.1. Check and clean fuses, holders and connections at controller.
- 4.2. Examine all sheaves and fixings for wear, lubricate as necessary.
- 4.3. Check car and landing buttons, wiring and clean out boxes.
- 4.4. Clean and check car and counterweight guides, brackets and fastenings.
- 4.5. Check all fixings to car frame top and underside, check cabin is secure in frame.
- 4.6. Check all shaft switches, rollers, etc for operation.
- 4.7. Inspect all trailing cables, anchorages and half way boxes.
- 4.8. Clean and brush down all shaft equipment.
- 4.9. Check all motor connections, check all bearing wear and change bearing oil.
- 4.10. Check all rope tensions and equalise as necessary.
- 4.11. Check operation of any sump pumps in pits.

4.12. Prepare certificate of SaFED LG1 legislation equivalent one year tests and examination and pass to University.

Report any defects or remedial actions to the University and enter in the Log Book