31.4.7.1 Provide handrails around all platforms more than 600mm above the adjacent floor and on all stairways. Design handrails to withstand a minimum load of 100kg applied in any direction at any point on the top rail. Vertical support posts shall be spaced not more than 2400 mm on centres. Make handrails continuous without gaps between segments.

31.4.7.2 Design all handrails to consist of a top rail with one intermediate rail (knee rail) positioned halfway between the top of the walking surface and the top of the top rail as per. Provide additional intermediate rails if required by local code.

31.4.7.3 In areas of restricted clearance (vertically or horizontally), make intermediate rails spanning across conveyor drive locations removable for drive maintenance access. The removable section shall have a lockable device to maintain the handrail contiguous with other handrails within place on the platform.

31.4.7.4 Close all open handrail ends, vertical or horizontal, by welding a metal cap, grind smooth all handrail welds.

31.4.7.5 Provide any additional features required by local code.

31.4.8 Kick Plates

31.4.8.1 Provide kick plates on both sides of all platforms, walkways and ramps except where adjacent equipment or building structure provides the required function.

31.4.8.2 Construct kick plates of a minimum of 100mm x 6mm flat steel plate and install these so as to leave no gap between the access way walking surface and the lower edge of the kick plate.

31.4.8.3 Securely weld toe boards to vertical handrail posts and to the access way support structure.

31.4.9 Stairs

31.4.9.1 Provide stairs in accordance with applicable safety regulations

31.4.9.2 Provide as a minimum stair as required to ensure safe access for all personnel who operate, maintain or have access to the BHS.

31.4.10 Ships Ladders

31.4.10.1 Provide Ships Ladders in accordance with applicable safety regulations

31.4.10.2 Provide fixed maintenance ship's ladders to access platforms and walkways as required to ensure safe access for all personnel who operate, maintain or have access to the BHS.

31.4.10.3 Provide tubular handrails on both sides

31.4.10.4 Provide protective measures (i.e. swing gate, chain or off-set) at the top of the ladders.

31.4.10.5 Grind smooth all rough surfaces and edges.

31.4.10.6 All ship's ladders shall be of steel construction as specified elsewhere in this document.

31.4.10.7 Provide ship's ladders with handrails from top to bottom

31.4.11 Vertical Fixed Ladders

31.4.11.1 Provide fixed, 90-degree ladders to reach platforms and walkways as required to ensure safe access for all personnel who operate, maintain or have access to the BHS.

31.4.11.2 All fixed ladders shall be of steel construction as specified elsewhere in this document.

31.4.11.3 Grind smooth all rough surfaces and edges.

31.4.11.4 Side rails shall be of such cross section as to afford adequate gripping surface without sharp edges or burrs.

31.4.11.5 For all fixed vertical ladders in excess of 2,000mm in height provide a safety cage at the top of the ladder.

31.4.11.6 Provide safety chains at the top of all ladders.

32 LOW LEVEL CONTROLS (LLC) SYSTEM

32.1 INTRODUCTION AND KEY REQUIREMENTS

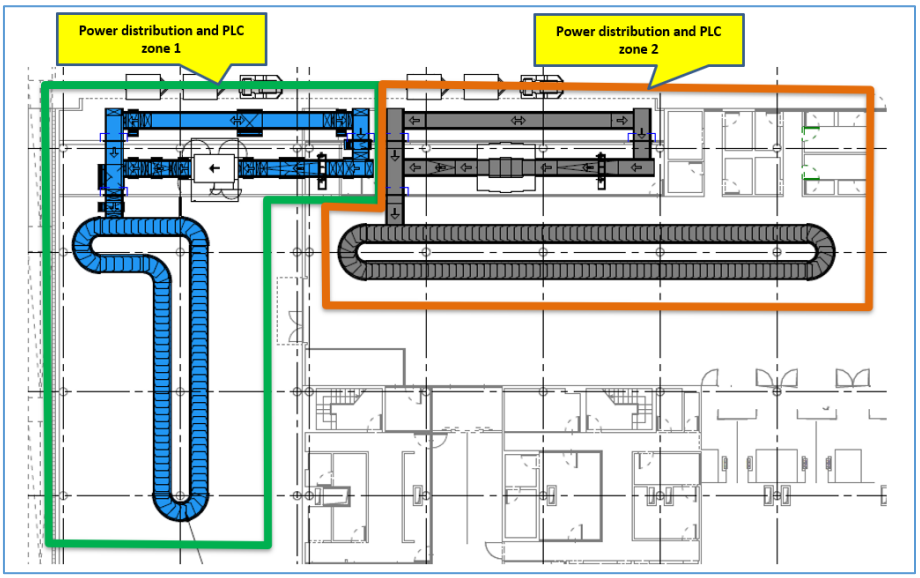
32.1.1 The Buyer is keen to re-use as much of the existing Control System as possible, but without impacting upon overall System Performance.

32.1.2 The existing Departures LLC are based on Siemens Simatic S7-300. There is limited documentation available on site, and Suppliers are invited to site to review this data.

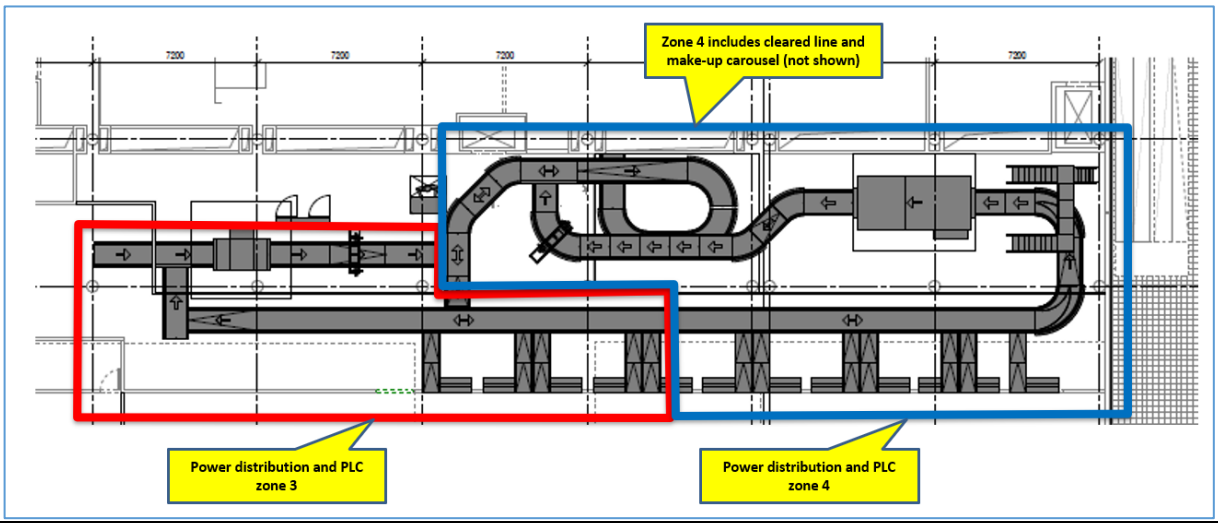
32.1.3 From a redundancy point of view, the BHS, mechanically and from a Controls perspective should be divided into 4 sub-systems, such that a fault of any type on one sub-system doesn't affect the performance nor availability of any of the others.

32.1.4 The 4 main sub-systems are identified as follows:

- New Arrivals Sub-system – 36 kW (estimated)
- Existing Arrivals Sub-system
- Departures OOG system (including 5 check-in desks for handling of IG bags during fault conditions) – 26 kW (estimated)
- Departures IG handling system (including 7 check-in desks, screening and make up carousel) – 81 kW (estimated)



32.1.5 The existing controls systems are based on a Centralised principle. Suppliers can maintain the centralised principle, or a combination of centralised and decentralised controls solutions, based on the most economical solution to meet the Performance Requirements.



32.2 GENERAL ELECTRICAL REQUIREMENTS

32.2.1 General

32.2.1.1 All devices, cabling, plugs and other material used for the electrical installation of the BHS must be of industrial grade.

32.2.1.2 All devices must be labelled. Labels must be adjacent to the device on a permanent part of the installation such that the ID label remains when a replaceable component is renewed.

32.2.2 Electrical Services

32.2.2.1 Provide and install all mains cable required from nominated Main Distribution Boards (MDB) to the BHS and within the BHS. Provide all electrical work downstream of the MDB locations up to and including all end devices.

32.2.2.2 Provide and install all services, feeders and main isolators for branch circuits to each control panel, with separate circuits for each subsystem as specified and provide and install all panel boxes, wireways, conduits, conductors, transformers, breakers/fuses, and any other equipment and materials required to complete the electrical power distribution for the operation of the system.

32.2.2.3 Coordinate with the building electrical supplier on distribution of emergency power to required BHS subsystems to enable operation of the required BHS subsystems to support The Buyer's operational policy in a power outage condition.

32.2.2.4 Provide separate circuits for controlling programmable logic controllers (PLCs), powered fire/security doors, and other devices requiring emergency power. Note that these circuits must originate within the respective MCP.

32.2.2.5 Calculate the electrical power supply requirements on the basis of total connected load with a diversity factor. Size the conductors to ensure that the voltage drop does not exceed 3% at the farthest outlet of power, heating and lighting loads, or combinations of such loads. Also ensure that the voltage drop does not exceed 5% at the farthest outlet for both feeders and branch circuits.

32.2.2.6 All electrical components, devices, accessories, and equipment must be listed, labelled and identified as suitable for the use intended by the testing agency acceptable to the authorities that have jurisdiction. This must include any control panels/cabinets, whether factory or Contractor fabricated.

32.2.3 Mains Distribution and Connection

32.2.3.1 Provide and install all services, feeders, and main isolators for branch circuits to each control panel, with separate circuits for each subsystem as specified and provide and install all panel boxes, wireways, conduits, conductors, transformers, breakers/fuses, and any other equipment and materials required to complete the electrical power distribution for the operation of the BHS.

32.2.4 Power Factor Correction (PFC)

32.2.4.1 Power Factor Correction (PFC) will be provided by the Supplier for all systems at PDP level upon completion of the installation to achieve a minimum of 95% corrected power.

32.2.5 Electromagnetic Compatibility (EMC)

32.2.5.1 Provide Noise and harmonic protection as required to meet applicable EMC requirements (eg mitigate under-voltage, abnormal-voltage conditions).

32.2.6 General Maintenance/Utility Power Outlets

32.2.6.1 Provide and install all equipment and cabling to provide a 240V AC, 50 Hz maintenance power outlets along the BHS placed at an interval of 10m or such that it is possible to perform maintenance on any segment of the BHS installation with power tools using a single 20 metre long extension cord from the maintenance power outlet. The extension cord must not cross any conveyors nor must it be necessary to change walkway or platform elevation by more than 1-metre.

32.2.6.2 The maintenance outlets must be powered separately from the Mains Distribution Board (via sub-panels, if needed) to ensure that the outlet is functional when the MCP main isolator of the equipment adjacent to the outlet is switched off.

32.2.6.3 The maintenance outlets must have a cover and IP rating sufficient for the environment (ie prevent dust and water ingress, minimum IP54).

32.2.7 Raceways - General

32.2.7.1 Enclose all power and control wiring, including low voltage wiring in Rigid Metal Conduit, Electrical Metallic Tubing, Flexible Conduit or enclosed wireways.

32.2.7.2 Enclosed wireways are the preferred method of cable containment in BHS areas, non-enclosed ladder cable tray is not to be used in BHS areas. E.g. non-enclosed ladder cable tray may be permitted on vertical runs above MCPs, along walls etc.

32.2.7.3 All raceways must be routed to respect the clearance zones of the equipment and maintenance walkways.

32.2.7.4 All wire and cable containment runs must be mounted so as not to restrict maintenance access to the BHS equipment, conveyors and conveyor components that requires servicing. Cable runs must not be run/or mounted on outside guards and/or perimeter chain guards of power turns or on merge conveyor deflector assemblies.

32.2.7.5 Horizontal runs must be racked and supported from the building roof or mezzanine steel in locations not interfering with the BHS, maintenance areas, or walkway areas.

32.2.7.6 Install drops to motors or other devices adjacent to the nearest available equipment or building column. Mezzanine supported equipment may be electrically fed from below the mezzanine from racked conduit supported under the mezzanine.

32.2.7.7 Avoid cable runs on floors, and ensure a minimum 150mm clear underneath.

32.2.7.8 Extra Low Voltage wiring must run in separate conduits or in separate compartments of wire ways and cable trays segregated (physical divider) from the Low Voltage wiring.

32.2.7.9 Appropriately sized insulated bushings and jumpers must be installed on all conduits and conduit fittings that enter metallic or non-metallic control panels, workstation/computer cabinet(s), outlet boxes, disconnects, or j-box/pull box(s).

32.2.8 Conduits

32.2.8.1 Where rigid metal conduit is required a minimum diameter of 20mm must be used.

32.2.8.2 All conduits must be run parallel or at right angles to structural members and equipment.

32.2.8.3 In public areas, make conduit runs inconspicuous.

32.2.8.4 In non-public areas, run exposed conduit in protected locations to prevent damage by moving vehicles, equipment or maintenance personnel.

32.2.8.5 Use rigid metal conduit in all areas of the BHS installation that are at elevations less than 2500mm above finished floor in all areas that are exposed to vehicular traffic.

32.2.8.6 Use Low Smoke Zero Halogen type flexible conduit for connection to motors, photocells, limit switches or any device, which may be subject to vibrations or require adjustment.

32.2.8.7 All cables not contained in conduit or raceways must be protected by flexible conduit.

32.2.8.8 Flexible conduit must not exceed 800mm in length.

32.2.8.9 As per relevant Electrical Standards do not run low voltage (less than 30 volts) or dc in the same conduit with power wires unless segregated, providing insulation from interference.

32.2.8.10 Conduit runs must be mounted so as not to restrict maintenance access to the works or other BHS equipment, conveyors and conveyor components which require servicing. Conduit runs must not be run or mounted on outside guards or perimeter chain guards of power turns or on merge conveyor deflector assemblies.

32.2.9 Wire and Cable

32.2.9.1 Use appropriate conductor size, Low Smoke Zero Halogen or approved equivalent, with insulation rated for at least 600 volts for all cables (excluding network cables and control cables installed within the control panel (below 48VDC)).

32.2.9.2 Connect pre-wired electrical devices to terminal blocks mounted in junction boxes adjacent to the devices.

32.2.9.3 Do not use blade connectors (such as but not limited to fork or ring style) for connections

32.2.9.4 Tag control and power circuit conductors with machine printed identification numbers (in accordance with electrical drawings) at both ends of the cable and wire. Tag method must be of the sleeve or other permanent type. The use of multiple tags to create a single tag is not acceptable.

32.2.9.5 Keep all cables on reels while being pulled. Do not allow cables to contact the ground or floor.

32.2.9.6 Cables are to be sized appropriately for their purpose. Calculations undertaken to confirm wire sizes shall be done in accordance with the appropriate standards.

32.2.10 Multi Conductor Cables

32.2.10.1 Use multi conductor cables with quick disconnect connectors with latching provision on both ends for all connections between the DCP and the end devices.

32.2.10.2 Use factory terminated and tested cables for cable lengths of less than 3 meters. The length of the cable must not be more than 0.5 meter longer than the minimum cable length required for the connection. Excessive cable must be coiled and clamped to the component frame (plastic wire (zip) ties are not acceptable).

32.2.10.3 Cable lengths longer than 3 meters must be routed through conduit or wire way to within 0.5 meter from the end device and 0.5 meter from the DCP. These cables must be manufactured with factory terminations on a connector on one side (i.e. a cord set).

32.2.10.4 Quick disconnects must be industrial grade, oil, lubricant and fuel resistant and must use a retention device (e.g. clip). Use ‘Harting’ or similar type connector.

32.2.10.5 Multi conductor cable must be of armoured type or run through flexible conduit for protection.

32.2.11 Spare Conductors

32.2.11.1 Provide a minimum of 5% spare conductors in all conduit home runs, with a minimum of two spare control wires and one spare power wire.

32.2.11.2 Terminate all spare conductors on terminal blocks in control enclosures, or coil all spare conductors allowing sufficient length to permit future connection.

32.2.11.3 Tag spare conductors as required above, i.e., each spare conductor is to be identified as a spare with its own unique wire identification number and field termination location.

32.2.12 Wiring Identification

32.2.12.1 Submit the wire colour method to be employed for this project prior to the start of any wire installation. Colour code all electric wire and cable as follows unless applicable codes and regulations for wiring colours states otherwise:

32.2.13 Earthing

32.2.13.1 Earth all electrical equipment to the building ground mat by a dedicated low resistance equipment-grounding conductor installed in accordance with the applicable codes. The BHS Earthing system shall provide the following functions:

- Clearance of electrical faults
- Prevention of dangerous potential differences
- Prevention and dissipation of static charges
- Reduce electromagnetic interference between electrical/electronic equipment in both the LF and HF range

32.2.13.2 Earth all outgoing conduits at all motor control panels and control consoles by means of conduit earthing bushings, using copper earthing wire looped between conduits in each cubicle and connected to an earth bus or lug.

32.2.13.3 Include a 600 Volt insulated copper earthing conductor of appropriate colour and conductor size in each conduit, wire-way, cable tray etc.

32.2.13.4 Provide a bonding jumper of green 600 Volt insulated yellow and green copper wire where flexible metal conduit is used at motors.

32.2.13.5 Motors/VFDs must be earthed in accordance with the manufacturer's recommendations and earthing methodology.

32.2.14 Support

32.2.14.1 Mount conduit supported from building wall using uni-strut type mounting channels to provide clearance to the wall.

32.2.14.2 Do not weld conduit to structural members.

32.2.15 Motors

32.2.15.1 The Buyer may request a demonstration that motors are appropriately sized, and the conveyor is installed correctly with a conveyor load test on selected units.

32.2.16 Isolator Switches

32.2.16.1 Provide isolator switches of the 3-pole, heavy-duty type, and are non-fusible with a quick-make and quick-break operating mechanism and a means of padlocking the switch in the OFF position for all drives.

32.2.16.2 Isolator switches must have an auxiliary contact monitored by the PLC and their status shall be monitored by the SCADA system.

32.2.16.3 Provide a N.O. auxiliary contact for connection to a PLC input.

32.2.16.4 Motor safety isolators for motors equipped with soft start devices must have an auxiliary N.O. contact interlocked with the associated emergency stop circuit.

32.2.16.5 Each Motor safety isolator must be identified with a permanently attached white phenolic plate, engraved with black characters, providing the identification of the conveyor with which the motor is associated.

32.2.16.6 Use IP54 enclosures for interior equipment and IP65 for exterior equipment.

32.2.17 Magnetic Motor Starters within the DCP

32.2.17.1 Within the DCP provide a separate IEC motor starter for each motor drive section with an auxiliary contact monitored by the control system and overload protection with manual reset and an auxiliary contact monitored by the control system.

32.2.17.2 Starters must be sized one rating higher than recommended by the manufacturer.

32.2.17.3 Starters must be selected by motor full load current and the motor service factor.

32.2.17.4 Provide IEC starters with lockout provision.

32.2.17.5 Provide each starter with an individual breaker.

32.2.18 Variable Frequency Drives (VFD)

32.2.18.1 The Type of VFD utilized must be IEC compliant.

32.2.18.2 Provide the ability to program and monitor all drive parameters. Provide programming devices with pre-programmed parameters for various types of VFD programs (e.g. standard queue, merge, etc.) to allow simple downloading of such programs when replacement or reprogramming of a VFD is required.

32.2.18.3 Where fast stopping is required provide dynamic braking resistors.

32.2.18.4 VFDs must be capable of the appropriate number of engagement cycles per minute (based on the subsystem throughput requirement and a start/stop cycle for each bag) for the specific application under full load without unreasonable heating, overload tripping or other VFD faults. This must be factored in when designing the system. Provide VFDs and dynamic braking resistors of a larger power rating if required to meet the application's requirements.

32.2.18.5 Factor in heat dissipation of the VFDs for the DCP design. If external brake resistors or heat sinks are used, which are expected to exceed 50 degrees C they must be located in such a way that they cannot be inadvertently touched.

32.2.18.6 When using VFDs, VFD rated shielded cable must be used.

32.2.19 Electric Brakes

32.2.19.1 Provide brakes with a mechanical release mechanism.

32.2.19.2 Incorporate automatic adjustment of brake disk wear or provide a brake, which requires minimal adjustment.

32.2.19.3 Select the brake to be capable of cycling as required by the conveyor application under full load with no excessive wear.

32.2.19.4 Choose brakes to have a minimum torque rating equal to the starting torque of the motor.

32.3 PROGRAMMABLE LOGIC CONTROLLERS (PLC)

32.3.1 Provide Programmable Logic Controller(s) (PLCs) for direct interface between all input and output devices in the BHS.

32.3.2 Provide each PLC with an EPROM or similar safeguard to provide memory backup. Ensure that under complete removal of all power to the PLC the program remains in the processor or memory card indefinitely.

32.3.3 Provide PLCs with Ethernet capability for connection to external devices, such as workstations, etc.

32.3.4 Provide each PLC with a minimum of 25% expansion and each I/O with space for adding 25% more modules.

32.3.5 Input/output (I/O) modules must have a visual indication of the status of each I/O point. The status displayed must be for both signals, input into each I/O module and the output signal from each I/O module

32.3.6 All PLCs must have a battery backup system (UPS) capable of storing data and maintaining communications with external interfaces including the HLC for a minimum period of 120 minutes, should a power outage occur.

32.3.7 In the event of an emergency stop or a power outage on a subsystem and restart within 120 minutes, the PLC must retain all baggage tracking information such that upon restart of the conveyors, the subsystem will still route bags to the appropriate location(s).

32.3.8 The primary function of the Programmable Logic Controllers (PLCs) must be the control of all conveyors including, but not limited to:

32.3.9 Primary PLC Functions

32.3.9.1 Tracking of baggage on conveyors using encoders and strategically located photoelectric sensors.
32.3.9.2 Tracking must be of shift register methodology; the use of FIFO must not be implemented.
32.3.9.3 Jam detection
32.3.9.4 Normal Start/stop routines
32.3.9.5 Auto-Stop/Auto-Start timing logic and start-up routines
32.3.9.6 Actuation diverters and merges.
32.3.9.7 Cascade stop control
32.3.9.8 Indexing control, start/stop routines
32.3.9.9 Control of associated feed conveyors
32.3.9.10 Screening equipment interfaces
32.3.9.11 Selection of alternate flow paths in the event of a failure
32.3.9.12 Self-diagnostics

32.3.10 Commonality of PLC equipment manufacturers must be maintained utilizing the minimum number of individual models.
32.3.11 PLC scan time regardless of the configuration (redundant or not) must not exceed 50ms

32.4 WIRING DEVICES

32.4.1 Provide full size controls (e.g. pushbuttons, indicator lights) to an IP65 rating.

32.4.2 As much as possible, use the same type of sensors (photocells, limit switches, and so on) to minimize the number and type of spares. Select sensors with the same mounting system wherever practical. Provide justification where different sensors are needed. This requirement for consistency applies to the entire scope of supply including scope delivered by subcontractors.

32.4.3 Use plug-in type electrical components wherever available. Do not use blade connectors.

32.4.4 For plug-in type electrical connectors, wherever possible use connectors that minimise the footprint of the connector (eg use right-angled instead of straight connectors to minimise cables protruding from devices or wire-ways into walkways).

32.5 KEYS

32.5.1 All keys provided by the Supplier, e.g. for boxes, locks, control cabinets, control stations, machinery, rooms, E-stop and similar must be coordinated with The Buyer.

32.5.2 As a minimum separate all key switches into operational and maintenance function groups. All key switches within each group must be keyed alike.

32.5.3 Provide a minimum of 5 Operational Keys and 5 Maintenance Keys.

32.6 PHOTOCELLS (PHOTOELECTRIC SENSORS) (PEC)

32.6.1 Provide photocells of the self-contained, retro-reflective type using an infrared modulated light source with sensitivity adjustment and LED status indicator that is readily visible.

32.6.2 Provide photocells with signal status that shows (a) fully aligned (b) almost misaligned (c) misaligned (via coloured LEDs).

32.6.3 Mount photocells to structural members or side guards using an adjustable bracket. Alignment and status LEDs must be easily visible for maintenance personnel. The use of magnetic photocell mounts is not permitted.

32.6.4 Ensure that photocell mountings are permanent and rigid and inhibit any movement of the photocell equipment during conveyor operation. It must not be necessary to adjust photocell locations as part of preventative maintenance routine.

32.6.5 Holes in the side guard for photocells must be dimpled away from baggage flow to minimize the possibility of snagging a bag and causing a jam.

32.6.6 Provide photocells as required by the functional needs of the BHS. Photocells must indicate a reliable life of over 10 million cycles, and be unaffected by environmental conditions such as vibration, rain, humidity, cold, heat, dust and sunlight. Provisions must be made to effectively accomplish the sensing of any of the typical types of airline baggage and packages.

32.6.7 Photocells must not be subject to interference from standard communication systems employed at the airport location due to airport and airline radio ground communications, ground to aircraft communications, aircraft to aircraft communications or any form of radar equipment operation.

32.7 ELECTRICAL DEVICES IN PUBLIC AREAS

32.7.1 All electrical devices and control stations in public area must be placed out of sight and must have stainless steel cladding and covers on all visible elements. Equipment must be recessed to avoid snag points and injury of passengers.

32.7.2 Reset of E-stop conditions in public area must only be possible with a key. The E-stop reset control station must be disabled when the key is not inserted into the control station.

32.8 CONTROL STATIONS

32.8.1 General

32.8.1.1 Indicating lamps, other than those associated with MCP and FCPs, are to be located as required to properly alert personnel.

32.8.1.2 All control stations must be rated to IP54 as a minimum.

32.8.1.3 Control stations must contain the appropriate control elements such as touch panels, push buttons, selector switches, and indicator lights to assist in the monitoring and control of the BHS.

32.8.1.4 Control station function identification plates must be identified in Lithuanian. Terms must be coordinated with The Buyer and use elementary concise terms supplemented by graphic symbols. All identification plates must be affixed to the console face double sided tape is acceptable, however if this fails during the maintenance the identification plate is to be. Mechanically fastened.

32.8.1.5 Emergency stop push buttons, disrupting electrical control power, must be employed where an emergency may require immediate shut down. Where more than one emergency stop button is used in any circuit or system, only the indicator lamp on the emergency stop button activated must be energized. Actuation of any emergency stop must be announced at the SCADA system. In the event an Emergency Stop is activated and then pulled out, but not reset, an indication at the dynamic status map and central visualization must be provided to allow maintenance personnel to locate the appropriate reset push button.

32.8.1.6 Indicator lights must be clearly visible in all lighting conditions.

32.8.1.7 Control elements such as switches, push buttons, handles, and others must be selected for ease of operation in an industrial "bag room" environment.

32.8.1.8 Control elements such as switches, pushbuttons, indicator lights, bulbs, and others must be easily replaceable and reasonably protected from physical damage. Durable LEDs must be used for lamps.

32.8.1.9 Freestanding control stations and manual encode consoles must be mounted on rugged and braced pedestals with large firmly anchored base plates.

32.8.1.10 Start-up warning alarms and Fault alarms (i.e., audible and visual) must be located at strategic locations to alert operations and maintenance personnel of a fault or the imminent start-up of conveyor equipment. As a minimum provide start-up alarms at baggage input areas, on top of the MCPs and along the conveyor line rights-of-way (e.g., ceiling supported conveyors, etc.).

32.8.1.11 System Start-up and Fault Indication Beacons: System start-up and fault indication beacons, with amber globes, must be located on top of the MCPs and FCPs, at the baggage input areas and along the conveyor rights-of-way (e.g., ceiling supported conveyor equipment).

32.8.2 Control Station Naming Plates

32.8.2.1 The electrical control stations, their related control devices, field wired control devices must be identified with a permanently attached white phenolic plate, engraved with black characters, providing the identification of the control station and control device. Dymo-type labels are not acceptable.

32.8.3 Locations

32.8.3.1 The location of the control stations and all other control devices must be such that maximum possible access is provided to the devices for servicing of the devices. Photocell devices are to be mounted so that they are accessible from catwalks adjacent to conveyors. In certain areas, protective guarding may be required to protect the control station and control devices. The design and installation of this protective guarding must not prevent quick access to the control devices for adjustment, servicing or replacements.

32.8.3.2 The location, mounting and guarding of control stations and control devices must not in any manner restrict the access and servicing of any mechanical components of the BHS.

32.8.3.3 As part of the submittal requirements provide drawings to show locations of all control devices. Final locations of the control devices must be approved by The Buyer after field survey verification when all control devices have been installed.

32.8.4 Emergency Stop Button

32.8.4.1 All pushbutton switches used for emergency stop applications must be of the maintained contact spring-loaded push to stop, twist to release red mushroom head type switch.

32.8.4.2 Emergency stop pushbutton switches must be equipped with a 'key release' in public and BHS operational areas and 'no key release' in non-public and non-operational areas.

32.8.4.3 Emergency stop pushbuttons must have a contact block that prevents the contact elements of the E-Stop button from working loose without detection. Situations such as the contact block falling off the back of the pushbutton will be detected by the safety circuit.

32.8.4.4 Emergency stop pushbuttons must have a round yellow sticker affixed behind the button labelled 'EMERGENCY STOP'

32.8.5 Pushbuttons

32.8.5.1 All Push Button Switches must be of the momentary contact type,

32.8.5.2 All pushbuttons must be flush head.

32.8.5.3 The colour coding for the push buttons must be coordinated with the Buyer.

32.8.6 Illuminated Pushbuttons

32.8.6.1 Where used, provide consistent use of indicator lamp colours in relation to functions.

32.8.6.2 All illuminated pushbutton switches must be of the momentary contact type.

32.8.7 Indicator Lamps

32.8.7.1 Where used, indicator lamps must be of the push-to-test type on control panels with less than five indicator lamps.

32.8.7.2 For control panels with five or more indicator lamps, a common lamp test pushbutton must be provided to test indicator lamps.

32.9 LIGHT BEACONS / TOWER LAMPS

32.9.1 Use light beacons with audible alarm connected to the PLCs throughout the system to alert operators and maintenance staff to the status of the equipment. The use of colours and sounds must be consistent throughout the system.

32.9.2 Light beacons must use minimum 50mm diameter lights.

32.9.3 Provide a 3-layer light beacon with audible alarm at all MCP locations, and at a maximum of 30-meter intervals and such that there is always one within the line of sight.

32.9.4 Use the light beacons and audible alarms to provide visual and audible start-up warning and fault warnings.

32.9.5 The alarm will be activated along with one of the following indicator lights whenever any fault has caused a section of conveyor to stop or prevent it from starting.

Function	Colour
Baggage Jam / Operational Fault	Amber
Motor Overload / Technical Fault	Blue
Emergency Stop Reset	Red

32.10 AUDIBLE WARNINGS

32.10.1 Audible alarms must be audible in all areas of the BHS during normal operating conditions (e.g. normal equipment noise or public space noise with maximum occupation).

32.10.2 The type of start-up/fault audible alarms must meet applicable codes and must be coordinated with the Buyer (type of sound, duration, etc.). The type of audible alarms used for public spaces, technical spaces (BHS operations maintenance staff only) and operational spaces (ground handler areas) maybe required to be different. Propose a suggested configuration of the audible alarms per type of space.

32.11 LLC / POWER DISTRIBUTION HARDWARE REQUIREMENTS

32.11.1 Mains Distribution Board (MDB)

32.11.1.1 . Connectivity and integraton withMDB is contractors responsibility. Contractor is responsible for connecting to and terminating between MDB's and BHS control panels.

32.11.2 Motor Control Panel (MCP)

32.11.2.1 The BHS Motor Control Panels receive power from the MDB, which is then distributed to the FCP's, PLC and other control devices.

32.11.2.2 Each MCP must have the necessary circuit breakers, surge protectors, reactive power correction and terminals required to distribute the incoming power to the relevant field panels.

32.11.3 Field Control Panel (FCP)

32.11.3.1 The Field Control Panels (FCP) are located in the field of the BHS installation close to the conveyors within the control area.

32.11.3.2 Distribute the power from the incoming MCP to the individual power busses feeding the power to the motors through the DCP.

32.11.3.3 The related circuit breakers for the protection of the individual power bus lines must be mounted inside the FCP.

32.11.3.4 All outgoing conduits from the FCP must be appropriately grounded in accordance with the relevant Standards.

32.11.4 Drive Control Panel (DCP)

32.11.4.1 The Drive Control Panels (DCP) are located in the field immediately adjacent to the individual conveyor controlled. Each DCP may control one conveyor segment or a group of conveyors. If the supplier proposes the use of distributed drives, DCPs may not be required however conveyor segment group control is still required as per the requirements below.

32.11.4.2 In case an E-stop condition is activated, or the E-stop circuit is broken, the power to the individual motor must be disconnected.

32.11.4.3 The related circuit breaker, that disconnects the motors in case of an "E-stop condition" is mounted in the area cabinet (group of conveyors are shut down), also called the MCP.

32.11.4.4 Each Local Control Unit must handle sufficient I/O signals for its function. Contractor's proprietary design can be used for configuration of I/O requirements and such that sufficient spare I/O is available for other requirements when applicable, e.g. over-height detection, over-length detection, light beacons and similar.

32.11.4.5 All outgoing conduits from the DCP must be appropriately grounded to an earth bus using copper earthing wire, looped between conduits in each panel.

32.11.4.6 All cable terminations to the DCP must be of industrial type quick disconnect plugs allowing maintenance staff to replace the DCP within 5 minutes.

32.11.4.7 Standardize the design of the Local Control units such that the fewest possible variations are used in the field.

32.11.4.8 Each DCP must have the following modes: Automatic mode, Off mode (conveyor is disabled, can be used for e.g. maintenance) and Manual mode (conveyor is continuously running, can be used for e.g. maintenance like belt tracking)

32.11.5 Panel Enclosures

32.11.5.1 All control equipment for the newly installed conveyors must be housed within new motor control panel(s) for the associated subsystems. Provide adequate capacity within the panel(s) for all necessary control devices.

32.11.5.2 Utilize cabinets with access doors for each bay providing access to all internal components in that bay.

32.11.5.3 Provide ventilation and/or air conditioning where needed for the panels.

32.11.5.4 Provide replaceable or cleanable filters suitable for the environment on the intake vents where fans are used.

32.11.5.5 The working space in front of control panels must be a minimum of 1000mm or more if required by the applicable codes and standards. In all cases, the workspace must permit at least 90 degree opening of the control panel doors.

32.11.5.6 For all free-standing control panels, provide a concrete or galvanized steel plinth, pedestal, legs or similar means to raise the control panel a minimum of 100mm above the floor to minimize the possibility of any water damage to the panels.

32.11.5.7 Appropriately sized waterproof bushings/seals/glands must be installed on all cables, conduits and conduit fittings that enter/exit the Motor Control Panel(s).

32.11.6 Control Devices within Panels and Workstations

32.11.6.1 The identification of control devices and components such as relays, timers, transformers, power supplies, overloads, fuses, PLCs, and other equipment in the panels, workstations and computer cabinets must be identified with I.D. tags.

32.11.6.2 The I.D. tags must be easily readable and located so that they can be easily read when the related panel, workstation or computer cabinet door is opened.

32.11.6.3 The I.D. tags are not to be mounted on the covers of the slotted wireways/cable ducts within the related cabinet or control panel.

32.11.6.4 The I.D. tags must be mounted on the backplane of the panel visibly and near to the component.

32.11.6.5 The conveyor I.D must be on a tag next to the I.D. tags for motor starters.

32.11.7 Panel Labelling & Identification

32.11.7.1 Each MCP must be identified with an ID tag label, the ID tag must as a minimum include the following information:

- MCP Designation, Related Baggage Subsystem, Related Conveyors or Devices Controlled by the MCP.
- MCP Manufacturer and manufacture date, fault current rating, point of electrical supply, upstream electrical isolation point and any other information required by applicable standards and codes.

32.11.7.2 Labels must be secured to the panel door surface in an ergonomic location with an appropriate adhesive, if this fails during the maintenance period the ID tag is to be mechanically refastened.

32.11.8 Fuses / Breakers

32.11.8.1 All Motor Circuit Breakers status shall be monitored by the PLC and provide relevant alarms on the SCADA when tripped.

32.11.9 Interruption Rating

32.11.9.1 Base interrupting rating of all circuit breakers, fused isolators, motor control centres, and panel boards on short circuit calculations and ensure they are compatible and coordinate with base contract equipment.

32.12 FIELD BUS COMMUNICATION

32.12.1 LLC Network

32.12.1.1 For the low-level BHS field communication network use one of the following acceptable technologies for the communication between the MCP-FCP and FCP-DCP. It is acceptable to use one of the technologies for the communication between MCP and FCP, while using a different technology (from the same list below) for the communication between the FCP and DCP communication.

32.12.1.2 The following field communication technologies are permitted: Industrial Ethernet, Profibus, AS-i, Modbus, ProfiNet. Additional technologies may be considered with consultation with The Buyer.

32.12.1.3 The field communication must allow for inter-communication of many types of devices, including, but not limited to PLCs, Maintenance Terminals, Displays, Computers, Printers, Handheld Bar Code Laser Scanner Guns, Manual Encoding Stations, Fixed Bar Code Scanner Arrays, RFID Scanner Arrays.

32.12.1.4 The design of the field communication must utilize no more than 75% of the nominal node capacity in order to achieve the required PLC scan times.

32.12.1.5 Each panel or device connected to the field communication must be one uniquely identified node. Configuration of the node ID must be the only required configuration when any panel or device is replaced, i.e. the PLC must automatically download motor starter parameters (VFD, soft start) when the replaced device is identified in the network.

32.12.1.6 The field communication must be a single connection from the MCP and PLC to the FCP and DCP. The field cabling can be done via direct point-to-point connection, Daisy-chain connections or Trunkline T-connectors, where the latter is preferred unless this contradicts with manufacturers installation recommendations.

32.12.1.7 The PLC must monitor the status of the field communication and status must be available at SCADA with uniquely identified alarms matching the identification of the field communication segment.

32.12.1.8 The field communications cabling design accordance manufacturers installation recommendations. Provide equipment such as repeaters between segments and terminating resistors as required to boost signal strength.

32.12.1.9 The field communication must be immune to external noise from electromagnetic interference and radio frequency interference (EMI/RFI).

32.12.1.10 The field communication must utilize a time-sharing method of communication control, thus eliminating the possibility of anyone-interface module from dominating the network.

32.12.1.11 Use industry best practice for the communication use data stream from one interface module to another or to the primary baggage system computer, and provide data transfer, message acknowledgments, and error recovery. The data must refer to ladder rungs/function blocks; register data, I/O status, and other information.

32.12.1.12 Ensure that expansion may be accomplished by interface module-to-interface module linking.

32.12.1.13 Use standard protocols with error recovery on all data transmissions for error checking.

32.12.1.14 Place source/destination message routes in the command for each device wishing to communicate.

32.12.2 Network Architecture and Infrastructure

32.12.2.1 The network must have a minimum update time of 1 ms and be capable of receiving, processing, and transmitting information within 50 ms or as required to facilitate baggage tracking.

32.12.2.2 The network communication speed must be agreed with The Buyer. The network architecture should be designed to optimize data transfer between network devices to fulfil the required time constraints.

32.12.2.3 At a minimum, cable must be capable of normal use in high noise environments. Industry approved cable taps, connectors, and adapters suitable for use in a bag hall environment must be used. Copper, ASI cable or Single Mode Fibre Optical cable or a combination thereof may be used for the LLC network.

32.12.2.4 Particular attention must be given to voltage across network components. Refer to manufacturer's literature for exact range of voltage potential.

32.12.2.5 Appropriate power supply ratings must be considered and applied for network components.

32.12.2.6 Repeaters must be used as recommended by the manufacturer to maintain network communication speed and reliability.

32.12.2.7 The network architecture must be designed to operate in conjunction with multiple processors. A minimum of 99 addressable nodes must be available for communication. Communication with essential components must be prioritized and used for reporting. The overall allowable length of the network cabling and remote components must be at least 15,000 feet 5,000 meters.

32.12.2.8 Each individual field bus network must be designed to operate up to 31 actuators or sensors and be capable of carrying data/power to distances of up to 100 meters.

32.12.2.9 No more than 32 I/O points may be assigned to each I/O module.
32.12.2.10 Network cables required for the new System must be installed, tested, and connected. The cables shall be of at least 6e category. The Supplier shall ensure the provision, installation, and preparation for use of all network units, devices, materials, and other accessories required for the System installation. All network infrastructure installation activities that have an impact on the System installation and smooth operation shall be carried out and included in the total price of the proposal.
32.12.2.11 The Supplier shall provide and ensure the network switches meeting the requirements below:
32.12.2.11.1 Power supply voltage shall correspond to the alternating voltage used in the Republic of Lithuania.
32.12.2.11.2 The unit structure: up to 1U high, mounted into the 19" switch cabinet.
32.12.2.11.3 The overall budget of the unit PoE power: At least 370W.
32.12.2.11.4 1GbE SFP ports: At least 1 pc. of free SFP 1 GbE ports.
32.12.2.11.5 The overall solid state memory "Flash" of the unit shall be at least 128MB.
32.12.2.11.6 The overall cashing memory of the unit shall be at least 512MB.
32.12.2.11.7 Total switching and routing capacity of the unit: At least 40 Mbps routing capacity, in 64 Byte packages, at least 55 Gbps switching capacity.
32.12.2.11.8 The overall size of "MAC" address table shall be at least 30,000 addresses.
32.12.2.11.9 There shall be an option of combining two switches into one logical unit by means of 1 Gbps or 10 Gbps ports. When combining two or more switches into one logic switch, there shall be an option of controlling them as a single unit and of using the port aggregation from different switches.
32.12.2.12 The following or equivalent standards shall be supported:
32.12.2.12.1 IEEE 802.3 az Energy-efficiency;
32.12.2.12.2 IEEE 802.1D MAC Bridges;
32.12.2.12.3 IEEE 802.1w Rapid Spanning Tree;
32.12.2.12.4 IEEE 802.1s MSTP;
32.12.2.12.5 IEEE 802.1Q VLANs;
32.12.2.12.6 IEEE 802.3ad Link Aggregation Control Protocol (LACP);
32.12.2.12.7 RFC 5905 NTP Client;
32.12.2.12.8 IEEE 802.1AB LLDP discovery protocol with LLDP-MED extension;
32.12.2.12.9 Rapid per-VLAN spanning tree (RPVST+);
32.12.2.12.10 VRRPv2/v3 (Virtual Router Redundancy Protocol).
32.12.2.13 The overall virtual network identifier: at least 4000 VLAN ID.
32.12.2.14 The overall virtual networks: at least 1000 at a time.
32.12.2.15 Routing functionality supported by the unit: IPv4 and IPv6 static routes.
32.12.2.16 RIPv1, RIPv2, RIPng, at least 200 static routes.
32.12.2.17 Supported Multicast protocols: IGMPv3, data driven IGMP, Multicast Listener Discovery Version (MLD).
32.12.2.18 At least the following L3 services and functions:
32.12.2.18.1 ARP (Address Resolution Protocol).
32.12.2.18.2 DHCP (Dynamic Host Configuration Protocol) server mode.
32.12.2.18.3 DHCP Relay function.
32.12.2.19 At least the following security functions:
32.12.2.19.1 Users' authentication by IEEE802.1X protocol, WEB interface or user's physical address simultaneously (web-based authentication and mac-based authentication).
32.12.2.19.2 An option of authentication of several different users by means of IEEE802.1X protocol in one port.
32.12.2.19.3 Supporting TACACS+, RADIUS, SSH v1/v2, SSL protocols.
32.12.2.19.4 Security filters (Access Control Lists) according to various level OSI L3 information (IP source and destination address, TCP/UDP source and destination port number).
32.12.2.19.5 An option of MAC address lockout.
32.12.2.19.6 STP BPDU port protection.
32.12.2.19.7 DHCP server protection.
32.12.2.19.8 STP Root Guard function.
32.12.2.19.9 Guest VLAN and Private VLAN functions.

32.12.2.20 At least 8 physical priority rows in each port.
32.12.2.21 Control functions of at least SNMP v2/v3, SSHv2.
32.12.2.22 At least the following traffic flow monitoring functions: RMON (4 groups).
32.12.2.23 NTP protocol support.
32.12.2.24 Cable arrangement panels shall be installed in the cabinets at each switch panel.
32.12.2.25 The proposed switches shall be compatible with the Buyer's switch management and monitoring software HPE IMC (Intelligent Management Center).
32.12.2.26 The compatibility shall cover at least an option to monitor, configure, and make configuration back-ups.
32.12.2.27 All proposed equipment shall be brand new, remarketed, or refurbished equipment shall not be accepted.
32.12.2.28 The manufacturer shall provide at least the 3 year warranty. During the warranty period the free-of-charge replacement of broken parts or the unit with the new one shall be ensured.
32.12.2.29 During the project the Buyer will not provide any hardware or related equipment. All the necessary hardware and equipment to be provided by the Supplier
32.12.2.30 All firewall and VPN's must be provided and installed by Contractor.
32.12.2.31 All BHS and EDS network must by physically and logically isolated. All necessary works and equipment must be provided by the Contractor.

32.12.3 Technical Requirements for Server Infrastructure

32.12.3.1 Below are indicative requirements for server infrastructure. The Supplier is responsible to provide and installed all server infrastructure according to the BHS and operational requirements defined in the contract.
32.12.3.2 The servers must meet the following requirements:
32.12.3.2.1 processor technology: x64, it shall support at least 64 bit operating systems and applications, memory type of at least DDR4-2133.
32.12.3.2.2 RAM expandability: at least 4 pcs. of free DIMM sockets.
32.12.3.2.3 hard drive RAID controller: supporting disk syndication at least into RAID 1.
32.12.3.2.4 power supply: redundant, "hot" replacement.
32.12.3.2.5 compatibility: equipment shall be compatible with the following or equivalent operating systems: Windows Server 2019.
32.12.3.2.6 case: mounted into the 19" cabinet, up to 3U high, with all accessories for mounting in the cabinet.
32.12.3.2.7 assembly and completion: hardware components (processor, memory, controllers, disks, etc.) shall be fully integrated into the unit at the manufacturer's factory. All parts (processor, memory, disks, control software, etc.) shall be completed by the manufacturer and marked by the manufacturer's trademarks. All equipment and its components shall be new and unused, refurbished components are prohibited.
32.12.3.3 The Supplier shall install and configure server software and software applications of the proposed solution.
32.12.3.4 During the project the Buyer will not provide any hardware or related equipment. All the necessary hardware and equipment to be provided by the Supplier
32.12.3.5 All Cabinets required for Servers or Network equipment must be provided by contractor.
32.12.3.6 All BHS server architecture must be redundant. Backups must be done on a daily basis, with possibility to recover 6 months old backup.

32.13 REQUIREMENTS FOR LICENSES

32.13.1 General

32.13.1.1 The Supplier shall provide all licenses required to use the System (hardware, software and system software, workstations, BHS and other equipment to be acquired within a scope of this purchase). Licences, licence types and quantities must be in line with the licencing rules of the manufacturer.
32.13.1.2 The licenses for the System components and software shall be issued for an unlimited period of time.
32.13.1.3 Licenses for software eg. Microsoft, VMware (if required), or others, shall be issued and supported by the manufacturer for a warranty period.
32.13.1.4 The provided licenses shall ensure an opportunity to use the System without restrictions.

32.13.1.5 The provided licenses shall be in line with the requirements referred to in the specification, as well as with the number of users, number of units and other requirements.

32.13.1.6 The Supplier shall notify the Buyer of the quantities and methods of acquisition licences in writing. The Supplier shall install and configure server software and software applications of the proposed solution.

32.13.1.7 For all software unique to the BHS and not commercially available the as-built deliverables shall include, at minimum, all of the information necessary to make revisions in the software program applications for the BHS for changes or expansions or extension of the BHS, such as functional, performance and interface requirements; descriptions of the supervisory, control, and operating software; source listings; flow charts; configuration control documentation; and programmer and user manuals incorporating appropriate modification and control procedures, including the name of any sub-contractor used for preparation of this software.

32.13.1.8 For all commercially available software used in the BHS, the as-built deliverables shall include all the documentation that is available from the supplier of such software. Copies of all programmer and user manuals and other similar material shall be provided to the Client along with a complete and fully documented listing of all software programs.

32.13.1.9 A back-up copy of the configured system software shall be provided in an approved media. All original distribution software shall be delivered with an installable back-up.

32.14 EMERGENCY STOP CONCEPT

32.14.1 General

32.14.1.1 Locate Emergency Stop devices as required to ensure that operating and maintenance personnel can easily and quickly reach an emergency stop device from anywhere in the system. Emergency stop devices must be located at all potentially dangerous positions and as listed herein.

32.14.1.2 Upon activation of an emergency stop device, illuminate the lamp in the activated control station, and annunciate the activation of the emergency stop device at the SCADA system and illuminate the emergency stop light on the MCP.

32.14.1.3 When the emergency stop device is reset (either by key reset of the push-button or as required by the specific emergency stop device), the lamp in the associated control station must turn off. Note that the conveyors must not restart until a reset push-button has been activated.

32.14.1.4 When the normal start switch (or jam reset as applicable) for the conveyor is actuated, actuate the start-up warning alarms and, after a delay, all conveyors in the subsystem.

32.14.1.5 Note that the activation of an emergency stop device must not close any powered security door within the area of control of the emergency stop device.

32.14.1.6 Provide emergency stop zoning and methodology details for The Buyer's approval. Obtain certification that the emergency stop zoning and methodology meets with local regulations. In addition to meeting safety code, the emergency stop zoning must be designed to minimize disruptions to operations.

32.14.2 Safety Standards

32.14.2.1 The supplied BHS must comply with the relevant safety standards and codes.

32.14.2.2 The design process of the BHS shall incorporate a Risk Assessment by the contractor to determine the required safety features and safety performance of the BHS.

32.14.2.3 All components of the BHS control system safety circuit architecture shall be agreed with The Buyer.

32.14.2.4 The safety performance of the as-built BHS design shall be validated by a suitably qualified independent assessor and a copy of the report shall be provided to The Buyer.

32.14.3 Hardwire/Relay E-stop Concept

32.14.3.1 The overall BHS installation must be divided into emergency stop zones each controlled by a certified failsafe safety relay installed in a control panel. These emergency stop zones are a logical area, dependent on the physical layout, safety requirements and operational requirements to be submitted in the detailed design and agreed with The Buyer.

32.14.3.2 Wire emergency stop circuits through failsafe safety relays, which when interrupted, will remove 415 V power from the affected 415 V FCP bus.

32.14.3.3 Upon activation of an emergency stop device, the failsafe safety relay must immediately stop/disconnect power to all drives in the affected emergency stop zone. Additionally, illuminate the lamp in the activated control station, and annunciate the activation of the emergency stop device at the SCADA system and illuminate the emergency stop light on the MCP. The E-Stop button box is to be

equipped with an activation light which is triggered by activation or de-activation of the E-Stop. When the E-Stop button is active (button pressed) the activation light is to be on. Otherwise the activation light is to be off

32.14.3.4 The output signals from the failsafe safety relays must disengage the contactor, which must switch off the 415 V FCP buses to disconnect the conveyor and other component drives/motors from the 415 V power.

32.14.3.5 The MTTF of the failsafe safety relay must be a minimum 15 years.

32.14.3.6 Provide the failsafe relay with a diagnostics output and monitor the same with the PLC. Provide an alert on the SCADA system, if the failsafe relay is not operating as expected.

32.14.3.7 When interlocking E-stop zones (as described below) with a hardwire/relay configuration, the E-stop interlocks between the E-stop zones must be via a hardwired signal to the adjacent zone whether or not the adjacent zone's FCP bus is contained in the same FCP containing the primary E-stop zone activated; a PLC must not be required to remove power from the associated FCP bus for an emergency stop condition.

32.14.4 Failsafe Hardware – Failsafe Safety Relays

32.14.4.1 These self-acknowledging relays (i.e. the relay must monitor the status of the 415 V power bus contactors) must be used to switch off the 415 V power buses to disconnect the conveyor and other component drives/motors from the 415V power.

32.14.5 Emergency Stop Zoning

32.14.5.1 The emergency stop functionality of the entire BHS must be independent of the conveyor control PLC system.

32.14.5.2 The overall BHS installation must be subdivided into emergency stop zones. These emergency stop zones are a logical area, dependent on the physical layout, safety requirements and operational requirements.

32.14.5.3 An activated emergency stop device in one emergency stop zone stops all conveyors and moving parts within that zone. There must be no effects to data security, i.e. no loss of data like tracking information.

32.14.5.4 E-Stop devices at the border between two different E-Stop zones must stop the equipment in both zones. This shall be achieved such that failure of one sub-system (eg power loss, PLC failure, component failure) does not interlock other sub-systems in overlapping zones.

32.14.5.5 The emergency stop zones must be designed in such a way that the equipment stopped by the activation of the emergency stop will be within 30 meters.

32.14.5.6 In case of conveyor lines or other devices between two different building levels (such as lifts, incline or decline conveyors), the emergency stop zones must be defined to decouple the conveyor lines/devices of two different building levels.

32.14.5.7 In case of two stacked conveyor lines on top of each other in the same level, these conveyor lines must belong to the same E-Stop zone, except when the distances between the lines is large (i.e., greater than 4 meters) or when separate walkway will be provided for the two conveyor lines.

32.14.5.8 The following points must be taken into consideration when designing the emergency stop zones:

- Power Bus Distribution
- Baggage Flow Model
- Functionality of the affected conveyor subsystem(s)
- Building Area
- Building Levels
- Visual Range

32.14.6 Interlocking E-Stop Zones

32.14.6.1 Provide interlocks and limits in the BHS to ensure safe operation. Integrate all interlocks and limits that may be necessitated by the characteristics of the elements selected for combination into a total system. Interlocks and limits must be included for the protection of the Public, personnel, equipment and baggage, and in the performance of the operational functions specified for the subsystem and the elements that comprise the system.

32.14.6.2 Electrical interlocks between the various conveyors in a subsystem must be set up to preclude a conveyor discharging baggage onto an E-stopped belt. Interlocks must be cascaded from the last conveyor in a train to the first. This provision must apply to all subsystems even if two different suppliers provide the equipment under separate contract.

32.14.6.3 Inhibit further equipment action upon emergency stop device failure should personnel or public safety be in doubt and inform the involved equipment operator or maintenance personnel of such failure through the SCADA system. Emergency stop devices must be selected and positioned such that false signals from debris and personnel movement do not cause activation.

32.14.7 E-Stop Push Buttons

32.14.7.1 Locate emergency stop pushbuttons as required to ensure that operating and maintenance personnel can easily and quickly reach an emergency stop push-button from anywhere in the system. In addition, ensure that emergency stop pushbuttons are installed at the following locations:

- Around the perimeter of all make-up carousels and reclaim carousels.
- At each end of load/unload conveyors.
- Along lengths of conveyors, whether running at floor level or overhead mounted on conveyor support legs or building columns.
- In or adjacent to each jam indication enclosure.
- Adjacent to jam reset control stations
- Diverters, Sorters, Ploughs, Merges, Loaders
- All manned positions

32.14.7.2 As a minimum, ensure that the maximum distance between E-stop push-buttons is no more than 10 meters such that maintenance personnel will not have to travel more than 5 meters to reach an E-stop push-button. It should be noted that other more stringent requirements from applicable standards or codes (such as emergency stop distances at make-up and reclaim carousels) must override the above requirement.

32.14.8 E-Stop Reset

32.14.8.1 Reset of an activated E-stop condition must be possible from the E-Stop FCP panel and from the individual E-stop related control stations installed in the field, which contains an E-stop reset push-button.

32.14.8.2 After correcting the emergency situation, the E-stop Push-Button must have to be manually reset by twisting and pulling out the emergency stop Push-Button (requires the use of a key to manually reset the Push-Button in public areas). Upon releasing the E-stop device the E-stop condition must be reset with the E-Stop reset button locally at the related E-stop control station or E-Stop Panel. The BHS equipment can be restarted by activation of any of the Reset/Restart Pushbuttons or by command from the SCADA system.

32.14.9 E-Stop Control Stations

32.14.9.1 Standardize the design of control stations using a modular approach. Control stations for E-Stop related function must be separate from normal conveyor control stations unless E-stop push buttons are an integrated part of the conveyor control station. The list (below) of E-stop control stations must be installed as appropriate for the sub-systems and as shown in the contract drawings.

32.15 LOW LEVEL CONTROL (LLC) SYSTEM FUNCTIONS

32.15.1 PLC Software Architecture

32.15.1.1 The LLC software architecture must be modular and make use of a common library with single representations (e.g. blocks) defining the behaviour of all equipment of that type.

32.15.1.2 It must be possible to automatically 'roll out' the LLC software by building or rebuilding the software for all or specific PLC's based on the system layout and the common library.

32.15.1.3 The LLC software must include the use of change control to include the storage of the version number in the registers of the PLC

32.16 BASIC CONVEYOR SYSTEM CONTROL FUNCTIONS

32.16.1 Sub-System Start

32.16.1.1 Before any conveyor system or subsystem may be started, a start-up warning alarm must be sounded throughout the area to be affected by the starting of the conveyors. Activation of the start-up warning alarm must be through the PLC's. The start-up warning alarm must sound for a period of between 5 and 25 seconds (configurable with initial setting to be set at 15 seconds), the conveyor system or subsystem must start, provided all security doors are sensed to be in the "fully open" position. All warning alarms must be volume adjustable.

32.16.1.2 Each conveyor drive in the subsystem must be sequentially started from the output (downstream) to input (upstream) with an appropriate delay between each motor starter activation as to ensure that electrical power surges are minimized. This must be achieved through the normal motor starter interlocking mechanism. When start up is initiated, the conveyor immediately upstream of the most downstream photocell with auto start functionality in the line (described below) will start first, followed by the conveyor immediately upstream, etc. until start-up of the most upstream conveyor component in the line occurs. The next sequence of conveyors controlled by auto start functionality must start in a similar manner, triggered by baggage at a predetermined location within the line. For systems without auto start functionality, the most downstream conveyor component in the line will start first, followed by the conveyor immediately upstream, etc. until start-up of the most upstream conveyor component in the line occurs.

32.16.2 Stop

32.16.2.1 Provide physical "stop" pushbuttons at the MCPs and FCPs and software "stop" function at the BHS SCADA workstations to manually stop the system. When the stop function is used ensure that the conveyors are run sufficiently long such that there are no bags remaining in the subsystem.

32.16.3 Auto Start

32.16.3.1 Each conveyor drive in the subsystem will be sequentially started from the output (downstream) to input (upstream) with an appropriate delay between each motor starter activation as to ensure that electrical power surges are minimized. This will be achieved through the normal motor starter interlocking mechanism.

32.16.3.2 Provide auto start photocells upstream of sections of transport conveyors not specifically controlled by start/stop switches.

32.16.3.3 Program auto start circuits to start a string of conveyors whenever an auto start photocell is interrupted.

32.16.3.4 The same photocell may control both auto stop and auto start circuits.

32.16.3.5 In addition to the auto start feature, provide physical "start" pushbuttons on site and software "start" function at the SCADA system to manually start the system

32.16.4 Auto-Stop (Energy Management)

32.16.4.1 Each conveyor subsystem must be divided into logical energy management zones based on the locations of merges and diverts such that the entire sub-system is not required to run, if up-stream sub-systems feeding the sub-systems are not in use or are in energy management.

32.16.4.2 The minimum size of an energy management zone must be the segments of the subsystem between a merge and the subsequent divert. Where merges or diverts are located within 15 meters of each other they may be considered as the same energy management zone.

32.16.4.3 If no bag is detected in the energy management zone for a configurable time the equipment in the energy management zone must stop. The SCADA system must reflect the state of the equipment to be in energy management mode.

32.16.4.4 Activation of any start button on any of the control stations or interruption of any photocell in the energy management zone must start the equipment and reset the timer.

32.16.4.5 The control system must use photocells upstream of the energy management zone to trigger the start of the equipment such that it is in running condition when the bag arrives at the zone.

32.16.4.6 The energy management timers must be configurable on a global level and on an individual zone level via the SCADA system.

32.16.4.7 As an alternative to the energy management zone concept a concept of individual conveyor energy management is acceptable if it follows the requirements in this section. In such a concept, conveyors shall only run when there is a bag to be transported and shut down immediately after the bag has left the conveyor. For such a concept the timers must be configured on a global or subsystem basis rather than for individual conveyors.

32.16.4.8 The energy management timers must be configurable between 10 seconds and 30 minutes and will initially be set for 2 minutes

32.16.5 Emergency Stop

32.16.5.1 Upon actuation of an Emergency Stop push-button, stop the associated conveyors in the subsystem, illuminate the lamp in the head of the push-button in a steady mode, and annunciate such activation at the SCADA system and illuminate the red emergency stop fault light at the MCP and FCP.

32.16.5.2 When the emergency stop push-button is reset, extinguish the light in the head of the push-button.

32.16.5.3 Depress the green “Re-Start” push-button (conveyors restart)

32.16.5.4 When the normal re-start switch for the conveyor is actuated, extinguish all emergency stop push-button lamps within the subsystem associated with that particular emergency stop actuation, actuate the start-up warning alarms and, after a delay, start all conveyors in the subsystem.

32.16.5.5 Note that the activation of an Emergency Stop push-button switch must not close any powered fire or security door within the area of control of the Emergency Stop switch.

32.16.5.6 "E-Stop" conditions must be reported both visually and audibly on the MCP, FCP and SCADA system.

32.16.5.7 Provide emergency stop zoning and methodology details for The Buyer’s approval. Obtain certification that the emergency stop zoning and methodology meets with local regulations.

32.16.6 Motor Overload

32.16.6.1 In the event of any subsystem motor drawing excess current, appropriate protection must be provided to isolate supply to all subsystem elements. Either the single "motor overload" indicator on the affected control panels must illuminate, or if individual “motor overload” indicators are specified for each drive then the effected drive indicator will illuminate.

32.16.6.2 Following rectification of the cause of the overload and resetting of the overload protection device in the motor control panel or DCP as applicable, the system may be restarted by actuation of the "start" button at the FCP or system may be restarted remotely from the SCADA system, at which stage, the "motor overload" indicator will be extinguished and normal control will resume.

32.16.6.3 "Motor overload" fault conditions must be reported both visually and audibly on the MCP, FCP and on the SCADA system.

32.16.6.4 In the event of individual conveyor motor overloads, all upstream conveyors will revert to cascade stop mode, while all downstream conveyors will continue to run in normal mode of operations.

32.16.7 Jam Detection

32.16.7.1 As a minimum, provide baggage jam detection photocells on the head ends of all conveyors, feeding onto power turns, tail end of all incline conveyors, at all merges for both the primary and secondary lines and across the merge junction, opposite all pushers and diverters and any other areas where experience indicates a potential jam area.

32.16.7.2 Combine photocell functions wherever possible provided proper operation of each circuit is maintained. In addition to dedicated baggage jam detection photocells, all other photocells will be used for baggage jam detection.

32.16.7.3 As soon as a photocell detects a jam, initiate the following steps:

- Stop the conveyor with the jam detection photocell and any conveyor within 5 meters upstream and 5 meters downstream of the photocell reporting the jam.

- Provide a baggage jam indication signal for the SCADA system (which will record the jam condition in the Alarm and Event Log), which in turn provides visual as well as audible warning.
- Illuminate the light on the jam reset push-button.

32.16.7.4 Whenever a conveyor stops for any reason, reset the jam detection timer and hold until the conveyor restarts.

32.16.7.5 The jam detection circuitry is only to function whenever the associated conveyor is running, i.e., if the conveyor is stopped and the jam detector photocell is blocked, the jam detection circuitry will not sense a jam condition and thus report a false jam condition.

32.16.7.6 Jam detection logic will take the speed of the conveyor into account (i.e. jam timers for faster belts will be shorter).

32.16.8 Photocell Fault Monitoring

32.16.8.1 Continuously monitor the Normally Open (NO) and Normally Closed (NC) outputs of each photocell. When the state of the NO and the NC output from the same photocell are not opposite from each other (which implies a loose connection or PEC fault) then create an alert on the SCADA system.

32.16.9 Cascade Stop (Dieback)

32.16.9.1 Each conveyor must have a head end photocell for cascade stopping purposes. The head end photocell must be located at a distance from the head end of the conveyor such that the conveyor and bag will come to a complete stop without any overhang of the bag onto the downstream conveyor.

32.16.9.2 Program cascade stop circuits to stop a conveyor whenever a cascade photocell is interrupted and the conveyor immediately downstream is stopped for any reason. Automatically restart the stopped conveyor(s) if the photocell is unblocked or the downstream conveyor has restarted with a delay if needed to ensure that minimum space between bags is maintained.

32.17 FUNCTIONAL DESIGN SPECIFICATIONS (FDS) SUBMITTAL

32.17.1 The Supplier shall submit a control system description including fallback procedures for failure scenarios. This description must include all proposed system functions including human machine interface screens, operational procedures, emergency procedures and all other aspects of the control system, etc.

32.17.2 The Supplier shall submit a software documentation plan for all SCADA and control systems, including network systems that defines all required documents for each stage of development from initial functional design to operations and maintenance manual production.

32.17.3 Prepare the Functional Design Specifications (FDS) following the below structure:

32.17.3.1 FDS - Power Distribution

- Interface to the building power supply
- Calculated power requirements
- Redundancy of power distribution
- Grounding/Earthing method
- Power factor correct and power conditioning provisions
- Calculation of UPS requirements and details of UPS provisions

32.17.3.2 FDS - LLC Submissions

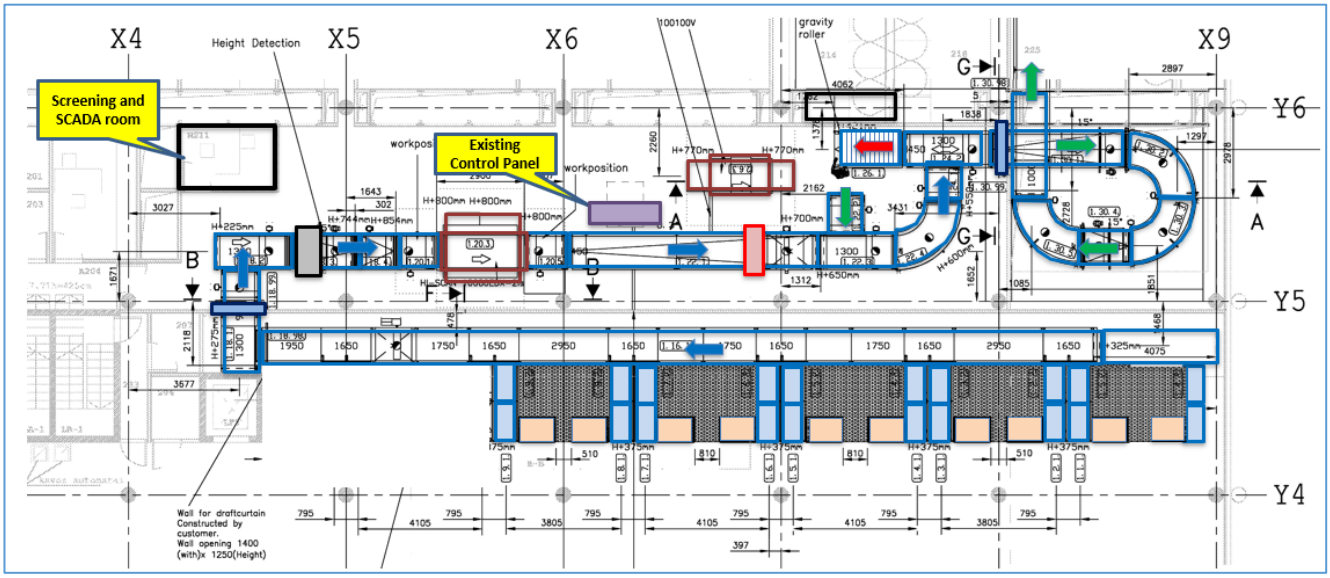
- Control system development and implementation master list
- List of system hardware employed
- Interface with inline and check-in weighing equipment
- Full and detailed description of the proposed BHS tracking algorithm
- Start-up/shutdown procedures
- Description of conveyor control logic outlined by subsystem
- Automatic operational/maintenance/defect/status routines
- Audio/Visual indications
- Control station layouts/functions/operations
- Fall-back/Anti-grid lock procedures
- Redundancy schematics/provisions
- Submit an overall system architecture diagram clearly identifying lower level controls. As a minimum, show all PLC's, power distribution up to one level above motors, network switches connected to PLC's, EDS machines, Radiation detectors, existing PLC's and any other major element of the LLC.

FDS - HLC Submissions

- Interfaces to external systems
- SCADA system
- SCADA Reporting Functionality with sample report formats
- User Right Management
- Network and IT hardware
- Submit an overall system architecture diagram clearly identifying upper level controls with respective networks.

32.18 BHS CONTROL AND SCREENING ROOM

32.18.1 The Existing room used for Screening workstations, and also SCADA workstations is located as follows:

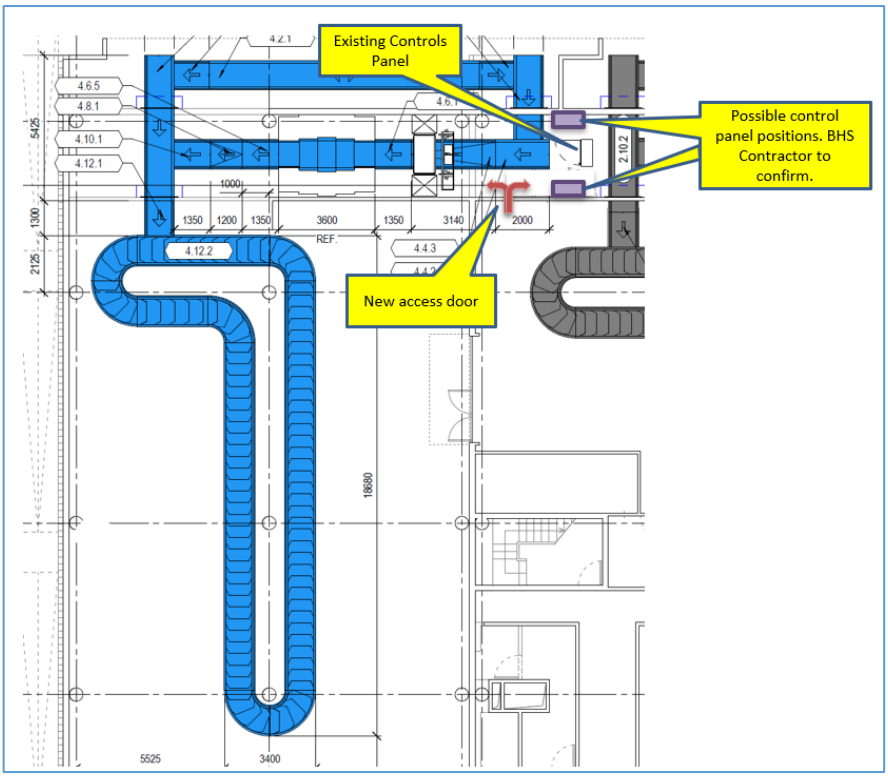


32.18.2 If required, this room can be extended to suit the requirements of the new Standard 3.1 layout. The Supplier should advise on the revised control room sizing and requirements including:

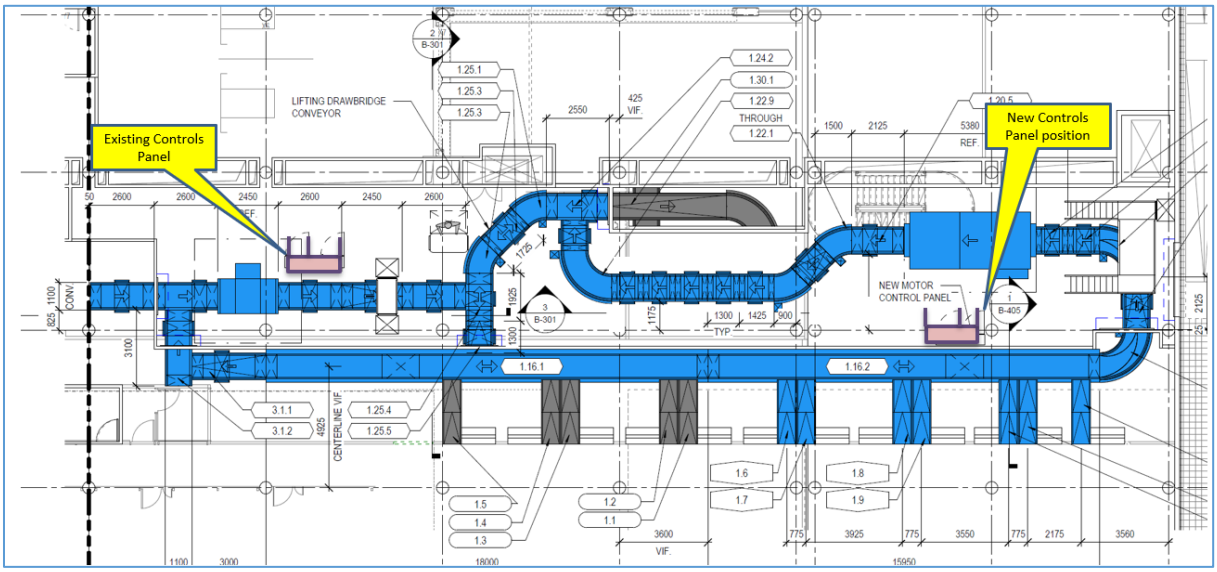
- A proposed room layout of equipment showing spatial requirements.
- Environmental requirements (temperature and humidity)
- Cable routing in the Control Room
- Fire protection
- Electrical power requirements and distribution
- Location of utility power outlets for workstations, printers, and other ancillary equipment.

32.19 CONTROL PANEL POSITIONS

32.19.1 It is envisaged that the new Arrivals Controls panel will be located as below, to be confirmed by the Supplier during the Design phase:



32.19.2 It is envisaged that the new Departures Controls panel will be located as below, to be confirmed by the Supplier during the Design phase:



33 SUPERVISORY CONTROLS AND DATA ACQUISITION SYSTEM (SCADA)

33.1 GENERAL

33.1.1 Provide a centralized Supervisory Control and Data Acquisition system (SCADA system) such that trained operators and maintenance employees can quickly identify, isolate location of a fault and determine cause within the entire system such that appropriate procedures can be enforced.

33.1.2 The Supplier will install new SCADA system which includes the entire Departures and Arrivals including the existing Arrivals and Departures elements.

33.1.3 The SCADA system, designed and installed by the Supplier must be such that maintenance personnel or an Operations and Maintenance Contractor can easily modify/add subsystems, display faults, modify/add reports etc. in the event that additional/modified subsystems are installed as part of any future project (i.e. very user friendly).

33.1.4 Provide a menu structure to allow for easy and efficient operation. All user screens and dialogues must be included in the FDS and submitted for review and approval.

33.1.5 The SCADA system should be located in the Departures screening room, generally as existing, with a fully functional workstation and monitor. A second monitor should be provided local to the new Arrivals control panel, which should normally display the graphics associated with the Arrivals BHS.

33.1.6 Monitors should be a minimum 28inch screen. Also, at least 2 new computers must be provided with all peripherals.

33.1.7 SCADA must be integrated with airports CCTV system, IT must be possible to select and view camera.

33.1.8 Navigation Ladder

33.1.8.1 The operator must be able to easily navigate between the different visualization screens and dialogs using a tab structure.

33.1.8.2 The colour of the individual icons representing each visualization screen must change colour according to the highest priority status within that visualization screen.

33.1.9 Tiered Structure of Visualization Screens

33.1.9.1 Provide a tiered structure for all visualization screens making navigation between screens simple and easy to navigate.

33.1.10 Equipment Visualization Status Screens

33.1.10.1 Provide equipment visualization status monitoring screens for all BHS equipment.

33.1.10.2 The equipment visualization status screens must display, in near real time, dynamic pictorial format, the operational status of the BHS equipment that is connected to the PLC's.

33.1.10.3 Provide ability to display Critical alarms, summary and Historical alarms or equipment navigation on a second screen

33.1.10.4 The equipment visualization status screens must identify the following conditions (this listing is not to be construed as being all inclusive)

33.1.11 Minimum Status Conditions

33.1.11.1 Emergency Stop Actuated (identify zone and location of device activated)
33.1.11.2 Motor Overload Tripped (identify location)
33.1.11.3 Excessive actuation time of a bag sensor to identify a jam, (identify location)
33.1.11.4 Photocell failure (identify location)
33.1.11.5 System configuration (Mode of Operation)
33.1.11.6 Failure of tracking encoder/pulse generator
33.1.11.7 Fire Alarm System Faults
33.1.11.8 Status of fire/security doors (closed, opening, open, closing, malfunction)
33.1.11.9 PLC failure (identify location)

33.1.11.10 Operator initiated or specified events not listed here.

33.1.11.11 Other faults or configuration status not listed, but necessary to ascertain BHS status.

33.1.12 Colour Convention

33.1.12.1 To be agreed with the Buyer, but generally: -

Condition	Colour
Stop, High Priority – Emergency stop, fire	RED
Normal condition - Run	LIGHT GREEN
Standby, normal condition - Available	MID GREEN
Abnormal condition - Jam	ORANGE
Abnormal condition – Equipment fault	YELLOW
Abnormal condition, warning - Manual	WHITE
Abnormal condition, warning – Disable by operator	BLACK
Normal condition - Reverse	PURPLE
Normal condition - Indexing	LIGHT BLUE
Abnormal condition – Equipment unavailable	DARK GREY

33.1.12.2 Visually monitor the operational configuration, including conveyor flow direction, operational status (On/Off/E-Stop/Overload/energy save) and operating mode (cascade, indexing, running, jam etc).

33.1.12.3 The visualization screens must allow operators to have control over each piece of BHS equipment, such as but not limited to horizontal and vertical diverter control, activating fallback procedures, locking off conveyors. For diverters it must be possible to manually divert all, manually divert none, set it to auto mode, or establish load balancing characteristics as relevant to process flow. Where a diverter is part of the Hold Baggage Screening related subsystems it must not be possible to force bags that do not have a 'Clear' security status to a conveyor, which leads to the sortation system (clear line).

33.1.12.4 It must be possible, through appropriate operator input (keyboard, touch screen, or mouse input), to individually override automatic control of a conveyor thereby allowing the conveyor to run despite a sensor or other such failure. An appropriate graphical and text display must be provided for conveyors in this "override" mode of operation.

33.1.12.5 The visualization screens must represent and depict the equipment layout and locations such that operators can easily recognize equipment on the screen as it is seen in the field. Each screen must include information of sub-system names, PLC, building grid location, operational identification (if different than sub-system name) and floor level.

33.1.12.6 Realistic graphical representations must be employed to portray the equipment with details up to the actual position of all equipment installed, metering positions, settings, indication, lamps, and alarm messages.

33.1.12.7 Operation must be accomplished by mouse activation and configuration of a series of hot keys for the most typical actions.

33.1.12.8 For ease of general orientation and identifying fault locations, placing the mouse over equipment must highlight the equipment's name, ID and key status.

33.1.12.9 The visualization screens must show status of BHS equipment, e.g. machines operating in manual/auto mode, scanning bag, conveyor running, off/on status, E-stop. Provide all screening machine faults, e.g. door jam, conveyor jam, motor overload, motor isolator in off position, no heartbeat, machine does not power on, etc.

33.1.12.10 The SCADA system must have the capability to render individual subsystems, check-in counter conveyors, diverters and conveyors of the baggage system available or unavailable.

33.1.13 Performance

33.1.13.1 Dynamic data on the current operator workstation displays must be updated within two (2) seconds from receipt of data from the PLC's. The time-of-day field on the operator workstation displays must be updated at least every second.

33.1.13.2 Supervisory control outputs at the workstations must occur within two (2) seconds following the entry by the operator. However, such operator entry must be immediately acknowledged on screen. In the select-before-operate mode of operation, the blinking or other visual indication of the selected control device must immediately appear on the operator workstation displays. If an operational parameter is changed or adjusted by the operator the change will be registered in all PLCs, computers, workstations and databases.

33.1.13.3 A System Upset Condition is defined for use in evaluation of the SCADA system performance. It is the change during a one (1) second interval of fifty (50) percent of all the system's field wired discrete inputs. No messages must be lost during the system upset.

33.1.13.4 During a system upset load condition, not more than five (5) seconds must elapse from the time a status change occurs at a PLC until the change appears on the operator workstation displays.

33.1.14 Supplier On-Line Support

33.1.14.1 Provide ability to dial in (eg VPN) from a remote location to access SCADA clients, perform diagnostics on the application software, check on systems configurations and integrity of database.

33.1.15 Security

33.1.15.1 All security violations such as, but not limited to, failed log-in attempts and unauthorized log-in attempts from remote locations must be logged by the system and reported / archived at the SCADA system, accessible by personnel with the appropriate user level.

33.1.16 Alarm Handling

33.1.16.1 All alarm filters must be user definable and easily changed. All of the alarm filters are options the user can select/deselect as desired. A user can select/deselect any of these options for any single alarm. As well as manual entry, alarm filter options must be accessible via a drop-down list. For entry of date and time filters, a calendar interface should be provided.

33.1.16.2 The system must manage the incoming alarms and warnings such that alarm/warning conditions are reported in a clear, concise and timely manner. The chronology of detection of alarm / warning conditions must be retained and alarms must be time stamped.

33.1.16.3 An alarm line containing the 5 latest alarms must be visible at the bottom of the operator workstations. It must provide the same features as the alarm list. The textual display must scroll showing the most recent, unacknowledged or uncorrected, highest priority faults. It must be user configurable, which type of alarms are shown in this scroll alarm window. Each user can enable/disable the view of the alarm line on his workstation.

33.1.16.4 It must be possible for an operator to inhibit the alarming or the logging of an alarm condition for an equipment status point.

33.1.16.5 It must be possible to delay the alarming for a process variable for a defined period so that it can be verified that an abnormal condition detected is permanent. The condition must persist for a specified time period.

33.1.16.6 It must be possible to remotely reset fault conditions from the SCADA system for alarm conditions that do not require manual interventions such as:

- VFD Fault
- Motor Overload Fault
- Soft Starter Fault
- Encoder Fault
- Missing Bag Fault

33.1.16.7 Alarm rationalisation must be employed such that only the main cause alarm is shown, while lower priority subsequent alarms are not shown to avoid overloading operators with alarm messages (ie prevent Alarm Storms).

33.1.16.8 Differentiate between alarms on the SCADA system by means of colour and flashing. A new alarm must be displayed with a quick flashing in a specified colour, an active, but acknowledged alarm must have steady alarm colour as specified.

33.1.16.9 It must be possible to filter alarms by tag, alarm text etc. Filter must include use of wild cards to allow maximum flexibility for the operator.

33.1.16.10 Alarm List must contain all active alarms, acknowledged or unacknowledged in chronological order. It is updated automatically when a new alarm appears.

33.1.16.11 Alarm List of Unacknowledged Alarms must contain all unacknowledged alarms, active or already reset in chronological order. It is updated automatically when a new unacknowledged alarm appears.

33.1.16.12 An alarm line containing the latest 5 alarms must always be visible on the operator workstations. It must provide the same features as the alarm list.

33.1.16.13 A configurable data table of alarm tags must be provided where a user with the appropriate access level can configure the desired system action from each alarm. An alarm category must be a set of options on the processing of alarms, return-to-normal, and information events / messages.

33.1.16.14 Each alarm, return-to-normal and information event / message issued must concern a single database item. For each item, the system database must identify the alarm category for that item.

33.1.17 Alarm Acknowledgment

33.1.17.1 The acknowledgment of either an alarm or return-to-normal message must perform several functions, including but not limited to the below.

33.1.17.2 Acknowledgment must prevent the alarm message from appearing in the alarm section of the operator workstations.

33.1.17.3 Acknowledgment must cause the symbols and messages associated with the alarm to stop flashing or change appearance on all displays on which they appear and on the map panel. They must continue to appear in an alarm condition by changed colour and/or shape unless the alarm signalled a return-to-normal.

33.1.17.4 Acknowledgment must cause the silencing of the audible alarm.

33.1.17.5 Return-to-normal messages must be removed (not displayed) from the latest alarm display lists.

33.1.17.6 All workstations must show an acknowledged alarm after that alarm is acknowledged from any workstation location.

33.1.17.7 The acknowledgment of either an alarm or return-to-normal message must be performed in several ways, including but not limited to:

- Sequentially as alarms appear in the alarm section of the operator workstations.
- Individually, by selecting then acknowledging the symbol or message for the individual alarm on the appropriate operator display or alarm display list. If more than one alarm is active for the same process variable, then all these alarms must be acknowledged together.
- All alarms shown on a latest alarm display list with a global acknowledgment command.
- Individually within the graphic operator displays.

33.1.18 Alarm Inhibiting

33.1.18.1 An inhibited point must be processed as usual, its value in the database reflecting its current value. The flag for the point must show it is alarm inhibited.

33.1.18.2 The appropriate displays must show the current value.

33.1.18.3 Alarm conditions caused by the point must not be logged.

33.1.18.4 The audible alarm must not be sounded.

33.1.18.5 The symbol for the alarm must not flash on the graphic display.

33.1.18.6 The alarm message for the point must not appear on the latest alarm display lists.

33.1.18.7 There must be a special monitoring inhibited alarm summary that must list all points that have been inhibited.

33.1.18.8 The inhibiting of an alarm message must be performed individually by selecting the symbol for the individual alarm on the appropriate operator display or alarm display list.

34 SYSTEM TESTING AND HANDOVER

34.1 GENERAL

34.1.1 System Testing and handover will take place over several stages, as follows:

- Factory Acceptance Tests (FAT)
- Installation Tests and Snagging
- Commissioning Tests (Supplier's own tests plus EDS Integration tests)
- Site Acceptance Tests (SAT)
- HBS Validation Test (HBSVT)
- Settling Down Period
- Confidence Trial

34.1.2 The Supplier is responsible for carrying out their own installation, commissioning, FAT and SAT tests to their own satisfaction, before inviting the Buyer to witness a repeat of such tests.

34.1.3 The Overall system will only be accepted, once all tests are completed and passed, and all other specified documentation has been provided and training completed.

34.2 TEST BAGS

34.2.1 Provide at least 150 test bags for System Testing and HBS Validation test purposes.

34.2.2 At least 50 of the test bags shall contain 'trigger plates', which shall trigger the EDS Machines to reject the bag. The 'trigger plate' shall have a unique number that is readable on the EDS Machine image. The 'trigger plate' bags shall be easily identified via red colouring or markings. The 'trigger plate' number need not be the same as the external number of the bag (a 'trigger plate' may have to be moved to another bag, if the bag it is in becomes damaged).

34.2.3 Provide secure storage of test baggage before and after each test and provide sufficient manpower and transport vehicles to handle bags before, during and after testing.

34.2.4 All test bags shall be uniquely numbered on both sides of each bag and be marked as a test bag.

34.2.5 Test bags shall it within the minimum and maximum bag sizes defined for the project and represent a realistic size and weight profile.

34.2.6 The test bag types shall include hard-shell and soft-shell bags, bags with and without wheels, tote bags, duffel bags, rucksacks, vanity cases, upright bags, and other typical Airport baggage.

34.2.7 The test bags shall include a range of OOG test items (e.g. surfboard, golf bag, cello case, bike in a bag/box, pushchair/buggy, and the like) shall also be supplied for testing the OOG sub-systems.

34.2.8 Test bags shall be of appropriate weight to ensure they can be handled through the EDS Machines.

34.2.9 There shall be at least 5 maximum and 5 minimum size and weight test bags provided.

34.2.10 The bag contents shall be sealed in robust, to prevent spillage of the content if the bags are damaged.

34.2.11 Test bags shall be stuffed with material that provides weight distribution similar to normal passenger bags and prevents weight from shifting inside the test bag.

34.2.12 The bag contents shall be such that they are not processed as 'unclear' by the EDS Machines. Coordinate test bag contents with the EDS Machine supplier.

34.3 FACTORY ACCEPTANCE TESTS (FAT)

34.3.1 Invite the Buyer to its facility for a demonstration and review of the Supplier's developed controls systems software, and SCADA system, all to include any software/hardware interfaces with other Airport systems and devices.

34.3.2 FAT Testing should include the following, as a minimum:

34.3.2.1 Control Panels
34.3.2.2 EDS X-ray interfaces
34.3.2.3 SCADA functionality, screens and reports

34.3.3 The Factory Acceptance Testing shall take place prior to the on-site installation of the computer software and associated hardware.

34.3.4 The Supplier should submit a FAT Plan document for review at least one month before commencement of the FAT.

34.3.5 Upon completion of the FAT, the Supplier should submit a FAT Report which records all the tests carried out and the results achieved, and comparisons to expected outcomes to meet the specification. It should clearly summarise where the FAT has been passed, or if failed in any areas, it should detail the rectification work to be carried out to achieve pass status.

34.3.6 The Buyer, or their representatives, reserve the right to visit the Supplier's or their supply chain premises at any time to inspect all goods before despatch.

34.4 INSTALLATION TESTS AND SNAGGING

34.4.1 The Supplier should continually inspect his own works as work progresses through the build phase and maintain their own snag list listing any items that need modifying or rectifying and recording when this has been done.

34.4.2 Upon completion of each installation phase, the Supplier shall provide detailed check lists, which include as a minimum:

34.4.2.1 Equipment is to specification, and in new condition
34.4.2.2 Installed equipment matches the agreed system layouts, unless changes have been agreed in which case layouts should be marked up pending update to 'as-built' status.
34.4.2.3 Ingress and egress routes for personnel meet the agreed standard
34.4.2.4 All equipment and steelwork, walkways, platforms, etc are all correctly lined and level
34.4.2.5 No bag snagging points at conveyor junctions, nor other locations
34.4.2.6 Equipment remains stable, and no sway nor deflection during operation.
34.4.2.7 All motors and drives are correctly installed and also have correct oil type and level
34.4.2.8 Belts properly fitted, joint is per specification, runs in correct direction, and is properly tracked
34.4.2.9 All mechanical fasteners have been tightened and meet standards for thread exposure etc
34.4.2.10 Noise levels are not exceeded
34.4.2.11 No unacceptable equipment vibrations
34.4.2.12 Control panels and operator pushbutton stations, HMI's etc are as per specification
34.4.2.13 All field devices are correctly mounted and functional
34.4.2.14 Verify that all electrical terminal connections are firm and provided electrical connectivity.
34.4.2.15 All ID tags and equipment identification of equipment are fitted
34.4.2.16 Easy and safe access for maintenance and operations to all parts of the system has been achieved, for both low level and high-level equipment.
34.4.2.17 Equipment finishes are clean, unmarked and scratch free.
34.4.2.18 Stainless steel parts are clean, polished and unmarked with brush finish in a common direction.

34.4.3 Upon completion of each phased installation, and snagging to Supplier's satisfaction, the Buyer should be invited to inspect the works, and also review the completed snag list.

34.4.4 The Buyer reserves the right to inspect further snag the works if it falls below the required standard. The Supplier shall make good any snagged items at his own cost to ensure that the quality and standard required has been met.

34.5 SITE ACCEPTANCE TESTS (SAT)

34.5.1 Site Acceptance Testing (SAT) shall be performed on-site to allow the Supplier to demonstrate that the BHS performs in accordance with the specification.

34.5.2 It is a pre-condition that FAT and Installation Snagging should be complete before commencement of the SAT tests, unless otherwise agreed with the Buyer.

34.5.3 As a minimum, SAT Tests should include at least the following elements:

34.5.3.1 Start-up procedures, via panel/HMI and through SCADA.
34.5.3.2 Re-setting of faults and re-start.
34.5.3.3 System shutdown procedure
34.5.3.4 Energy saving modes.
34.5.3.5 Check-in operation, including weighscale operation and local pushbutton controls.
34.5.3.6 Check-in 'window reservation' functionality
34.5.3.7 Bag knock-over functionality.
34.5.3.8 Merging functions of all merges.
34.5.3.9 System Dieback functionality including recovery after die-back
34.5.3.10 Jams detection functionality
34.5.3.11 Bag separation, separating and pitching functionality pre-EDS.
34.5.3.12 Over-height and over-length functionality pre-EDS.
34.5.3.13 Emergency stop functionality. All emergency stops to be tested
34.5.3.14 Fire system alarm interface.
34.5.3.15 Fire/security door and BHS functionality.
34.5.3.16 Maximum and minimum bag size and weight transportation through the BHS.
34.5.3.17 Baggage routing during normal operations. Check-in to Make-up. IG and OOG.
34.5.3.18 Baggage routing during failure conditions. Check-in to Make-up. IG and OOG.
34.5.3.19 Sub-system operation and throughput capabilities (Arrivals, Departs IG and Departs OOG) Peak capacity for minimum 15 mins of operation)
34.5.3.20 Full System Operation and Throughput (demonstrated at peak capacity for a min 15 mins)
34.5.3.21 X-ray integration tests.
34.5.3.22 Screening line functionality, integration, capacity and security integrity
34.5.3.23 Tracking accuracy
34.5.3.24 SCADA correctly installed to show equipment and system status.
34.5.3.25 Verify accurate SCADA alarming.
34.5.3.26 Verify accurate SCADA representation during equipment changes of state.
34.5.3.27 Verify SCADA reporting.
34.5.3.28 PLC failure, error reporting and recovery.

34.5.4 The Supplier shall include all necessary labour and test bags and bag tags, to demonstrate the above to the satisfaction of the Buyer.

34.5.5 The Supplier should submit a SAT Plan document for review at least one month before commencement of the SAT. SAT testing scenarios must be provided.

34.5.6 Upon completion of the SAT, the Supplier should submit a SAT Report which records all the tests carried out and the results achieved, and comparisons to expected outcomes to meet the specification. It should clearly

summarise where the SAT has been passed, or if failed in any areas, it should detail the rectification work to be carried out to achieve pass status.

34.5.7 In some instances, due to phasing limitations, it may be necessary to split the SAT tests into phases to suit the available equipment prior to it going into operation. This should be fully detailed and explained in the SAT plan and agreed with the Buyer. In these instances, it will still be necessary to carry out overall System SAT tests once the entire system has been completed.

34.6 HBS VALIDATION TESTS (HBSVT)

34.6.1 Specific HBS Validation Tests (HBSVT) are required before the BHS goes into live Screening Operational conditions. The Supplier, in conjunction with the EDS Equipment supplier is to demonstrate that the Screening sub-systems performs in accordance with the specification and meet ECAC requirements.

34.6.2 It is a pre-condition that SAT Testing should be complete before commencement of the HBSVT tests.

34.6.3 Once HBSVT tests are carried out, no further mechanical nor controls modifications can be made to the screening element of the system and associated PLC without repeating and passing the HBSVT tests.

34.6.4 Where minor changes are made, that do not affect the screening process nor integrity, then a reduced validation test may be carried out at the discretion of the Buyer. This would typically be a smaller single test, like test 'A' below, but with reduced number of bags, typically 20-50 bags.

34.6.5 For Tests A, B and C as detailed below, there should be 100 test bags used. 50 of these bags should be clear bags, with nothing inside that would alarm via the EDS machine. The other 50 bags should be 'suspect' bags and should alarm by the EDS machine. See details within the 'Test Bags' section above. All bags should be checked before the start of the test and should also be agreed with the EDS supplier as fit for the purpose of the tests.

34.6.6 Test bags should be clearly and uniquely numbered, ideally 1 to 100, and should be easily visually identifiable if it's a 'clear' or 'suspect' bag.

34.6.7 HBSVT tests should not be used to test anything other than screening integrity, and should not, for example be used as part of a throughput or bag type test.

34.6.8 The Supplier shall include all necessary labour and test bags, to demonstrate the above to the satisfaction of the Buyer.

34.6.9 The Supplier should submit a HBSVT Plan document for review at least one month before commencement of the HBSVT.

34.6.10 Upon completion of the HBSVT, the Supplier should submit a HBSVT Report which records all the tests carried out and the results achieved, and comparisons to expected outcomes to meet the specification. It should clearly summarise where the HBSVT has been passed, or if failed in any areas, it should detail the rectification work to be carried out to achieve pass status before the system can go into operation.

34.6.11 For each test, the Supplier should record the following data, on a bag by bag basis, and include the data in tabulated format in the HBSVT report:

- Bag number in sequence it was input to the BHS
- Pre-determined bag status eg 'clear' or 'suspect'
- Bag number as it enters the EDS machine
- Bag number/level 1 x-ray decision/PLC bag ID code number/EDS decision code ref
- Bag number/level 2 operator decision/PLC bag ID code number/EDS decision code
- Bag number/actual destination eg make-up carousel or level 3.

34.6.12 The Supplier should provide sufficient manpower to record the data at various strategic positions around the BHS on a bag by bag basis as follows:

- Bag input position eg check-in
- Input position into EDS machine
- PLC/SCADA location for PLC and EDS codes
- Level 2 operator position
- Level 3 position
- Cleared bag location eg make-up carousel.

34.6.13 In addition, labour will be required to handle bags at input and output positions, and there should be a 'Test Manager' appointed to oversee the entire test without a specific bag handling or recording function.

34.6.14 Should check-ins be used as the input position, it is suggested that only one check-in is used at a time so that bags do not get mixed which could happen if multiple check-ins are used to despatch bags onto the collector.

34.6.15 Once a bag arrives at level 3, it should be stored on the floor in its arrival sequence until the end of the test. Level 3 bags should not be returned to the BHS during the test, as may be the case during Operation once the bag has been cleared by an operator.

34.6.16 Tests should be carried out in a slow, steady and controlled manner such than operators are not rushed and have enough time to record data on a bag by bag basis.

34.6.17 On completion of the test, a check is made to ensure every bag was screened and routed to its correct location. Any discrepancies should be accounted for and documented eg if a bag mis-tracks it should have been flagged in the PLC system and routed to level 3.

34.6.18 If more than 3 bags mis-track, the reason should be investigated and rectified. The test should then be repeated until mis-tracks fall below 3 in 100 bags.

34.6.19 This test requires 100% Pass rate.

34.6.20 HBSVT Test A (50:50 test)

34.6.21 100 test bags are steadily input into the screening line, via check-ins or other means, alternating between clear and suspect bags. This will ensure that diverters are tested to maximum. It is recommended that these bags are also input in numerical sequence to make validation simple.

34.6.22 All suspect bags should be referred to the level 2 workstation, and the operator should always reject these bags so that they are routed to level 3.

34.6.23 All cleared bags should be automatically cleared at level 1 and routed to the make-up carousel

34.6.24 There should be 50 cleared bags ending up at make-up and 50 bags at the level 3 position, and bag ID's should correlate.

34.6.25 There should be zero suspect bags arriving at the cleared bag position.

34.6.26 Any cleared bags that arrive at the suspect level 3 position need to be fully accounted for eg if mis-track bag, why and where. There should be no more than 3 mis-track bags during the test.

34.6.27 HBSVT Test B (95:5 test)

34.6.28 The same 100 test bags as above test are steadily input into the screening line, via check-ins or other means, in a random sequence, both numerically and clear-suspect.

34.6.29 All 50 suspect bags should be referred to the level 2 workstation, and the operator should randomly accept 45 of these, and reject 5 bags to level 3. They should record these decisions as they go.

34.6.30 All level 1 and level 2 cleared bags should be automatically routed to the make-up carousel

34.6.31 There should be 95 cleared bags ending up at make-up and 5 bags at the level 3 position, and bag ID's should correlate

34.6.32 There should be zero suspect bags arriving at the cleared bag position.

34.6.33 Any cleared bags that arrive at the suspect level 3 position need to be fully accounted for eg if mis-track bag, why and where. There should be no more than 3 mis-track bags during the test

34.6.34 HBSVT Test C (95:5 test)

34.6.35 This is a repeat of Test B, but with a different random sequence of the same 100 bags being input into the system.

34.6.36 Results and expectations are the same as for Test B.

34.7 SETTLING DOWN AND CONFIDENCE TRIALS

34.7.1 Following successful SAT and HBSVT tests, the BHS will be handed over for the processing of live baggage, whilst the Supplier to carries out Settling Down and Confidence Trials.

34.7.2 The system shall then be monitored on-site during all operational hours by the Supplier during an initial 7 day Settling Down period when the Supplier will respond to and repair all faults that occur. A certain amount of 'hands on' adjustments can be made by the Supplier during this period, although Buyer permission should be sought to minimise Operations disruption.

34.7.3 The Supplier should submit a Settling Down and Confidence Trial Plan document for review at least one month before commencement of the Trials.

34.7.4 The Supplier shall be maintaining a fault logs during this period.

34.7.5 Upon completion of Settling Down, the Supplier should submit an Interim report which records all the BHS Performance characteristics during Settling Down, including but not limited to:

- Times and duration of Settling Down trial, including total Operational hours
- Total number of bags handled during the period (IG and OOG)
- Peak hour and peak day number of bags witnessed
- Total number of bag jams witnessed during trial, including explanations for jams, and details of any non-conveyable bags that were input incorrectly.
- Overall System availability and daily system availabilities during Trial, with explanations for any stoppages
- BHS Bag tracking performance % on a total and daily basis. Include explanations if has fallen before contractual requirements
- General summary of performance and any issues encountered

34.7.6 The results achieved should be compared to expected outcomes to meet the specification. The report clearly summarise where the requirements have been met has been passed, or if failed in any areas, it should detail the rectification work to be carried out to achieve pass status, before commencement of the Confidence Trial Period, which will be at the discretion of the Buyer based on performance witnessed during the Settling Down period and completion of any rectification work required.

34.7.7 After successful completion of the Settling Down period, the system will be subject to a 14-day Confidence Trial which shall be carried out at peak periods of operation determined by the Buyer.

34.7.8 The Supplier shall provide full-time site attendance covering all operational hours during both the Settling Down and Confidence Trial period.

34.7.9 The system will be physically operated and maintained by Buyer during these periods, the Supplier's attention is drawn to the requirement for new and unknown systems to be fully understood by the O&M staff to mitigate risks of prolonged downtime in the event of a failure. Unless agreed otherwise by the Buyer, the Supplier will be made responsible for the continuity of operations and the maintenance of the modified systems until such time as all reference material and training has been provided to Buyer and the O&M team. These materials will include the provision of all O&M manuals and as- built documentation to the satisfaction of the Buyer.

34.7.10 During the Confidence trial, the System's Availability, Bag Jam rate and Tracking Performance should be monitored and determined. The Supplier must demonstrate its systems' ability to meet a contractual Performance in these respects during this period.

34.7.11 Where appropriate, system Performance data will be generated by the SCADA and compared against independently calculated results.

34.7.12 The Interim Settling Down and Confidence Report should be updated to include data, as described above, for both periods, including comparison to contractual requirements and a summary as to whether the performance has been met.

34.7.13 Failure to achieve the Availability, Bag Jam rate and Tracking Performance during the Confidence period may, at the sole discretion of the Buyer, result in the following:

- a requirement to rectify the fundamental cause of the failure;
- a restart of the Full Confidence Trail;
- a limited re-test.

34.7.14 The Supplier shall bear the full costs of any retesting necessary to obtain sign-off.

35 OPERATE AND MAINTENANCE (O&M) MANUALS

35.1 GENERAL

35.1.1 The prime purpose of the Operation and Maintenance (O&M) Manual is to provide the Owner's operational and maintenance personnel with a thorough understanding of the layout of the system, its function, special features, operational requirements, maintenance requirements, parts information, warranty information, and safety considerations and requirements for operating and maintaining the system safely and effectively.

35.1.2 This specification is intended as a guide to indicate the basic requirements of the O&M Manuals. The Suppliers Standard O&M Manual may be acceptable provided it is functionally equivalent to that specified below and the documents are suitable and usable for the intended purpose.

35.1.3 The manual is to be divided into two main sections an operational portion and a maintenance portion.

35.1.4 The operational portion of the manual shall present the information required for personnel to be able to operate the system in a safe and efficient manner. The operational information shall be presented in easy to understand terms to ensure that personnel not familiar with the system will have a thorough understanding of the system upon reading the operational information.

35.1.5 The maintenance portion of the manual shall present the information required for personnel to be able to maintain the system in a safe and efficient manner. The maintenance information shall be presented in easy to understand terms to ensure that personnel not familiar with the system shall have a thorough understanding of the mechanical and electrical equipment operation and maintenance requirements so that they shall be able to effectively and safely perform maintenance functions such as troubleshooting, servicing, and repairing.

35.1.6 The draft O&M manual should be submitted for review at least 1 month before the system will go in to operation.

35.1.7 The final O&M manual must be updated and provided before the end of the Confidence Trial.

35.1.8 O&M Manuals must also be provided electronically, including one copy on a USB Flash Memory Drive. The electronic data must be stored in a folder and sub-folder structure following the overall structure of the O&M as specified herein such that user navigation is easy and straight forward.

35.1.9 The Buyer, at his discretion, may ask for up to 3 hard copies of the O&M manual. These should be provided free of charge.

35.2 OPERATIONS MANUAL

35.2.1 The Operations Manual shall include, at a minimum, the following items written in a clear concise manner;

35.2.1.1 Glossary of Operational Terms
35.2.1.2 System Overview
35.2.1.3 Normal IG Baggage Details
35.2.1.4 OOG Baggage Details
35.2.1.5 Detailed Description of System Operation, including

- Full BHS description, Departures, Arrivals, IG and OOG
- System Performance Capabilities and Limitations
- Start-up and shut down procedures
- HBS Screening procedures at levels 1/2/3
- IQT test procedure
- Over height/overlength procedures

- Initiating fallback routes
- SCADA standard reports
- SCADA adapted reports
- SCADA system fault alarm messages
- SCADA graphic display information systems
- HMI functionality
- All control station and light beacons and the function of the buttons and lights on these control stations and beacons.
- Placing equipment "in" or "out" of service

35.2.1.6 Operational Safety Features, including:

- Jam Clearance
- Handling of baggage at the Screening Machine interfaces
- Restart Procedure
- Pre-operating Procedure
- Start up and Shut down Procedure
- E-Stop and Restart Procedure

35.3 MAINTENANCE MANUALS

35.3.1 The Maintenance Manual shall include, at a minimum, the following items written in a clear concise manner;

35.3.1.1 Glossary of Terms

35.3.1.2 Description of System Equipment, including

- All of the mechanical conveyor equipment used in the system eg check-ins, conveyors, queues, curves, carousels, fire/security doors etc
- All the electrical equipment used in the system, eg power distribution and control panels, HMI's etc.
- Details of SCADA / PLC systems and networks

35.3.1.3 Electrical Control Sequence of Operation, including

- Location and operation of Control Stations
- Location and operation of Photocells
- Location and operation of Limit Switches
- Operation of PLC(s)
- Operation of Fire/Security Door(s)
- SCADA computer tags & configuration tables

35.3.1.4 Maintenance Safety Procedures

- Pre-operating Procedure
- Start up and Shut down Procedure
- E-Stop and Restart
- Jam Procedure
- Equipment Lockout/Tag Out Procedure

35.3.1.5 Service, Inspection and Preventive Maintenance
35.3.1.6 Warranty Information and Procedures
35.3.1.7 Troubleshooting
35.3.1.8 Removal and Installation Procedures of all key items of Equipment
35.3.1.9 Component Parts list with Illustrations
35.3.1.10 Manufacturer's Literature
35.3.1.11 As Built Mechanical Drawings
35.3.1.12 As Built Electrical Drawings
35.3.1.13 PLC Listings
35.3.1.14 List of Lubricants & Lubrication Chart

36 TRAINING

36.1 GENERAL

36.1.1 Instruct and train the Buyers O&M personnel at the work site prior to the handover of each main phase of the work.

36.1.2 Training is to be provided by a competent and knowledgeable instructor who are familiar with the specific site and installation.

36.1.3 Furnish all tools, equipment, materials and supplies, and perform all functions and services required to complete the training as specified.

36.2 TRAINING SCOPE

36.2.1 A detailed outline of the proposed training to be conducted shall be submitted to the Buyer for review and approval in accordance with the schedule of submissions prior to the testing of the system.

36.2.2 The Training Programmed Submittal shall include but not be limited to:

- Types and durations of training/classes.
- Name and professional credentials for each instructor/trainer.
- Max/min number of persons allowed per class.
- Facility of requirements such as classroom/site office/field training
- Copies of all training materials

36.2.3 Times and duration of the classes may involve irregular hours in order to provide training of the operational and maintenance personnel on different shifts.

36.2.4 Develop and maintain a training attendance record for all training sessions presented.

36.3 OPERATIONAL TRAINING

36.3.1 Provide formal instruction of the Owner's operational personnel at the site who will be charged with supervision of the operation of the BHS. Include a description and on-site demonstration of the electrical controls and their operation, modes of operation, the operating limitations of the equipment and the safety devices and their functions.

36.3.2 Provide a minimum of 4 hours of operational training per shift for this project, for a minimum of three (3) shifts. Total 12 hours. Assume maximum 4 personnel per session.

36.4 MAINTENANCE TRAINING

36.4.1 Provide formal training of the BHS maintenance personnel with the objective of preparing the employees to perform the required preventive maintenance to minimize breakdown and to perform necessary repairs when work stoppages or breakdowns of the equipment occur.

36.4.2 Maintenance Training shall include but not be limited to:

- Preventive and corrective maintenance procedures, including replacement of parts; lubrication quantities, types, frequencies and application points; and an estimate of the time to perform such procedures.

- Special tools, techniques, or procedures required for either preventative or corrective maintenance of the equipment, or it's auxiliary or support components.
- Procedures to perform adjustments required for alignment, wear and calibration for all preventative and corrective maintenance, and an estimate of time required to perform such procedures.
- Assembly and disassembly procedures, including parts lists required for appropriate and corrective maintenance. Hands on field training shall be provided, subject to the approval of the Engineer.

36.4.3 The formal training shall consist of classroom and on the equipment training, as required to properly train personnel for each shift, prior to the start of operation. The training must cover all aspects of the electrical and mechanical equipment provided in this project. The electrical aspects shall include but not be limited to, electrical controls and control systems and PLC control systems.

36.4.4 Provide a total of 16 hours of maintenance training. Assume 8 personnel per session.

37 WARRANTY AND MAINTENANCE SERVICES

37.1 GENERAL

37.1.1 Warranty and maintenance services include warranty services, preventive maintenance, technical maintenance, support services, spare parts and supply thereof. Scope of the warranty must include new and old BHS equipment.

37.1.2 The Supplier shall provide not less than 3 years of warranty, spare part supply and maintenance services. The provision of warranty and maintenance services shall commence after the BHS goes into complete live operations, i.e. after the end of project stage 6 – System Handover. The warranty and maintenance services will ensure continuous operation of the system and include for the supply of spare parts.

37.1.3 The Supplier shall warrant the BHS for the period stated above starting on the date of the BHS going into complete live operations, i.e. after the end of project stage 6 – System Handover. All acceptance tests, the Settling Down Period (Acceptance testing) must be successfully completed. If not, the start of the warranty shall be delayed until such a time as these tests are successfully completed. Upon successful completion of the System Handower, the final act of acceptance of the System is signed

37.2 SUPPLIERS RESPONSIBILITIES

37.2.1 Supplier will be responsible for delivery and supply of the System components and where it is necessary, replace the System components due to failures or depreciation during the warranty period.

37.2.2 Supplier will be responsible for management of spare parts stock.

37.2.3 Supplier will be responsible for elimination of malfunctions (errors) and ensuring of functionality of System components, hardware, software, system software, configuration, and integrations (cases when system functionality cannot be restored by trained service technicians employed by the Buyer, i.e., error recovery was not covered during the training and is not in the scope of training manuals. Also, cases that require specific knowledge controlled only by the Supplier and which requires high qualification).

37.2.4 Supplier will be responsible for preventive maintenance.

37.2.5 Supplier will be responsible for, if necessary, updates to the System maintenance manuals.

37.2.6 Supplier will be responsible for updates of software version. Once per year if stable version is available.

37.2.7 Supplier will be responsible for ensuring of a help desk that provides consultations on the System failure elimination and restoration of the System performance 24/7

37.2.8 The Supplier must provide all necessary infrastructure for the provision of maintenance services (tools, ladders, aisles, stands and other necessary equipment for the services of preventive and technical maintenance).

37.2.9 The Supplier must provide a dedicated information system (or an access to such) where the Buyer will be able to register all system failures, with descriptions, reaction times and downtimes.

37.2.10 For repeated System Errors or failures or cases where the requirements of this document for satisfying the System capacity, Efficiency, and Accuracy are not met, the Supplier shall provide a corrective action plan to reduce the number of failures and to restore System Performance / Capacity / Quality to meet the said requirements. Implementation of such plan will be Suppliers responsibility with no additional cost to the Buyer.

37.2.11 The Supplier's staff who will provide the warranty service will have to obtain KUN permanent permits (airport IDs) to access the baggage handling area. Background check must be performed, and general security awareness training have to be passed before the issuing of airport ID.

37.2.12 Tools required to replace the System components shall be supplied by the Supplier. If replaceable components are heavier than 20 kg, measures must be provided to service and replace them (hoists, winches).

37.2.13 Till the end of the System implementation phase, the Supplier shall provide detailed manuals for the System maintenance and assurance of the uninterrupted operation, as well as System functionality restoration manuals.

37.2.14 Additionally, the Supplier shall train the Buyer's representatives and provide all necessary documentation for them to carry out System maintenance, eliminate failures, control system parameters, monitor system parameters, replace spare-parts, and ensure uninterrupted operation of the System.

37.3 BUYER MAINTENANCE SERVICES

37.3.1 Removal of baggage jams.

37.3.2 Replacement of spare parts or depreciated equipment, troubleshooting, elimination of failures and malfunctions.

37.3.3 System settings control.

37.3.4 Equipment calibration.

37.3.5 Tensioning, adjustments, balancing of equipment components.

37.3.6 Replacement of sensors, indicators, buttons.

37.3.7 Lubricants and oil change.

37.3.8 Dust and equipment cleaning.

37.3.9 Reloading/ restarting of equipment, control of parameters.

37.3.10 Assessment of operational parameters and components condition.

37.3.11 IT components reloading and configuration.

37.3.12 Other services which are necessary to ensure continuous operation of the System (The Buyer must be trained to provide such services).

37.4 REQUIREMENTS FOR SUPPLY OF SPARE PARTS

37.4.1 Spare parts for replacement of faulty or depreciated equipment shall be supplied at the cost of the Supplier (including the price of the parts). The Supplier shall ensure the timely supply of spare parts and sufficient amount of spare parts stored at the warehouse.

37.4.2 Quantity and scope of spare parts in the warehouse shall be determined and managed by the Supplier based on its experience. The quantity of spare parts shall be sufficient to timely restore the System's performance. Critical spare parts shall be stored at the Buyers premises (spare-parts that frequently fail and are critical for the System's performance).

37.4.3 The Supplier shall ensure planning and supply of spare parts during the warranty period, as well as the warehouse management.

37.4.4 Delivery of spare parts must be organized in such way that in case of any failure spare parts stock is enough to restore system functionality.

37.4.5 Spare parts which fail often must be duplicated, which means that more than one unit of spare part must be stored in the warehouse.

37.4.6 The Supplier shall assess the risks regarding the timing of manufacturing and supply of spare parts.

37.4.7 The Supplier shall draft and coordinate the procedure for planning and supply of spare parts. During the project, the Supplier shall provide the warranty, preventive and technical maintenance procedures and intervals thereof.

37.4.8 Spare parts shall be brand new and unused. Spare part quality and parameters will not be worse than described in this technical specification.

37.4.9 The Buyer shall ensure the availability of premises (and protection) within the territory of the airport for storing spare parts.

37.4.10 The list of spare parts to be provided by the Supplier must include quick-wearing spare parts and materials, such as: lubricants, fasteners, oils, bolts and other. Supply of these parts is the responsibility of the Supplier.

37.4.11 In performing the Maintenance Services, the Supplier will maintain a suitable stock of spare parts and consumables as may be required to ensure the Products remain in, and where required can be restored to, Good Working Order. The Supplier acknowledges that the Buyer's personnel may also access this stock and remove spare parts and/or consumables for use with the Products and/or Corrective Maintenance, provided that the Buyer shall ensure that the personnel log any such removal of spare parts and/or consumables and the reason for which they were removed to enable the Supplier to replace the stocks accordingly.

37.4.12 All spare parts and/or replacements provided by the Supplier to the Buyer shall become part of the relevant Product and the property of the Buyer. The Supplier will assign to the Buyer, with full title guarantee and free from all third-party rights, all spare parts and/or replacements provided by the Supplier.

37.4.13 All parts and components removed from a Product by the Supplier in the course of performing the Maintenance Services shall no longer constitute part of the Product and the Buyer shall deal with such parts or components at its own cost.

37.4.14 The Supplier shall provide a detailed price list of spare parts (bill) based on the offered technological solution (if during the warranty period missing spare parts in the spare parts list are identified, the Supplier shall ensure the supply of additional parts).

37.4.15 The spare part list must include: spare part identification number, category, tool or device, short description, characteristics, measurements, quantity, manufacturer, model, series number, recommended quantity in warehouse, suppliers list, unit price, other related data.

37.4.16 The Supplier shall hold a suitable stock of spares on site, for the period of the warranty period, or other agreed period. Ownership of these parts shall remain with the Supplier, however they shall be used to replace any defective or worn parts during this period to ensure that continuous operation is safeguarded at no extra cost to the Buyer. The Supplier shall routinely on 30 day intervals top up these spares to ensure no impact on operation.

37.4.17 It is the Suppliers responsibility to ensure all spare parts stored on site are ready for use and all tools or equipment required to ensure parts are in correct condition for use.

37.4.18 At the end of the warranty period, the spares may be sold and transferred to the airport or third party who is taking care of the maintenance of the BHS.

37.4.19 In all cases, the Supplier shall provide a full list of spare parts, including quantities, OEM, cost, lead time and also a lump sum cost for the entire holding as detailed above.

37.4.20 At the end of the warranty the Supplier and the Buyer shall review the appropriateness of the stocked spare parts. At this time the Buyer shall be entitled to freely choose the desired quantity of each spare parts he wishes to keep and purchase. The Buyer can return to the Supplier any unwanted and un-used spare parts.

37.5 SUPORT SERVICES

37.5.1 The Supplier shall provide the following support services in respect of each Product:

37.5.1.1 Provide Help Desk Support accessible by the Buyer 24 hours per day, 7 days per week and 365 days per calendar year by means of telephone and e-mail;

37.5.1.2 Provide Help Desk escalation by telephone access to technicians who can provide advice to Buyers staff on diagnosis and elimination of faults;

37.5.1.3 Provide call-out technician support for the Product in accordance with the Service Levels;

37.5.1.4 Priority of Support Requests.

37.5.2 The Supplier shall:

37.5.2.1 Prioritise all Support Requests based on its reasonable assessment of the severity level of the problem reported;

37.5.2.2 respond to all Support Requests in accordance with the responses and response times specified in the table set out below.

37.5.3 The Supplier shall give the Buyer regular updates of the nature and status of its efforts to correct any Fault.

37.5.4 The Buyer shall provide the Supplier with:

37.5.4.1 Notice of any Faults; and

37.5.4.2 Such output and other data, documents, information, assistance and (subject to compliance with all Buyer's security and encryption requirements notified to the Supplier in writing) remote access to the Product, as are reasonably necessary to assist the Supplier in responding to the relevant Support Request.

37.5.5 The Buyer acknowledges that, to properly assess and resolve Support Requests, it may be necessary to permit the Supplier direct access to the Product, including remote access to the outputs of diagnostic software fitted to the Product.

37.5.6 The EDS x-ray machines are excluded from the scope and will be dealt with via a separate SLA.

37.6 SUPPORT SERVICE SLA

37.6.1 The Supplier undertakes to correct the faults and failures of the System (cases when system functionality cannot be restored by trained service technicians employed by the Buyer, i.e., error recovery was not covered during the training and is not in the scope of training manuals. Also, cases that require specific knowledge controlled only by the Supplier and which requires high qualification). Also, according to responsibility matrix.

Severity Level of Fault/ Failure	Definition	Service Level Responses and Response Time
Level 1 Fault Critical Failure	Business Critical Failures: An error in, or failure of, the Product(s) that:	Level 1 Response: Acknowledgment of receipt of a Support Request within 15 minutes. Level 2 Response:

Severity Level of Fault/ Failure	Definition	Service Level Responses and Response Time
	a) materially impacts the operations of the Company's business at one or more Sites; b) prevents a Product from being used; or c) prevents crucial functions of the Product from being used.	Where appropriate given the nature of the Fault, the Supplier shall remotely connect to the Product to allow the Buyer to continue to use all functions of the Product in all material respects within 4 hours after the Level 1 Response time has elapsed. Level 3 Response: Where remote connection to the Product is not appropriate given the nature of the Fault or remote connection is unable to remedy the Fault, the Supplier shall immediately despatch personnel to provide Corrective Maintenance to the relevant Product (within 24 hours after Level 1 Response time has elapsed). If the Supplier delivers a solution by way of a workaround reasonably acceptable to the Buyer, the severity level assessment shall reduce to a severity level 2 or lower.
Level 2 Fault Moderate Failure	System Defect with Workaround: a) a critical error in the Product for which a workaround exists; or b) a non-critical error in the Product that affects the operations of the Buyer's business or marketability of its service or product, but system can be used in operations.	Level 1 Response: Acknowledgment of receipt of a Support Request within 2 hours. Level 2 Response: The Supplier shall, within 1 Day after the Level 1 Response time has elapsed, provide: a) an emergency Software fix or workaround; and/or b) provide Corrective Maintenance to the relevant Product, which allows the Buyer to continue to use all functions of the Product in all material respects. Level 3 Response: The Supplier shall provide a permanent Fault correction as soon as practicable and no later than 3 Days after the Supplier's receipt of the Support Request.
Level 3 Fault Non-Critical Failure	Minor Error: An isolated or minor error in the Product that: a) does not significantly affect Product functionality; b) may disable only certain non-essential functions; or c) does not materially impact the Buyer's business performance.	Level 1 Response: Acknowledgment of receipt of the Support Request within 1 working day. Level 2 Response: The Supplier shall provide a permanent Fault correction within 5 working Days after the Level 1 Response time has elapsed.

37.7 PREVENTIVE MAINTENANCE SERVICES

37.7.1 The Supplier will provide on-going guidance on Product operation and maintenance based on outputs from remote diagnostic equipment and experience from the Suppliers Products installed at third party locations.

37.7.2 The Systems preventive maintenance shall include:
37.7.2.1 regular tests of the System components and equipment;
37.7.2.2 regular System load and efficiency tests;
37.7.2.3 regular assessments of the condition of the System components;
37.7.2.4 inspection of electric motors and mechanical devices (checking oil and lubricant level, drives, holders, connections, brakes and other required inspections under the manufacturer's recommendations);
37.7.2.5 inspection of control systems;
37.7.2.6 inspection of holders and side walls;
37.7.2.7 inspection of belts;
37.7.2.8 inspection of tracking devices
37.7.2.9 PLC inspection;
37.7.2.10 SCADA inspection
37.7.2.11 inspection fire-security doors;
37.7.2.12 shutters and diverters inspection;
37.7.2.13 need for equipment calibration;
37.7.2.14 other inspection activities under the recommendations of the System components manufacturers to ensure the uninterrupted operation of the System.

37.7.3 After every stage of the preventive maintenance (within 21 days from the end of preventive maintenance services), a detailed report on the System component condition and required actions to be taken to ensure the uninterrupted operation of the System shall be provided. The recommendations for the corrective actions, maintenance procedures and assurance of uninterrupted operation shall be drafted.

37.7.4 The preventive maintenance shall be planned according to the recommendations of the System components manufacturers, System operational parameters, depreciation and operational risks. BHS preventive maintenance must be carried out at least 2 times per year.

37.7.5 Warranty, maintenance and preventive maintenance services shall be carried out under the recommendations of the System component manufacturers.

37.8 SPECIAL WARRANTY

37.8.1 The failures or drawbacks of the System that are listed below shall be treated as cases subject to the Special Warranty. When a case falls under the Special Warranty the Supplier shall not only have to repair or replace components of the BHS to correct the failures or drawbacks to meet the quality standards set out in this technical specification but also investigate and eliminate the causes for those failures or drawbacks with no additional cost to the Buyer.

37.8.2 Component failures of the same type.
37.8.2.1 More than two (2) failures of the same component on an individual assembly within a six (6) month period of use.
37.8.2.2 More than five (5) failures of the same component across any assemblies within a six (6) month period of use.

37.8.3 Consistent performance below required minimums defined in this specification.

37.8.4 Excessive deterioration and/or aging of the equipment and System.

37.8.5 Abnormal wear considering intensity of use.

37.8.6 Unsafe conditions and/or unsafe operation.

37.8.7 Continual leakage/seepage of oil from a seal or seal(s) of similar components performing similar operation.

37.8.8 Excessive noise including a noticeable increase in noise after being placed into operation.

37.8.9 Excessive vibration.

37.8.10 Frequent loosening of retaining devices and/or the need to perform frequent adjustment.

37.8.11 High level control failures:
37.8.11.1 Two (2) or more partial network outages within a six (6) month period of use;
37.8.11.2 Two (2) or more software failures and/or loss of software within a six (6) month period of use across all equipment;
37.8.11.3 Two (2) or more events where applications loose connectivity with another application within a three (3) month period of use across all equipment;
37.8.11.4 More than two (2) system failures where a redundant piece of equipment is required to take over within a thirty (30) day period across all equipment.

37.9 VIOLATIONS OF WARRANTY OBLIGATIONS

37.9.1 During the warranty period The Supplier is responsible to ensure that:
37.9.1.1 The total number of system critical failures (level 1 faults) does not exceed 5 cases per year;
37.9.1.2 The total number of system moderate failures (level 2 faults) does not exceed 10 cases per year;
37.9.1.3 There are not more than two (2) failures of the same component on an individual assembly within a six (6) month period of use;
37.9.1.4 There are not more than five (5) failures of the same component across any assemblies within a six (6) month period of use;
37.9.1.5 There is sufficient stock of spare parts to restore system functionality;
37.9.1.6 Elimination of the critical failures (level 1 faults) lasts not more than 24 hours;
37.9.1.7 Elimination of the moderate failures (level 2 faults) lasts not more than 3 days;
37.9.1.8 Elimination of the non-critical failures (level 3 faults) lasts not more than 5 days;
37.9.1.9 Requirement for response time is breached not more than 3 times a year;
37.9.1.10 Sorting accuracy is higher than 99% per quarter;
37.9.1.11 BHS availability is more than 99.8% per quarter;
37.9.1.12 Due to the operation of the System, the number of damaged baggage units is not more than 1 baggage unit from 100 000 baggage units;
37.9.1.13 Other warranty obligations described in Section “WARRANTY AND MAINTENANCE SERVICES” are satisfied (a breach is considered when the Supplier gets a formal warning more than twice a year for failure to meet warranty obligations for the same problem).

37.9.2 Every additional case when the Supplier fails to fulfil the requirements set in chapter “SANCTIONS FOR VIOLATIONS OF WARRANTY OBLIGATIONS” shall be treated as a separate, additional violation of the terms of warranty. The violations of the terms of warranty shall be counted for each year separately starting from the start date of warranty services.

37.9.3 The fulfilment of warranty obligations in accordance with the rules described in Chapter “SANCTIONS FOR VIOLATIONS OF WARRANTY OBLIGATIONS” Warranty and Service Support is recorded in a separate journal, which is the responsibility of the Supplier.

38 APPENDIX 1 – BHS AND EDS SUPPLIER RESPONSIBILITY MATRIX

38.1 GENERAL

38.1.1 EDS Machines will be procured via separate contract between the Buyer and the EDS Supplier. Machine quantities are detailed within the specification above.

38.1.2 The table below specifies the key responsibilities of the parties regarding the integration of the EDS equipment within the baggage handling system and associated operations.

38.1.3 A detailed interface specification shall be produced by the Supplier as part of the coordination between the Supplier and the EDS Machine Supplier.

38.2 BHS INTEGRATION

R - Responsible Organisation. C - Consulted Organisation.

#	Activity	Buyer	EDS Supplier	Supplier
1.0	Planning			
1.1	EDS Machine(s) Delivery Schedule.	C	C	R
1.2	Provide data for layout planning and interfaces.	C	R	C
1.3	Layout planning and development.	C	C	R
1.4	Review and acceptance of layout planning & Interface specification.	C	R	C
1.5	Planning of power supply.	C	C	R
1.6	Planning of transportation route, installation process incl. Machine(s) repair/replacement routes.	C	R	C
1.7	Approval of transportation route & installation process.	C	R	C
2.0	Production			
2.1	FAT Testing	C	R	C
2.2	FAT Witness at EDS factory	R	C	C
3.0	Delivery and storage			
3.1	Provision of temporary off-site storage facility, if applicable	C	R	C
3.2	Provision of storage facility within the airport.	R	C	C
3.3	Transportation to storage facility, if applicable	C	R	C
3.4	Offload and store within facility, if applicable	C	R	C
4.0	Delivery to Site			
4.1	Define delivery date.	C	C	R
4.2	Organise site delivery – security screening and access arrangements.	C	R	C
4.3	Load onto truck at storage facility.	C	R	C
4.4	Transport to site.	C	R	C
4.5	Offload at designated site location.	C	R	C
4.6	EDS Machine(s) waste disposal	C	R	C
5.0	Installation			
5.1	Transport from designated site location to point of installation (lifting to the building).	C	C	R
5.2	Unpacking & assembly of EDS Machine(s).	C	R	C
5.3	Provide cable trays / containment of cables	C	C	R
5.4	Provide PLC interface box with serial communication port (RJ45) at/near EDS Machine(s) (EDS PLC to BHS PLC).	C	C	R
5.5	Provide communication cable from EDS Machine(s) to PLC interface box (EDS PLC to BHS PLC).	C	C	R
5.6	Connect and terminate communication cable from EDS Machine(s) to PLC interface box (EDS PLC to BHS PLC).	C	R	C

5.7	Provide safety circuit interface box with near EDS Machine(s) (EDS E-stop to BHS E-stop).	C	C	R
5.8	Cable safety circuit from BHS safety system to safety circuit interface box (EDS E-stop to BHS E-stop).	C	C	R
5.9	Provide cable from EDS Machine(s) to safety circuit interface box.	C	C	R
5.10	Connect and terminate communication cable from EDS Machine(s) to security systems.	C	R	C
5.11	Provide power cable to EDS Machine(s).	C	C	R
5.12	Connect and terminate power cables to the EDS Machine(s).	C	R	C
5.13	Provide E-stop cabling.	C	C	R
5.14	Terminate E-stop cabling at EDS Machine(s).	C	R	C
5.15	Install belt conveyors up & downstream of EDS Machine(s).	C	C	R
5.16	Provide surge protection/power regulators, if required.	C	R	C
5.17	Provide connection to cold water supply or air ducts for cooling, if required.	C	C	R
5.18	Provide condensation drain and plumbing to EDS Machine(s), if required.	C	C	R
5.19	Provide suitable enclosure around the EDS Machine(s), if required.	C	R	R
6.0	Testing and Commissioning			
6.1	Arrange Health Inspection (Radiation test) for the EDS Machine(s).	C	R	C
6.2	Test E-stop as an integrated system (EDS Machine(s) & conveyors).	C	C	R
6.3	Test EDS-BHS PLC Interface.	C	R	R
6.4	Test HMI Screen functionality and alarms.	C	C	R
6.5	Plan and organise sub-system and system tests of EDS and BHS as an integrated system.	C	C	R
6.6	Provide HBS validation bags and SAT bags (normal bags) for sub-system and system tests.	C	C	R
6.7	Provide Image Quality Test (IQT) bags.	C	R	C
6.8	Execute sub-system and system tests and provide necessary staffing.	C	R	R
6.9	Organise and hold standalone acceptance tests for EDS Machine(s).	C	R	C