Mead&Hunt

Transmittal

PROJECT:	MCE Terminal Replacement Project 2023 4665943-220849.05	DATE:	4/21/2023
SUBJECT:	MCE Terminal - Addendum 3	TRANSMITTAL ID:	00011
PURPOSE:	For your review and comment	VIA:	Info Exchange

FROM

NAME	COMPANY	EMAIL	PHONE
Joe Cruz	Mead & Hunt Inc.	Joe.Cruz@meadhunt.com	8582660890

TO

NAME	COMPANY	EMAIL	PHONE
Mike Beltran 678 W 18th Street Merced CA 95340 United States	City of Merced, CA	beltranm@cityofmerced.org	209-385-6898
floresp@cityofmerced.org		floresp@cityofmerced.org	
CardosoJ@cityofmerced.org		CardosoJ@cityofmerced.org	

REMARKS:

Hi Merced team,

See attached for the addendum 3 for bidders; everything dated 4.24.23

- Addendum 3 Narrative; word format (needs Mike's signature)
- Addendum 3 drawings; pdf (54 sheets)
- Addendum 3 specifications; pdf (8 specifications)

I will send a separate transmittal to you and InterWest for items required for the comment responses.

Thanks,

Joe

Transmittal

DATE: 4/21/2023
TRANSMITTAL ID: 00011

DESCRIPTION OF CONTENTS

QTY	DATED	TITLE	NOTES
1	4/21/2023	230424 - MCE Terminal Replacement - Addendum 3 Drawings.pdf	
1	4/21/2023	230424 - Addendum 3.docx	
1	4/21/2023	283111 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM_Addendum 3.pdf	
1	4/21/2023	347716 - Baggage Handling System BHS_Addendum 3.pdf	
1	4/21/2023	017419 - Construction Waste Management and Disposal_Addendum 3.pdf	
1	4/21/2023	071326 - Self-Adhering Sheet Waterproofing Addendum 3.pdf	
1	4/21/2023	072500 - Weather Barriers Addendum 3.pdf	
1	4/21/2023	087100 - Door Hardware_Addendum 3.pdf	
1	4/21/2023	093013 - Ceramic Tiling_Addendum 3.pdf	
1	4/21/2023	263213.13 - Diesel-Engine-Driven Generator Sets_Addendum 3.pdf	

COPIES:

Magda Prendergast (Mead & Hunt, Inc.)
Jeff Leonard (Mead & Hunt, Inc.)

April 24, 2023

CITY OF MERCED DEPARTMENT OF ENGINEERING
678 W. 18th Street, Merced, CA 95340

ADDENDUM NO. 3

To **ALL PROSPECTIVE BIDDERS**

Under Specifications for the Construction of

MERCED YOSEMITE REGIONAL AIRPORT TERMINAL REPLACEMENT

PROJECT NUMBER CP230060

FAA AIP NUMBER 3-06-152-030-2023
For which bids are to be received at the Office of the Purchasing Agent of the City of Merced, 2525 "O" St., Merced, California.

1. GENERAL

ITEM 1: Bid Schedule C has been updated to include line 5 for demo of existing structures as well as line 6 for the construction of the new terminal building. Bidders are responsible for providing a document, G703 or similar, as noted under item 1.2, A. of Bid Schedule C showing a breakdown of line items for principal material and subcontract amounts in excess of five (5) percent of the total Contract Sum (Schedules A through C).

2. SPECIFICATIONS

The following revisions to the specifications shall be made:

ITEM 1: Specification Section 017419 – Construction Waste Management And Disposal

Add new specification section.

ITEM 2: Specification Section 071326 – Self-Adhering Sheet Waterproofing

Remove section in its entirety and replace with new section.

ITEM 3: Specification Section 072500 – Weather Barriers

Remove section in its entirety and replace with new section.

ITEM 4: Specification Section 087100 – Door Hardware

Add new specification section.

ITEM 5: Specification Section 093013 – Ceramic Tiling

Add new specification section.

ITEM 6: Specification Section 263213.13 – Diesel-Engine Driven Generator Sets

Added requirement for double walled fuel tank.

ITEM 7: Specification Section 283111 – Digital, Addressable Fire-Alarm System

Added requirements for digital alarm communicator transmitter and radio alarm transmitter.

ITEM 8: Specification Section 347716 – Baggage Handling System (BHS)

Add new specification section.

3. DRAWINGS

The following revisions to the drawings shall be made:

ITEM 1: Sheet G-001 – Cover Sheet

1. Added "5. Anchorage of baggage handling systems/equipment" to list of Deferred Submittals.

ITEM 2: Sheet G-022 – Fire Access Plan

1. Revised background for clarity.

ITEM 3: Sheet C-003 – Overall Project Layout Plan

1. Removed two (2) "Clean Air Vehicle / EV" parking stall markings from back-to-back center row of parking stalls.
2. Added two (2) "Clean Air Vehicle / EV" parking stall markings to south row of parking stalls.

ITEM 4: Sheet C-011 – Construction, Safety & Phasing Plan – Overview

1. Removed two (2) "Clean Air Vehicle / EV" parking stall markings from back-to-back center row of parking stalls.
2. Added two (2) "Clean Air Vehicle / EV" parking stall markings to south row of parking stalls.

ITEM 5: Sheet C-012 – Construction, Safety & Phasing Plan – Condition 1

1. Removed two (2) "Clean Air Vehicle / EV" parking stall markings from back-to-back center row of parking stalls.
2. Added two (2) "Clean Air Vehicle / EV" parking stall markings to south row of parking stalls.

ITEM 6: Sheet C-013 – Construction, Safety & Phasing Plan – Condition 2

1. Removed two (2) "Clean Air Vehicle / EV" parking stall markings from back-to-back center row of parking stalls.
2. Added two (2) "Clean Air Vehicle / EV" parking stall markings to south row of parking stalls.

ITEM 7: Sheet C-014 – Construction, Safety & Phasing Plan

1. Detail 4, Note 4: Clarification: Large concrete blocks or metal pipe feet with 2 sandbags (per pipe foot) will be acceptable for temporary post bases.

ITEM 8: Sheet C-420 – Utility Connection Plan - 1

1. Removed two (2) "Clean Air Vehicle / EV" parking stall markings from back-to-back center row of parking stalls.
2. Added two (2) "Clean Air Vehicle / EV" parking stall markings to south row of parking stalls.

ITEM 9: Sheet C-601 – Bollard, Handrail, and Fencing Plan

1. Removed two (2) “Clean Air Vehicle / EV” parking stall markings from back-to-back center row of parking stalls.
2. Added two (2) “Clean Air Vehicle / EV” parking stall markings to south row of parking stalls.

ITEM 10: Sheet C-631 – Fencing Details

1. Detail 1: Revision/Addition: The outside diameter (OD) size and wall thickness for top rail and brace rail shall be 1-5/8-inches and 0.11 inches, respectively.

ITEM 11: Sheet C-651 – Marking Plan - 1

2. Removed two (2) “Clean Air Vehicle / EV” parking stall markings from back-to-back center row of parking stalls.
3. Added two (2) “Clean Air Vehicle / EV” parking stall markings to south row of parking stalls.

ITEM 12: Sheet C-653 – Temporary Marking Plan

1. Removed two (2) “Clean Air Vehicle / EV” parking stall markings from back-to-back center row of parking stalls.
2. Added two (2) “Clean Air Vehicle / EV” parking stall markings to south row of parking stalls.

ITEM 13: Sheet S-121 – First Floor Structural Wall Plan

1. Added new section cut 15/S-542.
2. Moved section cut 5/S-542.

ITEM 14: Sheet S-151 – Low Roof Framing Plan

1. Added new keyed note 3.607 for roof access penetrations to keyed note legend.
2. Added keyed note tags to roof drain penetrations.
3. Added new section cut callout 15/S-542.
4. Moved section cut 5/S-542.

ITEM 15: Sheet S-152 – High Roof Framing Plan

1. Added new section cut 15/S-542.
2. Moved section cut 5/S-542.

ITEM 16: Sheet S-243 – Framing Elevations

1. Added Top of Steel Tags and dimensions for framing members.

ITEM 17: Sheet S-244 – Framing Elevations

1. Added Top of Steel Tags and dimensions for framing members.

ITEM 18: Sheet S-245 – Framing Elevations

1. Added Top of Steel Tags and dimensions for framing members.

ITEM 19: Sheet S-411 – Enlarged Canopy Framing Plans

1. Added angle support member at deck corner on 5/S-411

2. Added new keyed note 3.614 to keyed note legend.
3. Added new section cut callout 14/S-542.

ITEM 20: Sheet S-423 – Shade Canopy Alternate Bid 1 Structural Details

1. Updated bolt size to 1” diameter on 6/S-423.

ITEM 21: Sheet S-525 – Metal Stud Wall Details

1. Updated 6/S-525 opening size to 48”x48”.
2. Updated 10/S-525 opening size to 48”x48”.

ITEM 22: Sheet S-542 – Framing Details

1. Added 14/S-542 section cut through canopy.
2. Added 15/S-542 section cut at Gridline A72.

ITEM 23: Sheet A-005 – Architectural Site & Egress Plan

3. Added gate designation tag to legend.
4. Added gate tags to northeast pedestrian gate and southwest pedestrian gate.
5. Removed valley gutter and inlet linework from new parking lot for clarity.
6. Revised parking stall count and accessible parking stall quantity provided on plan and in parking tabulation.
7. Revised location of keynote for bicycle parking.
8. Removed two (2) “Clean Air Vehicle / EV” parking stall markings from back-to-back center row of parking stalls.
9. Added two (2) “Clean Air Vehicle / EV” parking stall markings to south row of parking stalls.

ITEM 24: Sheet A-101 – First Floor Plan

1. Added splash blocks along southeast portion of building.
2. Adjusted tags on plan in area of splash blocks for clarity.
3. Added keynote 4.124 to keynote legend.
4. Added interior partition and exterior assembly types to legend.

ITEM 25: Sheet A-511 – Roofing Details

1. Detail 4: Added vapor barrier.

ITEM 26: Sheet A-512 – Roofing Details

1. Detail 1: Added vapor barrier, revised lapping of underlayment, high temp self-adhered flashing and vapor barrier, revised notes.
2. Detail 2: Added vapor barrier and roof assembly tag.
3. Detail 3: Added vapor barrier, revised lapping of underlayment, high temp self-adhered flashing and vapor barrier, revised notes.
4. Detail 5: Added vapor barrier.
5. Detail 6: Added vapor barrier, revised lapping of underlayment, high temp self-adhered flashing and vapor barrier, revised notes.
6. Detail 7: Added vapor barrier.

ITEM 27: Sheet A-531 – Details – Wall Section

1. Detail 7: Added vapor barrier, revised lapping of underlayment, high temp self-adhered flashing and vapor barrier, revised notes.

ITEM 28: Sheet A-601 – Door Schedule

1. Added gate schedule to sheet.

ITEM 29: Sheet A-602 – Architectural Schedules - Finishes

1. Added coved ceramic tile base to finish schedule.

ITEM 30: Sheet P-101 – Plumbing Aboveground Plan

1. Showed condensate drain indirect waste receptacles on sheet notes. Referenced overflow drain detail to architectural drawings on general notes.

ITEM 31: Sheet P-102 – Plumbing Enlarged Views

1. Showed condensate drain indirect waste receptacles on sheet notes.

ITEM 32: Sheet P-300 – Plumbing Details

1. Changed water closet detail to be wall mounted.

ITEM 33: Sheet P-301 – Plumbing Details

1. Included roof drain and overflow drain detail.

ITEM 34: Sheet M-001 – Mechanical Equipment Schedules

1. Updated the DOAS Unit and Condensing Unit schedule to reflect EER/IEER and COP values.

ITEM 35: Sheet M-501 – Mechanical Title 24

1. Updated energy model documents to match EER/IEER and COP values with the mechanical equipment schedules.

ITEM 36: Sheet E-001 – Notes, Symbols & Abbreviations

1. Added General Notes 24 & 25
2. Added symbology for controlled receptacles.

ITEM 37: Sheet E-002 – Title 24 Documentation - Electrical

1. Updated Title 24 documents

ITEM 38: Sheet E-006 – Title 24 Documentation - Electrical

1. Added voltage drop calculations.

ITEM 39: Sheet E-011 – Electrical Site Plan

1. Adjusted location of handhole near
2. Added conduit and handhole for new future EV charging station
3. Relocated handhole near the (3) headed light pole

ITEM 40: Sheet E-011PH – Electrical Site Photometric Plan

1. Added north arrow.

ITEM 41: Sheet E-101 – First Floor Power Plan

1. Added voltage drop calculations.
2. Modified symbology for controlled receptacles.
3. Modified receptacles in Lactation rooms, Toilet rooms, and Janitor rooms to be GFCI.

4. Added switched outlet in Lactation Room 105
5. Added new keyed note 9.122 to provide signage on electrical equipment per CEC 700

ITEM 42: Sheet E-102 – Roof Power Plan

1. Modified keyed notes 9.114 and 9.302.

ITEM 43: Sheet E-121PH – First Floor Egress Photometric Plan

1. Modified plan name.

ITEM 44: Sheet E-401 – Enlarged Plans, Elevations & Sections

1. Added new keyed note 9.122 to provide appropriate signage on service entrance equipment and the emergency lighting emergency lighting inverter in Elec Room 102 per CEC 700
2. Modified keyed note 9.112 for Enlarged Power Plan – Telecom 101

ITEM 45: Sheet E-502 – Details

1. Replaced detail 3 with Handhole detail.

ITEM 46: Sheet E-503 – Details

1. Remove scales to details.

ITEM 47: Sheet E-601 – Schedules

1. Revised Electrical Equipment Wiring Schedule and Schedule notes.

ITEM 48: Sheet E-602 – Schedules

1. Revised floor box schedule.

ITEM 49: Sheet E-603 – Schedules

1. Revised panel schedule 1DOL1 and 1POL2.

ITEM 50: Sheet E-603 – Schedules

1. Revised panel schedule 1DOL1 and 1POL2.

ITEM 51: Sheet E-604 – Schedules

1. Revised panel schedule 1POL4.
2. Removed inverter panel schedule as it is not an actual panel.
3. Rearranged panel schedules.

ITEM 52: Sheet E-701 – One-Line Diagram

1. Added service entrance rating to the 600A service entrance disconnect.
2. Revised PV system breaker to coordinate with the keyed note.
3. Added note to provide appropriate signage for all service entrance equipment and emergency lighting inverter in accordance with CEC article 700.

ITEM 53: Sheet F-141 – First Floor Fire Alarm Plan

1. Added fire alarm One Line Diagram.
2. Relocated pull station and smoke detector in Elect 102 to be near FACP.
3. Added keyed note to coordinate final location of duct smoke detectors with mechanical sheets.
4. Added tamper switches and associated keyed note at knox box locations.
5. Removed fire alarm pull stations from public spaces.
6. Added control module and associated keyed note for interconnection with PA system.

ITEM 54: Sheet T-100 – Communications Site Plan

1. Modified site conduit routes to match Civil sheet C-421.
2. Modified KEYED NOTE 9.707 to increase the shielded Cat6a cable count from 1 to 2.
3. Added COMMUNICATIONS GENERAL NOTE 3 to refer to the Civil sheets C-420 and C-421 for site conduit routing.

ITEM 55: Sheet T-121 – First Floor Security Plan

1. Modified CAM-03, CAM-05, CAM-08, and CAM-17 from wall-mount configuration to ceiling mount configuration with junction box. Updated KEYED NOTE 9.805 to reflect this change.
2. Modified GATE1 and GATE2 to have audio and visual notification alert devices and to fail safe. Updated KEYED NOTE 9.806. Gates allow for free exit with alarm.
3. Modified doors 135A and 134B (Delayed Egress doors) to fail safe.
4. Modified door 142A in have audio and visual notification alert devices.

ITEM 56: Sheet T-601 – Schedules

1. Update VIDEO SURVEILLANCE SCHEDULE with T-121 camera changes.
2. Update ACCESS CONTROLLED DOOR SCHEDULE with T-121 door changes.

ITEM 57: Sheet T-701 – One-Line Diagrams

1. On Detail 3 increase quantity of shielded Cat6a cables from 1 to 2.

4. RESPONSES TO QUESTIONS FROM BIDDERS

ITEM 1: Bidder questions sent in during the allowed period are answered as shown in the attached ***Addendum 3 – Questions from Bidders*** document.

END OF ADDENDUM 3

Michael R. Beltran II, P.E.
City Engineer

Name of Bidder or Firm: _____

THIS ADDENDUM MUST BE SIGNED AND RETURNED WITH BID PROPOSAL.

ADDENDUM NO. 3 has been received and incorporated into the bid proposal.

Received By: _____

Date: _____ Planholder: _____

NOTE: RECEIPT OF THIS ADDENDUM MUST ALSO BE ACKNOWLEDGED IN THE CONTRACTOR'S BID PROPOSAL.

BASE BID – BID SCHEDULE C
1.1 BID FORM SUPPLEMENT A. A completed Proposed Schedule of Values form is required to be attached to the Bid Form. 1.2 PROPOSED SCHEDULE OF VALUES FORM A. Proposed Schedule of Values Form: Provide a breakdown of the bid amount, including alternates, in enough detail to facilitate continued evaluation of bid. Coordinate with the Project Manual table of contents. Provide multiple line items for principal material and subcontract amounts in excess of five percent of the Contract Sum. B. Arrange schedule of values consistent with format of AIA Document G703. 1. Copies of AIA standard forms may be obtained from the American Institute of Architects. a. Website: http://www.aia.org/contractdocs/purchase/index.htm b. Email: docspurchases@aia.org c. Phone: (800) 942-7732.
TOTAL BID SCHEDULE C IN FIGURES: $
TOTAL BID SCHEDULE C IN WORDS:

BASE BID – BID SCHEDULE C – Building and Utilities							
ITEM NO.	**SPEC. REF**	**ITEM DESCRIPTION**	**UNIT**	**QTY**	**UNIT PRICE**		**TOTAL Price (Figures)**
					Figures	**in Words (dollars & cents)**	
1	A-300-5.1	6-inch Sanitary Sewer Lateral	LS	1	$		$
2	A-321-3.7a	8-inch Fire Service Lateral with Double Check Valve Backflow Preventer and Fire Department Connection Assemblies	LS	1	$		$
3	A-321-3.7b	2-inch Domestic Water Service Connection Lateral with Backflow Preventer Assembly	LS	1	$		$
4	A-321-3.7c	6-inch Fire Hydrant and Valve Assembly	LS	1	$		$
5	Division 02	Demolish existing GA Terminal building, Restroom building, and Restaurant building	LS	1	$		$

BASE BID – BID SCHEDULE C – Building and Utilities							
ITEM NO.	**SPEC. REF**	**ITEM DESCRIPTION**	**UNIT**	**QTY**	**UNIT PRICE**		**TOTAL Price (Figures)**
					Figures	**in Words (dollars & cents)**	
6	Division 02 – Division 34	Construct new terminal building and mechanical yard	LS	1	$		$
TOTAL BID SCHEDULE C IN FIGURES: $							
TOTAL BID SCHEDULE C IN WORDS:							

SECTION 283111 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Notification appliances.
5. Device guards.
6. Remote annunciator.
7. Addressable interface device.
8. Digital alarm communicator transmitter.
9. Radio alarm transmitter

B. Related Requirements:

1. Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for cables and conductors for fire-alarm systems.

1.3 DEFINITIONS

A. EMT: Electrical Metallic Tubing.

B. FACP: Fire Alarm Control Panel.

C. HLI: High Level Interface.

D. NICET: National Institute for Certification in Engineering Technologies.

E. PC: Personal computer.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, including furnished options and accessories.

1. Include construction details, material descriptions, dimensions, profiles, and finishes.
2. Include rated capacities, operating characteristics, and electrical characteristics.

B. Shop Drawings: For fire-alarm system.

1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
2. Include plans, elevations, sections, details, and attachments to other work.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
4. Detail assembly and support requirements.
5. Include voltage drop calculations for notification-appliance circuits.
6. Include battery-size calculations.
7. Include input/output matrix.
8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
9. Include performance parameters and installation details for each detector.
10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
11. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.

    a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
    b. Show field wiring required for HVAC unit shutdown on alarm.
    c. Locate detectors according to manufacturer's written recommendations.

12. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

C. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:

    a. Trained and certified by manufacturer in fire-alarm system design.
    b. NICET-certified, fire-alarm technician; Level IV minimum.
    c. Licensed or certified by authorities having jurisdiction.

D. Delegated-Design Submittal: For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Drawings showing the location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the device.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
3. Indicate audible appliances required to produce square wave signal per NFPA 72.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following and deliver copies to authorities having jurisdiction:

    a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
    b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
    c. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points.
    d. Riser diagram.
    e. Device addresses.
    f. Record copy of site-specific software.
    g. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:
        1) Equipment tested.
        2) Frequency of testing of installed components.
        3) Frequency of inspection of installed components.
        4) Requirements and recommendations related to results of maintenance.
        5) Manufacturer's user training manuals.

    h. Manufacturer's required maintenance related to system warranty requirements.

i. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Smoke Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than one unit of each type.
2. Detector Bases: Quantity equal to two percent of amount of each type installed, but no fewer than one unit of each type.
3. Keys and Tools: One extra set for access to locked or tamperproofed components.
4. Audible and Visual Notification Appliances: One of each type installed.
5. Fuses: Two of each type installed in the system. Provide in a box or cabinet with compartments marked with fuse types and sizes.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level III technician.

B. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL (nationally recognized testing laboratory).

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Source Limitations for Fire-Alarm System and Components: Components shall be compatible with, and operate as an extension of, existing system. Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.

B. Noncoded, UL-certified FM Global-placarded addressable system, with multiplexed signal transmission and speaker/strobe evacuation.

C. Automatic sensitivity control of certain smoke detectors.

D. All components provided shall be listed for use with the selected system.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices

1. Manual stations.
2. Smoke detectors.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances.
2. Identify alarm and specific initiating device at fire-alarm control unit, off-premises network control panels, and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Record events in the system memory.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Duct smoke detectors
2. Valve supervisory switch.
3. User disabling of zones or individual devices.
4. Loss of communication with any panel on the network.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of communication with any addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
4. Loss of primary power at fire-alarm control unit.
5. Ground or a single break in internal circuits of fire-alarm control unit.
6. Abnormal ac voltage at fire-alarm control unit.
7. Break in standby battery circuitry.
8. Failure of battery charging.
9. Abnormal position of any switch at fire-alarm control unit or annunciator.

E. System Supervisory Signal Actions:

1. Identify specific device initiating the event at fire-alarm control unit, off-premises network control panels, and remote annunciators.

2. After a time delay of 200 seconds, transmit a trouble or supervisory signal to the remote alarm receiving station.

2.3 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.
    a. System software and programs shall be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining the information through failure of primary and secondary power supplies.
    b. Include a real-time clock for time annotation of events on the event recorder and printer.
    c. Provide communication between the FACP and remote circuit interface panels, annunciators, and displays.
    d. The FACP shall be listed for connection to a central-station signaling system service.
    e. Provide nonvolatile memory for system database, logic, and operating system and event history. The system shall require no manual input to initialize in the event of a complete power down condition. The FACP shall provide a minimum 500-event history log.
2. Addressable Initiation Device Circuits: The FACP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.
3. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FACP shall be listed for releasing service.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

C. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:

1. Pathway Class Designations: NFPA 72, Class B .
2. Pathway Survivability: Level 0.
3. Install no more than 50 addressable devices on each signaling-line circuit.
4. Serial Interfaces:

a. One RS 485 port for remote annunciators, Ethernet module, or multi-interface module (printer port).
b. One USB port for PC configuration.

D. Notification-Appliance Circuit:

1. Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
2. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.

E. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory.

F. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

G. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

H. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Sealed lead calcium .

I. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.4 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Single-action mechanism, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
2. Station Reset: Key- or wrench-operated switch.

2.5 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be two-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.

B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

C. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC system ducts.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

2.6 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Individually addressed, connected to a signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.

B. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.

1. Rated Light Output:

    a. 15/30/75/110 cd, selectable in the field.

2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished, white.

2.7 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

1. Mounting: Flush mounted, NEMA 250, Type 1.

B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.8 ADDRESSABLE INTERFACE DEVICE

A. General:

1. Include address-setting means on the module.

2. Store an internal identifying code for control panel use to identify the module type.
3. Listed for controlling HVAC fan motor controllers.

B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.

C. Control Module:

1. Operate notification devices.

2.9 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture one telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that telephone line is available.
2. Programming device.
3. LED display.
4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:

1. Address of the alarm-initiating device.
2. Address of the supervisory signal.
3. Address of the trouble-initiating device.
4. Loss of ac supply.
5. Loss of power.
6. Low battery.
7. Abnormal test signal.
8. Communication bus failure.

E. Secondary Power: Integral rechargeable battery and automatic charger.

F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.10 RADIO ALARM TRANSMITTER

A. Transmitter shall comply with NFPA 1221 and 47 CFR 90.

B. Description: Manufacturer's standard commercial product; factory assembled, wired, and tested; ready for installation and operation.

1. Packaging: A single, modular, NEMA 250, Type 1 metal enclosure with a tamper-resistant flush tumbler lock.
2. Signal Transmission Mode and Frequency: VHF or UHF 2-W power output, coordinated with operating characteristics of the established remote alarm receiving station designated by Owner.
3. Normal Power Input: 120-V ac.
4. Secondary Power: Integral-sealed, rechargeable, 12-V battery and charger. Comply with NFPA 72 requirements for battery capacity; submit calculations.
5. Antenna: Omnidirectional, coaxial half-wave, dipole type with driving point impedance matched to transmitter and antenna cable output impedance. Wind-load strength of antenna and mounting hardware and supports shall withstand 100 mph with a gust factor of 1.3 without failure.
6. Antenna Cable: Coaxial cable with impedance matched to the transmitter output impedance.
7. Antenna-Cable Connectors: Weatherproof.
8. Alarm Interface Devices: Circuit boards, modules, and other auxiliary devices, integral to the transmitter, matching fire-alarm and other system outputs to message-generating inputs of the transmitter that produce required message transmissions.

C. Functional Performance: Unit shall receive alarm, supervisory, or trouble signal from fire-alarm control unit or from its own internal sensors or controls and shall automatically transmit signal along with a unique code that identifies the transmitting station to the remote alarm receiving station. Transmitted messages shall correspond to standard designations for fire-reporting system to which the signal is being transmitted and shall include separately designated messages in response to the following events or conditions:

1. Transmitter Low-Battery Condition: Sent when battery voltage is below 85 percent of rated value.
2. System Test Message: Initiated manually by a test switch within the transmitter cabinet, or automatically at an optionally preselected time, once every 24 hours, with transmission time controlled by a programmed timing device integral to transmitter controls.
3. Transmitter Trouble Message: Actuated by failure, in excess of one-minute duration, of the transmitter normal power source, derangement of the wiring of the transmitter, or any alarm input interface circuit or device connected to it.
4. Local Fire-Alarm-System Trouble Message: Initiated by events or conditions that cause a trouble signal to be indicated on the building system.

5. Local Fire-Alarm-System Alarm Message: Actuated when the building system goes into an alarm state. Identifies device that initiated the alarm.
6. Local Fire-Alarm-System, Supervisory-Alarm Message: Actuated when the building alarm system indicates a supervisory alarm.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.

1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.

B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EQUIPMENT INSTALLATION

A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."

1. Devices placed in service before all other trades have completed cleanup shall be replaced.
2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.
3. with existing configuration without degrading the performance of either system.

B. Install wall-mounted equipment, with tops of cabinets not more than 78 inches (1980 mm) above the finished floor.

1. Comply with requirements for seismic-restraint devices specified in Section 260548.16 "Seismic Controls for Electrical Systems."

C. Manual Fire-Alarm Boxes:

1. Install manual fire-alarm box in the normal path of egress within 60 inches (1520 mm) of the exit doorway.

2. The operable part of manual fire-alarm box shall be between 42 inches (1060 mm) and 48 inches (1220 mm) above floor level. All devices shall be mounted at the same height unless otherwise indicated.

D. Smoke-Detector Spacing:

1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
2. Smooth ceiling spacing shall not exceed 30 feet (9 m).
3. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Annex A in NFPA 72.
4. HVAC: Locate detectors not closer than 36 inches (910 mm) from air-supply diffuser or return-air opening.
5. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture and not directly above pendant mounted or indirect lighting.

E. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.

F. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches (9100 mm) long shall be supported at both ends.

1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.

G. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position or as indicated on drawings.

H. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.

I. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling. Install all devices at the same height unless otherwise indicated.

3.3 PATHWAYS

A. Pathways shall be installed in EMT.

B. Exposed EMT shall be painted red enamel.

3.4 CONNECTIONS

A. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches (910 mm) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Supervisory connections at valve supervisory switches.

3.5 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.6 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.7 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by authorities having jurisdiction.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

D. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Visual Inspection: Conduct visual inspection prior to testing.

a. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test visible appliances for the public operating mode according to manufacturer's written instructions.
5. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

F. Fire-alarm system will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

I. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.8 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Include visual inspections according to the "Visual Inspection Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
2. Perform tests in the "Test Methods" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Perform tests per the "Testing Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

3.9 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION 283111

Merced Yosemite Regional Airport

20 Macready Drive, Merced, CA, 95641

Section 34 77 16
Baggage Handling System (BHS)

Terminal Replacement Project 2023

Technical Specifications

Division 34

Mead&Hunt

March 30, 2023

logplan

Revisions

Revision	Date	Remark/Explanation of Changes

Note to the Reader:
This Specification has been prepared such that cross-references within the Specification are active hyperlinks within the document allowing the reader to easily navigate the content. This functionality works from the Table of Content, list of figures as well as specific cross-references within the text of the specification.
Additionally, the Specification contains a detailed list of bookmarks within the PDF navigation pane matching the full Table of Content, again to aid the reader in navigating the Specification.

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List of Tables

1 PART 1 - GENERAL REQUIREMENTS

1.1.a This specification is intended for all new work at Merced Yosemite Regional Airport (MCE). This specification and the Contract Drawings are meant to define the work requirements necessary for the BHS Contractor to provide a safe, and efficient system for the Owner and all personnel who operate, maintain or have direct access to the completed BHS.

1.2 CONFLICTS

1.2.a The BHS Contractor is advised to provide written notification of any conflicts that might arise in the proposed design at the time of their offer where the BHS Contractor believes the design cannot be accomplished or fails to meet any of the performance criteria identified in this Specification.

1.2.b Failure of the BHS Contractor to identify issues at the time of their offer places responsibility on the BHS Contractor for establishing and achieving all the performance criteria identified in this Specification.

1.2.c The BHS Contractor will be held to all the requirements of the Contract Documents. In the event of a discrepancy between the Specifications and issued Drawings the more stringent of the requirements will prevail.

1.2.d The Drawings and Specifications take precedence when they are more stringent than codes, statutes, or ordinances in effect. Applicable codes, ordinances, standards, and statutes take precedence when they are more stringent than the Drawings and Specifications.

1.2.e The BHS Contractor shall notify the Owner of any conflicts identified between the Contract Documents and federal or international law within three (3) days of discovery. The Owner will have the sole right to decide which requirement will govern.

1.2.f Under no circumstances shall deviations identified by the BHS Contractor relieve the BHS Contractor from the requirements defined within these Specifications unless approved in writing by the Owner.

1.3 REFERENCE DOCUMENTS

1.3.1 General

1.3.1.a Drawings, General and Special Conditions, Division 1 - General Requirements and other applicable Technical Specifications apply to work of this Section 34 7739.

1.3.1.b It is the BHS Contractor's responsibility to contact the applicable Supplier, Firm, and/or Engineer to request documents needed for coordination, equipment interfacing, referencing, and testing requirements.

1.3.2 Specific Related Technical Sections

1.3.2.a Division 1, Section 01010 "Summary of Work"

1.3.2.b Division 1, Section 01014 "Work Sequence and Constraints"

1.3.2.c Division 1, Section 01300 "Submittals"

1.3.2.d Division 1, Section 01310 "Schedule"

1.3.2.e Division 26, "Electrical"

1.3.3 External Reference Documents

1.3.3.a 'Screening Equipment Installation Guide' specific to the screening equipment supplier (to be confirmed by TSA).

1.3.3.b Screening equipment to BHS Interface Design Document.

1.3.3.c IATA Passenger services Conference Resolution's manual.

1.3.3.d PGDS – Planning Guidelines and Design Standards for Checked Baggage Inspection Systems, Version 7.0.

1.3.3.e ATA Facility Planning Guidelines – New Baggage Handling Systems for Passenger Terminals (latest version).

1.4 DEFINITION OF TERMS

1.4.1 Contract Documents

1.4.1.a The Contract Documents include (but are not limited to) the baggage handling system drawings, architectural drawings, communications/network drawings, fire protection system drawings, mechanical, electrical, and plumbing (MEP) drawings, structural drawings, program phasing plans, contract provisions, special provisions, Specifications, addendum, RFIs, general project correspondence and formally issues Change Orders from the Owner, if any. The Contract Documents define the Scope of Works of this project. The BHS Contractor is to familiarize himself with all of the Contract Documents and how they interface with the installation of the baggage system.

1.4.2 Main Contractor

1.4.2.a The Main Contractor shall mean the individual or group of companies, which have contracted with the Owner for the construction of the complete airport construction project. The Main Contractor sub-contracts out the Scope of Works defined in these Specifications to the BHS Contractor.

1.4.3 BHS Contractor

1.4.3.a The BHS Contractor shall mean the BHS Contractor responsible for the Scope of Works defined herein. The BHS Contractor shall design, execute, and complete the Works in accordance with the Contract, and remedy any defects in the Works. When completed, the Works shall be fit for the purposes for which the Works are intended as defined in the Contract.

1.4.4 BHS Integrator

1.4.4.a The BHS Integrator shall mean all the responsibilities of the BHS Contractor in addition to providing BHS equipment and/or BHS controls and/or BHS installment for the project.

1.4.5 Supplier and Sub-Contractor

1.4.5.a Supplier and Sub-Contractor shall mean any external company or 3rd party hired by the BHS Contractor for the supply, delivery, installation, testing or other relevant activities. Such companies shall refer to the BHS Contractor and are subject to the same terms and conditions of this contract as the BHS Contractor.

1.4.6 Owner

1.4.6.a The Owner shall mean the airport authority.

1.4.7 Project Management Consultant (PMC)

1.4.7.a The Project Management Consultant shall mean the company or consortium of companies working on behalf of the Owner and Stakeholders to ensure that the execution of the project is done according to the Owner's defined processes.

1.4.8 Engineer

1.4.8.a The Engineer means the person or company appointed by the Owner to act as the Engineer for the purposes of the Contract or other person appointed from time to time by the Owner and notified to the BHS Contractor. Logplan LLC is the Engineer.

1.4.8.b The Engineer shall retain the role of the Concept Designer of the Contract and shall have the sole discretion with regards to approval of all design issues and any interpretations thereof.

1.4.8.c The BHS Contractor shall comply with any instructions given by the Engineer or delegated assistant in writing, on any matter related to the Contract.

1.4.9 Furnish

1.4.9.a Except as otherwise defined in greater detail, term "furnish" is used to mean supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.

1.4.10 Install

1.4.10.a Except as otherwise defined in greater detail, term "install" is used to describe operations at Project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning and similar operations, as applicable in each instance.

1.4.11 Provide

1.4.11.a Except as otherwise defined in greater detail, term "provide" means furnish and install, complete and ready for intended use, as applicable in each instance.

1.4.12 Sub-system

1.4.12.a A group of independent but interrelated elements comprising a unified whole which can be tested as a group and which forms a major sub-division of the complete system.

1.4.13 In-Gauge (aka. Normal Size) Bags

1.4.13.a Bags which by TSA definition can be processed through a normal size baggage system, and processed by an EDS screening machine.

1.4.14 Out-of-Gauge (OOG)

1.4.14.a Bags which by TSA definition can be processed through a normal size baggage system but cannot be processed by an EDS screening machine. Such bags by-pass the EDS machines and are routed directly to the CBRA for TSO inspection.

1.4.15 Oversized (OS)

1.4.15.a Bags which by TSA definition cannot be transported through a normal size baggage system and which are transported through dedicated oversize conveyors and associated screening.

1.4.16 Line of Sight

1.4.16.a Line of sight is defined as the unobstructed view or access path from any location within the CBIS/BHS to any component or safety device and shall not exceed a maximum 60’.

1.4.16.b

1.4.17 Failure or Breakdown

1.4.17.a A failure is the event when a piece of hardware or software fails and stops working as intended.

1.4.17.b A failure is the malfunctioning of a system component (physical or software), which interrupts normal operational procedures, i.e., a fault/malfunction occurs requiring an Operator to go to the location of the fault to check or remedy the problem. Such cases need not necessarily result in an impairment of material flow (e.g., defective outbound monitor).

1.4.18 Fault or Outage

1.4.18.a A fault or outage is a situation when operation stops, i.e., the processing of bags is halted.

1.4.19 Down-Time

1.4.19.a Defined as the time taken to repair defective equipment and return to service once suitably qualified repair personnel have responded.

1.4.19.b All time to inspect, disassemble, reassemble, calibrate, and bring back into service shall be regarded as down time.

1.4.19.c An allowance of ten (10) minutes to obtain replacement parts shall be included in any down time calculations requiring replacement of hardware.

1.4.19.d An allowance of one (1) minute to respond to the defective equipment shall be included in any down time calculations.

1.4.20 Up-Time

1.4.20.a Equipment is in service and available for use. This includes when the equipment is in energy saving mode.

1.4.21 User Configurable

1.4.21.a An interface parameter that can be configured on a workstation that is normally accessible to the User (e.g., O&M, TSA, etc.).

1.4.22 User

1.4.22.a User is the general term used for the personnel working with and using the CBIS/BHS, e.g., O&M personnel, airlines, control room operators, Customs officers, and TSA officers.

1.4.23 Black-out Days / Embargo Days

1.4.23.a Defined periods that the BHS Contractor shall not perform certain types of work. Emergency work necessary to keep an operational system operating shall be properly coordinated with the Owner.

1.4.24 Plug and Play

1.4.24.a A technique which facilitates the discovery of a hardware component in the system, without the need for physical device configuration, or user intervention in resolving resource conflicts.

1.4.25 Remote Access

1.4.25.a A mechanism that provides electronic access to the CBIS/BHS from a remote location within the Airport boundary, e.g., operations command center.

1.4.26 Off-site Access

1.4.26.a A mechanism that provides electronic access to the CBIS/BHS from a location that is outside the Airport boundary, e.g., a support technicians place of residence.

1.4.27 Low Level Controls (LLC)

1.4.27.a Low Level Control shall mean all hardware and software required to perform the low-level field equipment control in a safe and controlled manner as defined herein.

1.4.27.b LLC includes PLC's, bus communications, local visualization at panels, sensors, lights, beacons, equipment status, signal, alarms, E-stop, and failsafe equipment functions as minimum.

1.4.28 Hot Standby / Hot Back-up

1.4.28.a A Hot Standby is an automatic failover mechanism to provide increased availability in system configurations.

1.4.28.b A Hot Standby configuration contains a pair of duplicate and identical hardware components running the same application software, e.g., PLC, server, computers or similar. Both parts of the pair are running and connected as part of the working system, however only one part is the active part (Master), while the other is inactive (Slave).

1.4.28.c When a component fails in the Master, the Slave of the Hot Standby configuration is seamlessly and automatically switched into operation and becomes active without loss of data or disruption to the operation.

1.4.28.d Real time synchronization between the Master and Slave is used to completely mirror the data environment of the Master.

1.4.28.e It shall be possible to reset and replace a failed processor without affecting the operation. A failure of either processor shall be alarmed and reported.

1.4.28.f Provide health messages (heartbeat) between the Master and Slave parts of the Hot Standby configuration to report the operational status of all parts to the SCADA.

1.4.29 Cold Standby / Cold Back-up

1.4.29.a A Cold Standby is used as a manual failover mechanism to provide increased availability in system configurations.

1.4.29.b A Cold Standby configuration contains a pair of duplicate and identical hardware components installed, e.g., PLC, server, computers or similar. Only the active part contains the application software and is running and connected to the working system.

1.4.29.c When a component fails in the Cold Standby configuration the equipment-controlled stops, e.g. conveyors controlled by a PLC will stop. In order to continue operation an operator has to manually switch the second part of the Cold Standby configuration into operation.

1.4.29.d As no data synchronization takes place between the two (2) parts of the Cold Standby configuration the system has to be flushed for baggage and brought to an empty start-up condition before operation can resume. All data tracking will be lost during a Cold Standby switch-over.

1.4.29.e Following a switch-over from an active part to an inactive part of the Cold Standby configuration, the newly active part shall request information from the HLC to ensure data integrity of tracking information based on the CBIS/BHS condition prior to switch-over (and/or failure of the previously active part) before commencing operation after a switch-over.

1.4.29.f It shall be possible to reset and replace a failed processor without affecting the operation. A failure of either processor shall be alarmed and reported.

1.4.29.g Provide health messages (heartbeat) between the active and inactive parts of the Cold Standby configuration to report the operational status of all parts to the SCADA.

1.4.30 Replacement Standby / Replacement Back-up

1.4.30.a A Replacement Standby shall mean that identical redundant hardware is available on-site in the Spare Parts Storage or other location, such that an operator can physically replace the faulty part with the replacement part and load the required application software.

1.4.30.b During such replacement, the system is stopped. Once the replacement part is installed and the system has been flushed for baggage and brought to an empty start-up condition operation can resume. All data tracking will be lost during a Replacement Standby switch-over.

1.4.31 SCADA

1.4.31.a For the purposes of this Specification SCADA and Graphics shall be synonymous for an interface that allows the User to identify the actual status of the CBIS/BHS and monitor and configure system operations through dialogues and reports.

1.4.32 Redundancy

1.4.32.a Redundancy shall mean the duplication of critical components of the system and/or the alternative baggage transportation routes with the intention of increasing reliability of the CBIS/BHS.

1.4.33 Load Point

1.4.33.a A load point shall mean any input point where bags are inducted or introduced to the CBIS/BHS. Such points include, but are not limited to, ticketing, arrival inputs, and CBRA reinsert points.

1.4.34 Unload Point

1.4.34.a An unload point shall mean any point in the system where bags are removed. Such points include, but are not limited to, Make-up laterals, Claim carousels, OS Claim run-out belts, and CBRA.

1.4.35 Guardrails

1.4.35.a Guardrails shall be synonymous with ‘Impact Protection’.

1.4.36 Remove

1.4.36.a Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

1.4.37 Remove and Salvage

1.4.37.a Detach items from existing construction, wrap and label and deliver them to the Owner ready for reuse.

1.4.38 Remove and Reinstall

1.4.38.a Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

1.4.39 Existing to Remain

1.4.39.a Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed, and salvaged, or removed and reinstalled.

1.4.40 Installation

1.4.40.a Installation shall mean the phase in the Construction Schedule in which the BHS Contractor installs equipment on-site. Installation shall also mean the activity by the BHS Contractor to put in place equipment on-site.

1.4.41 Pre-Commissioning

1.4.41.a Pre-commissioning shall mean the phase in the Construction Schedule in which the BHS Contractor carries out his post-installation check-outs and prepares for the following activities of testing in the Commissioning phase. It shall also mean the activities carried out by the BHS Contractor during the Pre-commissioning phase.

1.4.41.b The Owner shall have the right to witness any and all on-site activities performed by the BHS Contractor during this phase.

1.4.42 Commissioning

1.4.42.a Commissioning shall mean the phase in the Construction Schedule in which the BHS Contractor carries out his testing prior to acceptance testing with the Owner. It shall also mean the activities carried out by the BHS Contractor during the Commissioning phase.

1.4.42.b The BHS Contractor testing shall cover all activities on a component, sub-system, and system level, whether being functional, availability, reliability, redundancy, switch-over or otherwise. The BHS Contractor shall in this phase perform the necessary testing to verify that the component, sub-system, and system is compliant with the Contract requirements and subsequent acceptance testing is performed with the Owner.

1.4.42.c The Owner shall have the right to witness any and all on-site activities performed by the BHS Contractor during this phase.

1.4.43 Acceptance Testing

1.4.43.a Acceptance Testing shall mean the phase in the Construction Schedule where the Owner verifies that the components, sub-systems, and system is compliant with the Contract requirements. It is the responsibility of the BHS Contractor to plan, execute and document all tests as directed by the Owner during Acceptance Testing. The BHS Contractor shall as minimum, but not limited to, perform the tests defined herein. The BHS Contractor shall conduct other Owner defined tests as deemed necessary by the Owner.

1.4.43.b Acceptance Testing shall also mean the activities carried out during the Acceptance Testing phase.

1.4.44 Practical Completion

1.4.44.a Practical Completion shall mean a milestone achieved by the BHS Contractor and accepted by the Owner where the Works is practically complete and is available for beneficial use with only minor outstanding defects, if any.

1.4.44.b The BHS Contractor shall prior to Practical Completion ensure that all defects identified through System Acceptance Testing and recorded in the Punch List have been rectified. Only minor defects can be outstanding at time of Practical Completion.

1.4.45 Beneficial Use / Beneficial Occupancy

1.4.45.a Beneficial Use shall mean the milestone when the Owner commences beneficial use of the Works. Upon commencement of Beneficial Use the Start-up System & Monitoring Period shall commence.

1.4.45.b The Owner shall take-over responsibility for the operation and maintenance of the portions of the CBIS/BHS, which has gone into beneficial use.

1.4.46 Substantial Completion

1.4.46.a Substantial Completion shall mean a milestone achieved by the BHS Contractor and accepted by the Owner where the Works is substantially complete and the CBIS/BHS has successfully completed the Start-up System & Monitoring Period.

1.4.46.b General Warranty cannot commence prior to Owner issuance of a Substantial Completion Certificate.

1.4.47 Final Completion and Acceptance

1.4.47.a Final Completion and Acceptance shall mean the acceptance of the Works by the Owner in accordance with Owner regulations.

1.4.47.b The Design Warranty cannot commence prior to Owner issuance of Final Completion and Acceptance of the Works.

1.5 ACRONYMS

Table 1 Abbreviations & Acronyms

ID	Acronym	Full Description
1.	L10	Ball bearing rating life for radial contact bearings is calculated per ANSI standard and AFBMA standard 9-1978. It is known as the L10 rating and is the life rating of apparently identical bearings in millions of revolutions. For a single bearing, it is the life associated with 90% reliability.
2.	AC	Alternating Current
3.	AFF	Above Finished Floor
4.	ANSI	American National Standards Institute, Inc.
5.	ASME	American Society of Mechanical Engineers
6.	ATA	Air Transport Association
7.	ATP	Acceptance Test Plan
8.	ATR	Automatic Tag Reader
9.	AWS	American Welding Society
10.	BAS	Baggage Allocation System
11.	BHS	Baggage Handling System
12.	BIDS	Baggage Information Display System
13.	BMA	Baggage Measuring Array
14.	BOM	Bill of Materials
15.	B/H (bph)	Bags per Hour
16.	B/M (bpm)	Bags per Minute
17.	BPM	Baggage Processing Message
18.	BRS	Baggage Reconciliation System
19.	BSM	Baggage Source Message
20.	CAR	Corrective Action Report
21.	Carrier	Synonymous with Airline
22.	CBIS	Checked Baggage Inspection System
23.	CBRA	Checked Baggage Resolutions Area
24.	CBS	Checked Baggage System (aka Hold Baggage Screening)
25.	CCR	BHS Contractor Change Request
26.	CMMS	Computerized Maintenance Management System
27.	CN	Change Notice
28.	CO	Change Order
29.	CPM	Critical Path Method

ID	Acronym	Full Description
30.	CR	Change Request
31.	CSI	Construction Specifications Institute
32.	CT	Computed Tomography (aka EDS technology)
33.	DC	Direct Current
34.	DCS	Departure Control System
35.	DDS	Detailed Design Specification
36.	EDS	Automated Explosive Detection System
37.	ETD	Explosive Trace Detection
38.	FAA	Federal Aviation Administration
39.	FAT	Factory Acceptance Testing
40.	FDS	Functional Design Specification
41.	FFL	Finished Floor Level
42.	FLASH	A form of non-volatile memory
43.	Float	Unallocated time in the construction schedule, sometimes referred to as 'slack'
44.	FIFO	A logic mechanism defining data control using a First In First Out methodology
45.	FPM	Feet per Minute
46.	Graphics	Synonymous with SCADA or GUI
47.	GUI	Graphical User Interface
48.	HBS	Hold Baggage Screening (aka Checked Baggage screening)
49.	HOA	Hand-Off-Auto Control Stations. (aka Manual Intervention Panel) (operator switch to select between manual vs. automatic PLC control of equipment)
50.	HVAC	Heating, Ventilation & Air Conditioning
51.	I/O	Input/Output
52.	IATA	International Air Transport Association
53.	IATA RP	IATA Recommended Practice, as adopted by member Airlines/Carriers
54.	ICAO	International Civil Aviation Organization
55.	IDD	Interface Design Documentation
56.	IEEE	Institute of Electrical and Electronics Engineers
57.	IP	Internet Protocol
58.	IQT	Image Quality Test
59.	IRD	Interface Requirements Document
60.	iSAT	Integrated Site Acceptance Testing of EDS screening equipment
61.	ISO	International Organization for Standardization
62.	ITA	Independent Testing Agency
63.	License Plate	A 10-digit number assigned by the airline Host as defined by IATA RP 1740
64.	LC	Load Center (transformer room)
65.	LED	Light Emitting Diode
66.	LEED	Leadership in Energy and Environmental Design
67.	LG	Longitudinal Grove (conveyor belting top surface)
68.	LLC	Low Level Control
69.	MIS / MIP	Manual Intervention Station, aka. Manual Intervention Point
70.	MCP	Motor Control Panel
71.	MSDS	Material Safety Data Sheets
72.	NCR	Nonconformance Report
73.	NEC	National Electric Code (NFPA 70)
74.	NEMA	National Electrical Manufacturers Association
75.	NFPA	National Fire Protection Association
76.	NTP	Notice to Proceed. Documentation authorizing the BHS Contractor to commence Works after award of Contract
77.	O&M	Operation & Maintenance

ID	Acronym	Full Description
78.	OOG	Out-of-Gauge. Bags which by TSA definition can be processed through a normal size baggage system but cannot be processed by an EDS screening machine. Such bags by-pass the HBS machines and are routed directly to the CBRA for TSO inspection.
79.	OSHA	Occupational Safety and Health Administration
80.	OSR	On-Screen Resolution. A TSA protocol for visual inspection of ALARMED images generated by EDS screening equipment
81.	OS	Oversized. Bags which by TSA definition cannot be transported through a normal size baggage system and which are transported through dedicated oversize conveyors and associated screening.
82.	Owner	The person(s) and/or entity appointed by the Owner to manage the Contract.
83.	P/N	Part Number
84.	PC	Personal Computer
85.	PEC	Photo Electric Cell (photocell)
86.	PGDS	Planning Guidelines and Design Standards for Checked Baggage Inspections Systems
87.	PLC	Programmable Logic Controller
88.	QA	Quality Assurance
89.	QC	Quality Control
90.	RA	Right Angle. A shaft mounted RA motor/reducer is a motor gearbox combination with a hollow shaft that mounts directly onto the roller shaft, where the motor is typically mounted in a vertical orientation.
91.	RAM	Random Access Memory
92.	RF	Radio Frequency
93.	RFI	Request for Information
94.	ROW	Right of way.
95.	RT	Rough Top (conveyor belting top surface).
96.	SAT	Site Acceptance Testing
97.	SBE	Small Business Edition (Norton End-Point Antivirus Protection)
98.	iSAT	Site Acceptance Testing of EDS screening equipment
99.	SCADA	Supervisory Control and Data Acquisition
100.	Slack	Unallocated time in the construction schedule, commonly referred to as 'float'
101.	SMS	Short Message Service
102.	SS	Stainless steel
103.	SSI	Sensitive Security Information
104.	SSPC	The Society for Protective Coatings
105.	TOB	Top of Belt
106.	TRR	Test Readiness Review
107.	TSA	Transportation Security Administration
108.		
109.	UHMW	Ultra-High Molecular Weight
110.	UI	User Interface
111.	UL	Underwriters Laboratories Inc.
112.	UPS	Uninterruptible Power Supply
113.	VAC	Volts Alternating Current
114.	VDC	Volts Direct Current
115.	VFD	Variable Frequency Drive
116.	WBS	Work Breakdown Structure
117.	IMPB	Illuminated Momentary Push Button
118.	SMPB	Solid Momentary Push Button
119.	ILPB	Illuminated Latched Push Button (E-stop)
120.	2LKS	2-position Latched Key Switch
121.	2LSS	2-position Latched Selector Switch
122.	2MKS	2-position Momentary Key Switch
123.	2MSS	2-position Momentary Selector Switch

ID	Acronym	Full Description
124.	3LKS	3-position Latched Key Switch
125.	3LSS	3-position Latched Selector Switch
126.	3MKS	3-position Momentary Key Switch
127.	3MSS	3-position Momentary Selector Switch

1.6 INTRODUCTION

1.6.a The objectives of the baggage screening system's functionality and design are:

1.6.1 Objectives

1.6.1.a Design, manufacture and install in accordance with the Contract Documents.

1.6.1.b Ensure safeguarding for a future installation of a stand-alone CT80dr+ EDS machine and associated processes compliant with Planning Guidelines and Design Standards for Checked Baggage Inspection Systems v 7.0 provided by the TSA (including updates and/or revisions).

1.6.1.c The sustained baggage flow of the System shall be greater than the Key Performance Indicators (KPI) defined in Part 1 § 1.14.9 below.

1.6.1.d The availability of the System shall be greater than defined in Part 1 § 1.15.4 below.

1.6.1.e The System uptime needs to be a minimum of twenty-two (22) hours per day.

1.6.1.f The System shall include allowances for the handling of 'in gauge' bags and 'out of gauge' (odd size) bags.

1.6.2 Language

1.6.2.a The official language of this project is US English. All documentation and correspondence in connection with this project shall be done in the official language.

1.7 CONVENTIONS

1.7.1 Organization of Drawings and Specifications

1.7.1.a Organization of the Specifications into divisions and sections, and arrangement or numbering of drawings is intended solely for the convenience of the BHS Contractor in his responsibilities to divide the Works among sub-contractors or to establish the extent of Works to be performed by any trade.

1.7.1.b The Owner does not assume any liability arising out of jurisdictional issues or claims advanced by trade organizations or other interested parties based on the arrangement or organization of Drawings or Specifications.

1.7.2 Gender and Number

1.7.2.a For convenience and uniformity, parties to the Contract, including the Owner, BHS Contractor, and their sub-contractors, suppliers, installers, consultants, or other interested parties are referred to throughout the Contract Documents as if masculine in gender and singular in number. Such reference is not intended to limit the meaning of the Contract Documents to the masculine gender or singular number.

1.7.3 Singular vs. Plural

1.7.3.a Materials, products, equipment, or other items of Works referred to in the singular shall be construed as plural where applicable by the intent of the Contract Documents and shall not limit quantities to be provided by the BHS Contractor.

1.7.4 Imperative Mood

1.7.4.a Specifications and notes on the drawings or elsewhere in the Contract Documents are generally written in the imperative mood, i.e., instructions or commands to the BHS Contractor, whether the BHS Contractor is specifically addressed or not.

1.7.5 References to Sub-Contractors or Trades

1.7.5.a References to sub-contractors, trades, or other entities, which are not parties to the Contract, shall be construed as meaning the BHS Contractor whose responsibility it shall be to divide the Works among sub-contractors or trades. Such references are used as a matter of convention and are not intended to preclude or direct the BHS Contractor's responsibility to divide the Works.

1.8 CODES & STANDARDS

1.8.1 General

1.8.1.a All Works shall comply with applicable federal, state, and local codes, laws, acts, ordinances, and all authorities having jurisdiction.

1.8.1.b All equipment furnished shall carry a listing from an independent testing lab such as UL.

1.8.1.c All equipment and accessory items furnished and installed under this Contract shall be governed at all times by applicable provisions of Federal laws, including, but not limited to the latest revisions of the standards defined in “Division 1, Section 01091 - REFERENCE STANDARDS” in addition to the following CBIS/BHS specific codes and standards:

1.8.2 Screening Machine Supplier Reference Documents

1.8.2.a Screening equipment installation guide specific to the screening equipment supplier (to be confirmed by TSA),

1.8.2.b Screening equipment to BHS Interface Design Document.

1.8.3 Transportation Safety Administration (TSA) Documentation

1.8.3.a PGDS - Planning Guidelines and Design Standards for Checked Baggage Inspection Systems, Version 7.0.

1.8.3.b Transportation Safety Administration (TSA) Interface Requirements Document (IRD)..

1.8.4 Federal Safety & Health Standard

1.8.4.a William Steiger Occupational Safety and Health Act of 1970, Public Laws 91-596

1.8.4.b Bureau of Radiology Health Safety Specifications for Class II-B laser devices

1.8.5 Occupational Safety and Health Standards (OSHA)

1.8.5.a Part 1910 – Occupational Safety and Health Standards, Chapter XVII of Title 29, Code of Federal Regulations.

1.8.5.b Part 1917 – Occupational Safety and Health Standards, Chapter XVII of Title 29, Code of Federal Regulations.

1.8.5.c Part 1926 – Occupational Safety and Health Standards, Chapter XVII of Title 29, Code of Federal Regulations.

1.8.6 Local Codes

1.8.6.a City and County Building Code plus Amendments.

1.8.6.b City and County Fire Protection Code plus Amendments.

1.8.7 American Welding Society (AWS)

1.8.7.a AWS-A2.0 Standard Welding Symbols

1.8.7.b AWS-C1.1 Recommended Practice for Resistance Welding

1.8.7.c AWS-D-1.0 Welder Qualifications

1.8.7.d AWS-D1.1 Structural Welding Code

1.8.7.e (Copies of AWS publications may be obtained from the American Welding Society, 550 NW LeJeune Road, Miami, FL 33126.)

1.8.8 American Gear Manufacturers Association Standards (AGMA)

1.8.8.a 460.04 Practice for Gear Motors.

1.8.8.b 461.01 Practice for Worm Gear Motors.

1.8.8.c (Standards of the American Gear Manufacturers Association are published by the American Gear Manufacturers Association, 1500 King Street, Suite 201, Alexandria, VA 22314-2730.)

1.8.9 American National Standards Institute (ANSI)

1.8.9.a A-12.1 Safety Code for Floor and Wall Openings, Railings and Toe Boards.

1.8.9.b B-20.1 Safety Code for Conveyors, Cableways and Related Equipment.

1.8.9.c B-29.0 Transmissions, Roller chains and Sprocket Teeth.

1.8.9.d B-105.1 Specifications for Welding Steel Conveyor Pulleys.

1.8.9.e C-33.1 Safety Standard for Flexible Cord and Fixture Wire.

1.8.9.f S1.1-1994 Sound Code.

1.8.9.g Z-53.1 Safety Color Code.

1.8.9.h ANSI/IEEE C2 - National Electrical Safety Code

1.8.9.i ANSI C80.1 – Rigid Steel Conduit, Zinc-Coated.

1.8.9.j ANSI C80.3 – Electrical Metallic Tubing, Zinc-Coated.

1.8.9.k ANSI/NEMA FB 1 – Fittings and Supports for Conduit and Cable Assemblies.

1.8.9.l (Copies of ANSI Standards may be obtained from ANSI, 1819 L Street, NW, Washington, D.C. 20036.)

1.8.10 American Society for Testing Materials (ASTM)

1.8.10.a A-36 Structural Steel

1.8.10.b A-233-64T Welding electrodes

1.8.10.c A-307 Fasteners (Bolts)

1.8.10.d A-563 Fasteners (Nuts)

1.8.10.e A-569 Sheets and Strip (hot rolled)

1.8.10.f A-794 Sheets and Coils (cold rolled)

1.8.10.g A-844 Fasteners (Washers)

1.8.11 Conveyor Equipment Manufacturers Associates (CEMA)

1.8.11.a CEMA standard No. 402-1992 Belt Conveyors

1.8.11.b CEMA standard No. B105.1-1990 Steel Conveyor Pulleys

1.8.12 American Wood Preservers Association (AWPA)

1.8.12.a C-27 Fire Retardant Wood

1.8.13 Institute of Electrical and Electronics Engineers (IEEE)

1.8.13.a IEEE standard 519 recommended practices and requirement for harmonic control in electrical power systems.

1.8.13.b IEEE standard 241 “IEEE Recommended Practice for Electric Power Systems in Commercial Buildings” pertaining to connections and terminations.

1.8.13.c IEEE 802.3x Full duplex on 10BaseT, 100BaseTX 1000BaseX ports

1.8.13.d IEEE 802.3ae 10 Gigabit Ethernet Specification

1.8.13.e IEEE 802.1d Spanning Tree Protocol

1.8.13.f IEEE 802.1q VLAN

1.8.13.g IEEE 802.3z 1000BaseX Specification

1.8.13.h IEEE 802.3u 1000Base TX Specification

1.8.13.i IEEE 802.3 10BaseT Specification

1.8.13.j IEEE 802.3af DTE Power via MDI (Power over Ethernet)

1.8.13.k IEEE 802.2 Logical Link Control

1.8.13.l 802.11a/h 5GHz, 54Mbit/s Physical layer

1.8.13.m 802.11b 2.4GHz, 11Mbit/s Physical Layer

1.8.13.n 802.11g 2.4GHz, 54Mbit/s Physical Layer

1.8.13.o 802.11i WLAN network security standard

1.8.14 Internet Engineering Task Force (IETF)

1.8.14.a RFC 792 Internet Control Message Protocol (ICMP)

1.8.14.b RFC 1155-SMI for SNMP

1.8.14.c RFC 1157: Simple Network Management Protocol (SNMP)

1.8.14.d RFC 1212: Concise Management Information Base (MIB) definitions

1.8.14.e RFC 1213: Management Information Base for Network Management of TCP/IP-based internets: MIB-II

1.8.14.f RFC 1305: Network Time Protocol (NTP)

1.8.14.g RFC 1757: RMON MIB

1.8.14.h RFC 2119: Key words for use in RFCs to Indicate Requirement Levels

1.8.14.i RFC 2791: Scalable Routing Design Principles

1.8.14.j RFC 4061: Benchmarking Basic OSPF Single Router Control Plane Convergence

1.8.14.k RFC 4063: Considerations When Using Basic OSPF Convergence Benchmarks

1.8.15 National Bureau of Standards (NBS)

1.8.15.a Handbook H28 – Screw Thread Standards.

1.8.15.b (Copies of handbook H28 may be obtained upon application accompanied by a money order, coupon, or cash, made out to the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.

1.8.16 National Fire Protection Association (NFPA)

1.8.16.a NFPA 70-2002 National Electrical Code (2002 Ed.) National Fire Code.

1.8.16.b NFPA 79 Electrical Standards for Industrial Machinery

1.8.16.c NFPA 80 Standard for Fire Doors and Fire Windows

1.8.16.d (Copies of the NFPA publications may be obtained from the NFPA, 1 Batterymarch Park Quincy, MA 02269-9101.)

1.8.17 American Society of Mechanical Engineers (ASME)

1.8.17.a ASME B20.1 Safety standards for conveyors and related equipment.

1.8.18 National Electrical Code (NEC)

1.8.18.a NEC electrical standards

1.8.19 National Electrical Manufacturers Association (NEMA)

1.8.19.a IC-S Industrial Controls and Systems.

1.8.19.b MG-1 Motors and Gear Motors.

1.8.19.c NEMA WC 3 - Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

1.8.19.d NEMA WC 5 - Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

1.8.19.e NEMA WD 1 - General Purpose wiring devices.

1.8.19.f NEMA WD 5 - Specified-Purpose wiring devices.

1.8.19.g NEMA RN 1 – PVC Externally-Coated Galvanized Rigid Steel Conduit and Electrical Metallic Tubing

1.8.19.h NEMA TC-3 PVC fittings for use with rigid PVC conduits.

1.8.19.i NEMA TC 15 PVC Fiber Optic Innerduct

1.8.19.j NEMA FS WW-C-566 – Specification for Flexible Metal Conduit.

1.8.19.k (Standards of NEMA are available from NEMA, 1300 North 17th Street, Suite 1847, Rosslyn, Virginia 22209.)

1.8.20 The Society for Protective Coatings (SSPC)

1.8.20.a SSPC-SP 10 painting Specification

1.8.21 Air Transport Association

1.8.21.a ATA Specification No. 101 (Specification for Ground Equipment Technical Data, rev. 5, October 1986)

1.8.21.b (Copies of ATA Spec. No. 101 may be obtained from the Air Transport Association of America Inc., 1301 Pennsylvania Ave., NW, Suite 1100, Washington, D.C. 20004-1707.)

1.8.22 IATA Standards

1.8.22.a IATA Passenger Services Conference Resolutions Manual.

1.8.22.b IATA Airport Development Reference Manual (9th Edition - January 2004)

1.8.22.1 IATA Recommended Practices

1.8.22.1.a Res 706

1.8.22.1.b RP 1706

1.8.22.1.c RP 1740 a

1.8.22.1.d RP 1740 b

1.8.22.1.e RP 1740 c

1.8.22.1.f RP 1740 d

1.8.22.1.g RP 1745

1.8.22.1.h RP 1797

1.8.23 ICAO Standards

1.8.23.a International Civil Aviation Organization (ICAO)

1.8.23.b ICAO annex 17, Safeguarding International Civil Aviation Against Acts of Unlawful Interference

1.8.23.c ICAO 8973, Security Manual for Safeguarding Civil Aviation Acts of Unlawful Interference (Sixth Edition - 2002)

1.9 SCOPE OF WORKS

1.9.1 General

1.9.1.a The Scope of Works for this Contract covers the design, supply, installation, test, commissioning and start-up of a complete operating and maintainable Baggage Handling System (BHS) as part of the Terminal Replacement project at Merced Yosemite Regional Airport in the State of California.

1.9.1.b The BHS Contractor is fully responsible for the system design, equipment selection, fabrication and installation, the functionality, the performance, the efficiency, the maintainability, and all interfaces of the system to satisfy the requirements defined in the Contract Documents.

1.9.1.c The BHS Contractor shall use only pre-approved OEM equipment as per Part 2 § 2.3.

1.9.1.d The system shall be engineered to sustain the heavy-duty impact and abuse experienced in airport baggage handling operations, while considering design elements of safety, functionality, simplicity, reliability, and maintainability.

1.9.1.e The BHS Contractor shall ensure that when completed the CBIS/BHS meets all local, state, and federal laws, codes and safety standards and assures a safe and efficient system for all personnel who operate it, maintain it, or have access to it.

1.9.1.f The BHS Contractor shall provide all professional skill, labor and tools, supplies, equipment, supervision, materials, and everything necessary to perform equipment removal, demolition, refurbishment, supply, installation, testing, commissioning, training, startup services, and complete all of the Works described, drawn, set forth, shown, and included in the Contract Documents.

1.9.1.g The CBIS/BHS system layout drawings are contained in the “B” series of the Contract Drawings and the BHS Contractor shall ensure that the design fits within the envelope (right-of-way) defined by the Contract Drawings to make the best use of mechanical and electrical rights of way for the overall good of the Airport.

1.9.1.h Any modifications to the Contract Drawings required to accommodate the BHS Contractor’s final design and layout will be done at the BHS Contractor’s expense. All modifications must bear the stamp of a Professional Engineer, licensed in the State of North Dakota and meet the requirements of the North Dakota Building Department, and shall be approved by the Owner in writing.

1.9.1.i The general construction Works defined in the Contract Documents will be performed by the Main Contractor.

1.9.1.j The BHS Contractor will most likely be a Sub-Contractor to a larger Main Contractor, who will be responsible for building and modifying the terminal facility.

1.9.1.k The BHS Contractor shall be responsible for other facilities and services necessary to properly execute and complete the BHS Contractor’s Scope of Works, including security for worksite, and the storage and protection of all materials awaiting incorporation into the Works.

1.9.1.l The BHS Contractor is responsible for the general construction Works required in the Contract Documents. The BHS Contractor is responsible for all works performed by Others including the necessary coordination, management and supervision of their activities in accordance with the Contract Documents.

1.9.1.m The BHS Contractor shall provide fourteen (14) days of On-site Start-up Support once Beneficial operation commences. For details on responsibilities and activities during the On-site Start-up period refer to Part 3 § 3.32.2

1.9.1.n The BHS Contractor shall provide thirty (30) days of remote Off-site Start-up Support upon expiration of the On-site Start-up Support. For details on responsibilities and activities during the Off-site Start-up period refer to Part 3 § 3.32.3.

1.9.1.o The BHS Contractor shall allow for forty (40) hours of Operations and Maintenance training. For details on training requirements refer to Part 3 § 3.27.

1.9.2 Coordination Responsibilities

1.9.2.a The Contract Drawings depict certain mechanical dimensional constraints necessary for coordination with the building structure and for design preference. They also indicate the general arrangement of equipment, circuits, outlets, panel boards and other mechanical and electrical Works in a schematic form; however, re-circuiting will not be permitted without specific acceptance.

Data presented on the drawings is as accurate as planning can determine, but accuracy is not guaranteed and field verification by the BHS Contractor of all dimensions, locations, levels, etc., to suit field conditions is required. All design responsibilities are with the BHS Contractor.

1.9.2.b It is the BHS Contractor's responsibility to request and obtain all necessary information, drawings and Specifications applicable to the Works from the Owner. These Specifications are a part of the Contract Documents, which define the functional requirements, and establish the minimum standard of quality for the project.

1.9.2.c Any design, engineering, or other professional service provided by the BHS Contractor shall be performed in accordance with all terms of the Contract Documents. The BHS Contractor shall employ such competent architects, engineers and consultants, appropriately licensed and/or registered in the State of North Dakota, as shall be necessary for the prompt, efficient and proper performance of the obligations under this project.

1.9.2.d The BHS Contractor shall coordinate his Scope of Works with the Main Contractor to ensure the project is delivered on-time and budget and to the right quality as defined by the Contract Documents.

1.9.2.e All CCTV Scope of Works is provided by Others. However, the BHS Contractor shall assist with the coordination of placement of CCTV cameras, routing of their associated cable trays and placement of bracketry with the CCTV Contractor to provide the best possible monitoring of the complete CBIS/BHS and avoid installation clashes.

1.9.3 New Equipment

1.9.3.a The BHS Contractor shall furnish, install and maintain all necessary equipment to provide a complete, operable, maintainable and safe system on a "Turn-Key" basis, including, but not limited to, floor supports, anchors, guard rails, impact protection/bollards, conveyor bed sections, framing, drives, take-ups, sideguards, shrouding, stainless steel panels and equipment trim, safety protection, security doors, fire doors, draught curtains, carousels, electrical power distribution, power panels, controls and control panels, MCP's, PLC's and I/O, motors, motor starters, disconnects, conduit and wiring, field bus, control stations/operator panels, operator devices (push buttons and switches), PEC, encoders, proximity switches, limit switches, sensors, beacons, horns, E-stop, test baggage, spare part hoist/lift and any other materials or equipment whether specifically shown and described, or implied in the plans and Specifications or wherever required to effectively accomplish the intended functions of the CBIS/BHS.

1.9.3.b The BHS Contractor is responsible to design and furnish a complete, integrated control system in compliance with the Contract Documents. This includes the testing, commissioning and training of the installed system according to these Specifications and to the satisfaction of the Owner. Once approved by the Owner, the BHS Contractor shall turn over to the Owner a fully operable and maintainable Baggage Handling System, along with the complete as-built documentation, including Maintenance and Operating Manuals.

1.9.3.c The BHS Contractor shall furnish, install and maintain all Fire and Security doors as required to provide a safe a secure terminal facility. The CBIS/BHS shall interface with the terminal's Fire Alarm System (FAS).

1.9.3.d The control system shall be provided with the redundancy as defined in Part 1 § 1.14.8.

1.9.4 Modifications to Existing Equipment

1.9.4.a The BHS Contractor shall ensure a complete functional baggage system and shall modify any existing BHS equipment (whether shown on the drawings or not) that is in the way of the implementation of Baggage Asset Replacement including, but not limited to, support structures, conveyors, platforms, screening equipment support, roller doors, etc. Coordinate and execute the work required to existing services that are obstructing the installation of this project scope. Such modifications shall encompass removal of existing baggage equipment and rerouting/modification of all work necessary to allow routing of the new equipment and to return the existing system to an operational state.

1.9.4.b As per the Drawings the BHS Contractor shall complete the work required to modify the existing CBIS/BHS including any and all power, data, furnishings, hardware, equipment, and functionality required to complete the work.

1.9.4.c Any modifications to existing operational services/equipment shall not interrupt existing operations. The BHS Contractor shall in writing obtain approval from the Owner to take out of service any existing operational services/equipment and minimize to the greatest extent possible the time, which such service/equipment is out of service including working multiple shifts in order to bring said equipment back on line as quickly as possible.

1.9.4.d The BHS Contractor shall pay and perform all required LLC and HLC hardware upgrades as a result of the modifications required to complete the Scope of Works.

1.9.4.e Modify (or replace) the existing SCADA to reflect modifications to the existing baggage handling equipment and to meet the requirements as described in these Specifications. The SCADA shall encompass all new and existing equipment.

1.9.4.f Modify as necessary existing equipment that connects / interfaces with equipment provided under this Contract to ensure that the requirements of these Specifications are met.

1.9.4.g When modifying existing system, notify and obtain approval from the Owner, if existing functionality cannot be maintained or if in the BHS Contractor's opinion, it would be beneficial for the Owner to change the functionality.

1.9.4.h When a system is modified, the BHS Contractor shall also modify any upstream and downstream functionality affected by the modification.

1.9.4.i Ensure proper disassembly, transportation, refurbishing and storage of modified equipment in a manner that enables reassembly of the equipment in its final location in a like-new condition.

1.9.5 Demolition of Existing Equipment

1.9.5.a The Scope of Works include the removal of existing Claim Device (E) CD1 as per Contract Drawing series B-100/B-101.

1.9.5.b The BHS Contractor shall disassemble and remove obsolete equipment by removing nuts, bolts, screws, or other fasteners with the use of hand tools. Sections/pieces that are too large to be removed through existing doorways and openings may be cut into smaller sections following the Owner's safety procedures.

1.9.5.c Removed equipment shall be disposed off following the Owner's recycling procedures.

1.9.5.d Information regarding existing equipment designated for demolition shall be obtained from the Owner (e.g., electrical as-built drawing, O&M manuals, PLC architecture).

1.9.6 Provision for TSA Screening

1.9.6.a The BHS Contractor shall ensure that the design is safeguarding and prepared for the below described future expansions as per Contract Drawing B-201.

1.9.6.b In addition to the normal contractual relationship with the Main Contractor, the BHS Contractor will also be expected to interface and work with the TSA to coordinate the required TSA work into the production and construction schedule to facilitate a final TSA certified screening system.

1.9.6.c Due to the nature of the Works, the BHS Contractor will be required to have their own experienced Scheduler to support the Project. The Airport will have reporting requirements, which require detailed visibility of the CBIS/BHS portion of the Works for the TSA oversight activities. These may or may not extend beyond the details required by the Main Contractor.

1.9.6.d Due to the funding on this project, the BHS Contractor will be required to differentiate between TSA-funded portions and non-TSA-funded portions of the Works completed on invoices submitted for payment. Guidelines will be provided as part of the project kick-off meeting.

1.9.6.e The security screening machines will be provided, installed and commissioned in stand-alone mode by the TSA and EDS OEM. The BHS Contractor is responsible for the coordination of such installation and stand-alone commissioning activities.

1.9.7 Provision for TSA Certification Schedule/Documentation

1.9.7.a The BHS Contractor shall submit to the Owner a detailed TSA Certification schedule and relevant documentation. This schedule shall be a standard-alone schedule for TSA activities; however, it must be coordinated and in line with the overall project construction schedule.

1.9.7.b The BHS Contractor shall coordinate their Works with the TSA and/or the TSA's representative to ensure that all necessary documentation is completed and submitted as required, in order to ensure that the certification process is completed according to the TSA requirements.

1.9.7.c The BHS Contractor shall be responsible for collecting information from other parties to complete required documentation.

1.9.7.d It is the BHS Contractors responsible to ensure that the latest TSA requirements are obtained to meet all schedule events. The following is the minimum content;

1.9.7.1 TSA Scheduling Activities

1.9.7.1.a EDS machines installation complete

1.9.7.1.b CBIS/BHS integration test plan complete

1.9.7.1.c EDS SAT dates

1.10 EXISTING CONDITIONS

1.10.a The BHS Contractor shall have had the opportunity to visit the jobsite to verify dimensions, measurements, locations, elevations, interfaces and obstructions relevant to the Works prior to submitting his proposal. Any conflict identified during the project execution shall be the responsibility of the BHS Contractor and included in the Contract price.

1.10.b The BHS Contractor shall perform a complete mechanical and electrical field survey of the existing CBIS/BHS equipment and maintain consistency with the existing conveyor components in term of motors, gearboxes, bearing, belting, field control components and MCP control components to reduce parts inventory.

1.10.c The Scope of Works shall include the cost of relocating existing equipment, piping, ductwork, and conduit to allow for installation of the new Works.

1.10.d All installation work related to operational equipment needs to be scheduled in a way to ensure that there is no interruption of the live operations.

1.10.e Connections to existing systems shall be made so that the use of these systems is not interrupted without the Owner's approval as to the time and duration.

1.10.f Information regarding existing equipment designated for modification or to remain shall be obtained from the Owner (e.g., electrical as-built drawing, O&M manuals, PLC architecture).

1.11 PROJECT MILESTONES

1.11.a The BHS Contractor is bound by the activity durations and milestones in the following table for scheduling. The durations, start and finish details in the following table shall be incorporated by the BHS Contractor into the Construction Schedule. The Construction Schedule shall be approved by the Owner.

Table 2 Project Milestones

Description	Duration	Start	Finish
Issue Bid documents	0 days		-55 days
BHS Contractor to submit bid to the Owner	0 days	-55 days	-30 days
Review bid	30 days	-30 days	-10 days
Contract negotiations	30 days	-10 days	+0 days
Issue Contract/NTP	0 days		+0 days
Preliminary Design by BHS Contractor	30 days	+0 days	+30 days
Detailed Design by BHS Contractor	30 days	+30 days	+60 days
Design complete	0 days		+60 days
Supply & Installation of EDS	10 days	+60 days	+70 days
Installation phase	20 days	+60 days	+80 days
Mechanical installation complete	0 days		+80 days
Electrical installation complete	0 days		+80 days
Pre-Commissioning phase	10 days	+80 days	+90 days

Description	Duration	Start	Finish
Commissioning phase	20 days	+90 days	+110 days
Commissioning complete	0 days		+110 days
System Acceptance Testing	10 days	+110 days	+120 days
System Acceptance Testing complete	0 days		+120 days
Delivery of Spare Parts	0 days		+130 days
Training	5 days	+130 days	+135 days
Practical Completion	0 days	+135 days	+135 days
Beneficial Use (Going Live)	0 days	+135 days	+135 days
On-Site Start-up Support	14 days	+135 days	+149 days
Off-Site Start-up System Monitoring & Support	30 days	+149 days	+179 days
Substantial Completion	0 days	+179 days	+179 days
General Warranty Period	365 days	+179 days	+544 days
Final Completion and Acceptance	0 days		+544 days
Design Warranty Period	5 years	+135 days	+2004 days

1.11.b * Note: All days are calendar days.

1.12 CONSTRUCTION SCHEDULE (TIME SCHEDULE)

1.12.1 General

1.12.1.a The BHS Contractor shall complete the Works within the Contract Time and in accordance with the most recent schedule submittal that has been approved in writing by the Owner.

1.12.1.1 Preliminary Schedule

1.12.1.1.a Provide a Preliminary Schedule as per Division 1, Section 01310 - SCHEDULE (LP)

1.12.1.2 Construction Schedule

1.12.1.2.a Provide a Construction Schedule as per Division 1, Section 01310 - SCHEDULE (LP) and defined below.

1.12.1.b The BHS Contractor shall submit to the Owner a detailed Construction Schedule based on a Work Breakdown Structure (WBS) covering the entire project duration, which shall comply with the milestones defined in Part 1 § 1.11 above and be structured as follows;

1.12.1.3 Project Stages

1.12.1.3.a Notice to Proceed (NTP)

1.12.1.3.b Preliminary Design

1.12.1.3.c Detailed Design

1.12.1.3.d Manufacture

1.12.1.3.e Installation

1.12.1.3.f Pre-Commissioning

1.12.1.3.g Commissioning

1.12.1.3.h System Acceptance Testing

1.12.1.3.i Start-up System Monitoring & Support

1.12.1.3.j General Warranty

1.12.1.3.k Design Warranty

1.12.1.c The Construction Schedule for the performance of the Works shall be a Critical Path Method (CPM) system in bar chart format, unless an alternate system is specifically identified in the Specifications, with reasonable detail including a time scaled network.

1.12.1.d Submit a supporting narrative detailing the BHS Contractor's methods for determining construction logic, durations and resources (manpower), and overall progress curve shall be submitted for approval.

1.12.1.e The Construction Schedule shall besides the detail activities contain an overview showing the major activities and milestones. Failure of the BHS Contractor to have a Construction Schedule approved by the Owner will be considered cause for withholding progress payment(s).

1.12.1.f The BHS Contractor's Sub-Contractor(s) shall be clearly identified along with their responsibilities and activities.

1.12.1.g The BHS Contractor shall clearly identify the work calendar that applies to the schedule. Specific attention shall be given to ensure compliance with black-out days as defined in Part 3 § 3.7.2.

1.12.1.h The Construction schedule shall be provided as a GANT chart with links, dependencies and fully resourced using an electronic software package, as directed by the Owner.

1.12.1.i The schedule shall show the total contract time, including project milestones, as indicated in the Contract Documents.

1.12.1.j The BHS Contractor shall prepare a work plan to complete the Works within the contract time and complete those portions of Works relating to each milestone date and other contract requirements.

1.12.1.k The BHS Contractor shall generate a computerized Critical Path Method (CPM) schedule in the Precedence Diagram Method (PDM) format for the Works.

1.12.1.l The computerized format shall be compatible with Primavera version 3.1 or Microsoft Office Project Professional 2019 or later.

1.12.1.m The Schedule shall be submitted electronically to the Owner in a format, which will allow review and manipulation of any part of the schedule, and in reproducible hard copy. The schedule activities shall be resource loaded showing labor man hours by crafts, major construction equipment by type, and value of the Works. The value of the Works shall summarize each pay item shown in the Schedule of Values and balance to their amount.

1.12.1.n In addition to the construction activities the schedule shall include activities for furnishing materials and equipment and vendor shop drawing preparation.

1.12.1.o To the extent that the construction schedule or any revisions thereof contains anything not jointly agreed upon in writing or fails to show anything jointly agreed upon in writing, it shall not be considered to have the approval of the Owner. Failure to include any Works item required for performance of this contract shall not excuse the BHS Contractor from completing all Works within applicable completion dates, regardless of the Owner's approval of the schedule.

1.12.1.p Failure of the BHS Contractor to comply with these requirements will be considered cause for withholding progress payment(s) or termination for default.

1.12.1.q The BHS Contractor is required to develop and submit for approval to the Owner a Phasing Plan for the Works in accordance with the Contract Drawings thirty (30) days after NTP.

1.12.1.4 Phasing Plans

1.12.1.4.a The Phasing Plan shall address the current airlines' needs and operating hours along with total counter availability and so on.

1.12.1.4.b These plans shall be coordinated with both the Owner and the airline operators affected. This is a standalone document that will be utilized to work with the affected airlines and Airport Management and should be reflected in the Construction Schedule.

1.12.1.r The BHS Contractor is responsible for scheduling all installation Works related to active equipment of the CBIS/BHS in a way to ensure that there is no interruption to airline operations. This schedule must be accepted by the Owner in writing prior to any installation Works beginning.

1.12.2 Mobilization, Demobilization Activities

1.12.2.a The BHS Contractor shall in the construction schedule identify activities associated with the mobilization and demobilization.

1.12.3 Milestones

1.12.3.a The construction schedule shall as minimum include the project milestones defined in Table 2 Project Milestones.

1.12.4 Deliverables

1.12.4.a The BHS Contractor shall in his schedule identify all deliverables such as, but not limited to samples, documentation, manuals, equipment, reports, results, drawings, spare parts list, training material and so on.

1.12.5 Long Lead Items

1.12.5.a The construction schedule shall identify all long lead items and bring to the attention of the City any items where early procurement could improve the project critical path.

1.12.5.b The schedule shall identify multiple deliveries separately as necessary to allow accurate progress monitoring.

1.12.6 3rd Party Interfaces

1.12.6.a The BHS Contractor shall in the construction schedule identify all interfaces with third parties and other trades including but not limited to the following.

1.12.7 Construction Activities

1.12.7.a The BHS Contractor shall in the construction schedule identify all construction activities including design, delivery/shipping, installation, testing, commissioning, system monitoring, operational support, and warranties.

1.12.7.b The construction schedule shall be prepared such that it is possible to monitor progress of each sub-system independently, including, but not limited to the following sub-systems independently.

1.12.7.1 Sub-System

1.12.7.1.a Ticketing

1.12.7.1.b Inbound

1.12.7.c The construction schedule shall be prepared such that it is possible to monitor progress of all disciplines and trades independently, including, but not limited to the following disciplines/trades independently.

1.12.7.d The construction schedule shall include all BHS Contractor access dates.

1.12.8 Critical Path

1.12.8.a The BHS Contractor shall identify and provide the critical path of the construction schedule for review by the Owner.

1.12.8.b No more than twenty-five percent (25%) of the total number of line items shall be represented by the critical path and the BHS Contractor shall aim at limiting the Critical Path by building in slack and flexibility in the schedule.

1.12.9 Implementation

1.12.9.a The BHS Contractor is responsible for coordinating their Works with the projects master schedule.

1.12.9.b The BHS Contractor is responsible for coordinating and scheduling all Works for their sub-contractors and/or suppliers.

1.12.9.c The BHS Contractor is responsible for coordinating with third parties and other trades to identify their Works and include their activities as line items in the construction schedule as necessary to prevent scheduling conflicts. In the event that an agreement cannot be reached between the BHS Contractor and other parties, the BHS Contractor shall bring the matter to the attention of the Owner at the earliest opportunity and the Owner's decision shall be binding on the BHS Contractor.

1.12.9.d The BHS Contractor is responsible for providing updates to their sub-contractors and/or suppliers of changes to the project schedule within three (3) days of such changes.

1.12.9.e Unallocated time in the schedule otherwise referred to as 'float' or 'slack' shall not be for the exclusive use of the BHS Contractor or the Owner (including other trades and/or suppliers).

1.12.9.f Failure of the BHS Contractor to include items in the schedule shall not excuse the BHS Contractor from completing those tasks within the allocated project time frame and omitted tasks shall be completed so as not to affect other scheduled tasks irrespective of any approvals for the schedule obtained from the Owner.

1.12.9.g Any deficiencies and omissions in the approved construction schedule (time, resources, constraints, or the like) shall not relieve the BHS Contractor of their obligations to complete the Works within the allocated project timeline. The BHS Contractor shall be solely responsible for any additional resources needed to complete the Works within the project timeline so as to meet the milestones detailed in this Specification and costs associated with any escalations shall be borne solely by the BHS Contractor.

1.12.9.h At the completion of all Works items, the BHS Contractor shall provide an 'as-built' construction schedule accurately reflecting the Works done including actual start and finish dates.

1.12.10 Progress Monitoring

1.12.10.a The BHS Contractor shall submit an updated schedule to the Owner identifying an accurate progress status of the project and the most up to date work complete progress as part of the regular progress reports and on-demand as directed by the Owner.

1.12.10.b The BHS Contractor shall submit a monthly progress report at the end of each month following the Notice to Proceed. At the end of each month, the BHS Contractor and Owner shall agree on the progress of the Works and the BHS Contractor shall update the Construction Schedule accordingly. The updated Construction Schedule is a prerequisite to the submittal of the BHS Contractor's application for progress payment. This review does not constitute an approval of the Construction Schedule and shall not be used for the purposes of modifying the initially approved Construction Schedule.

1.12.10.c A bar chart format schedule shall be provided showing the BHS Contractor's completion status (progress) on each Works item.

1.12.10.d The physical progress curve shall be updated to show actual progress.

1.12.11 Delay and Recovery

1.12.11.a The BHS Contractor shall maintain an adequate work force and the necessary materials, supplies, and equipment to meet the current approved Construction Schedule. In the event that the BHS Contractor, in the judgment of the Owner, is or is projected as failing to meet any milestones, then the BHS Contractor shall submit a "CPM Recovery Schedule".

1.12.11.b The CPM Recovery Schedule shall set forth a plan to eliminate the schedule slippage. The plan must be specific to show the methods to achieve the recovery of time, i.e., acceleration of the Works, concurrent operations, additional manpower, additional shifts or overtime, weekend work, additional equipment, or alternative construction methods. All costs associated with implementing the CPM Recovery Schedule shall be borne by the BHS Contractor.

1.12.11.c Upon receipt of the CPM Recovery Schedule the Owner will review the schedule for compliance with the Contract Documents and degree of detail. The Owner will within fourteen (14) days of receipt accept or reject it with written comments. If the CPM Recovery Schedule is rejected, the BHS Contractor must submit a revised schedule within seven (7) days after the date of rejection.

1.12.11.d The BHS Contractor shall notify the Owner within forty-eight (48) hours of any events known to the BHS Contractor that would result in a delay to the construction schedule, if left unattended.

1.12.11.e In the event that a delay results in slippage of the construction schedule, the BHS Contractor shall submit within seven (7) calendar days a detailed CPM Recovery Schedule identifying all efforts that are required to ensure the construction schedule meets all milestones dates identified elsewhere in this Specification. The delay shall be absorbed within the next thirty (30) days or next project milestone. This shall be decided by the Owner.

1.12.11.f If the latest completion time for any Works item does not fall within the time allowed by the construction schedule, the sequence of Works and/or duration shall be revised by the BHS Contractor through concurrent operations, additional manpower, additional shifts or overtime, additional equipment, or alternative construction methods until the schedule produced indicates that all significant contract completion dates, occupancy dates and milestones will be met. No additional costs will be allowed if such expediting measures are necessary to meet the agreed completion date or dates except as provided elsewhere in the Contract Documents.

1.12.12 Schedule Changes

1.12.12.a The BHS Contractor's request for construction schedule changes shall be made on the latest approved construction schedule and shall be accompanied by a narrative description and

justification for the change and shall be submitted in accordance with the General Conditions on changes in time. Minor revisions submitted at monthly progress review meetings are not considered as changes in this context.

1.12.12.b The construction schedule may be changed when one or more of the following occur:

1.12.12.1 Pre-requisite for Schedule Changes

1.12.12.1.a When a Change Order significantly affects the contract completion date or sequence of Works items.

1.12.12.1.b When the BHS Contractor elects to change the sequence or duration of Works items affecting the critical path.

1.12.12.1.c When the Owner directs a change that affects a milestone date(s) specified in the Special Conditions or alters the length of a critical path.

1.12.12.c If, after submitting a request for change to the construction schedule, the Owner does not agree with the request, the Owner will schedule a meeting with the BHS Contractor to discuss the differences. If a settlement cannot be reached on the change in the construction schedule or if the BHS Contractor has failed to submit revisions to the network, the Owner has the option of providing suggested logic and/or duration times in all subsequent updating reports. The suggested logic and/or duration times will remain in effect until the change in the construction schedule is settled or until the logic and duration are superseded.

1.12.12.d If the BHS Contractor has any objections to the data furnished by the Owner, the BHS Contractor shall advise the Owner within ten days in writing, fully supporting the objections with a counter plan. The revisions suggested by the Owner shall be used for updating reports until the Owner approves the counter plan.

1.12.12.e If the BHS Contractor does not submit a counter plan and data within ten days after the date of the Owner's suggested logic, the BHS Contractor is deemed to have concurred with the Owner's suggested logic/duration time changes. The Owner's plan will be the basis of negotiations for any adjustment of the time and cost for performance of the Works.

1.12.13 Contract Extensions

1.12.13.a If the BHS Contractor is granted an extension of time for completion of any milestone or contract completion date under the provisions of the contract, the determination of the total number of extended days will be based upon the current analysis of the schedule and upon all data relevant to the extension. Such data shall be incorporated in the next monthly update of the schedule.

1.12.13.b The BHS Contractor acknowledges and agrees that delays in Works items which, according to schedule analysis, do not affect any milestone dates or the contract completion date shown on the CPM network at the time of the delay will not be the basis for a contract extension.

1.13 SUBMITTALS

1.13.1 General

1.13.1.a The following Section is a general outline of submittals. Please refer to Division 1, Section 01 33 00 "Submittals" for further details. It must be noted that the details outlined in this section does not summarize all submittals required under this Contract.

1.13.1.b The BHS Contractor shall read this document and where indicated in the individual sections, provide all relevant submittals. The BHS Contractor shall provide a submittal schedule within fourteen (14) days after Notice to Proceed as per Division 1 Section 01 33 00.

1.13.1.c The BHS Contractor shall ensure that submittals are produced and supplied in a timely manner so as to ensure scheduled dates are maintained. Allow a minimum cycle of thirty (30) days for review of each submittal by the Owner.

1.13.1.d Coordinate each submittal document with the requirements of the Works; place particular emphasis upon ensuring that each submittal of one trade is compatible with other submittals of that trade and submittals of other trades including producing as needed drawings showing the relationship of the Works of different trades.

1.13.1.e All submittals shall become the property of the Owner.

1.13.1.f The BHS Contractor shall maintain a file of all approved submittal documents at the worksite. The complete file of approved submittal documents shall be turned over to the Owner with the As-Built Documents at the end of the project.

1.13.1.g The BHS Contractor shall at the time of submission describe variations from the Contract Documents in writing, separate from the submittal document. If the Owner approves any such variations, an appropriate Contract Change Order shall be issued except that, if the variation is minor and does not involve a change in price or in time of performance, a modification need not be issued. If a submission contains variations and the variation column is not marked on the transmittal form, it will not be considered for review and acceptance. Should the proposed variation from the specified product be substantial, a description must be included which outlines all the differences, including maintenance and utility services along with any cost savings from an item not containing the variation, utilizing the Substitution Request Form as provided by the Owner.

1.13.1.h Changes in accepted submittal documents will not be permitted unless those changes have been accepted, in writing, by the Owner.

1.13.2 Submittal Management

1.13.2.a The BHS Contractor shall coordinate the submittal management procedures with the Owner, who reserves the right to dictate any special conditions as seen necessary. Such requirements may differ from the requirements defined in Division 1 Section 01 33 00.

1.13.2.b Each submittal shall be resubmitted in full, not partial. Resubmission of a submittal shall reuse the same main submittal number.

1.13.2.c The BHS Contractor shall consider how documents are submitted. Submitting individual documents under individual submission numbers allow better tracking of the status of each submission rather than consolidating many non-related documents / drawings / subjects under the same submission number.

1.13.3 Owner Document Formatting Requirements

1.13.3.a The documents, reports, manuals, journals and the like submitted to the Owner for information, review, approval, or construction as part of this project shall contain the information defined below.

1.13.3.b Each document submitted shall be of a high quality and have been proofread by the BHS Contractor's manager responsible for that particular submission.

1.13.3.1 Cover Page

1.13.3.1.a Each document shall contain a front cover page detailing the contents of the document, project name, BHS Contractor's name and logo, date of submission, revision number, and other relevant information as defined by the Owner.

1.13.3.2 Revision History

1.13.3.2.a Each document shall contain a revision history table at the beginning of the document after the front cover page.

1.13.3.2.b The revision number shall be updated every time the document has been changed since the last submission.

1.13.3.2.c A summary of the changes made in the document shall be described in the revision history table. The detail changes made since the last submission shall clearly be identified using "track" changes in the document or a similar manner of mark-up.

1.13.3.3 Table of Contents

1.13.3.3.a Each document shall contain a table of contents at the beginning of the document after the revision history page.

1.13.3.4 Header

1.13.3.4.a Each document shall contain a document header, which is included on every page. The header shall contain the project name, document title, and contract number as minimum.

1.13.3.5 Footer

1.13.3.5.a Each document shall contain document footer, which is included on every page. The footer shall contain the document revision, date of preparation, page number and total number of pages as minimum.

1.13.3.6 Paragraph Numbering

1.13.3.6.a To assist with the document review process each chapter, section and paragraph of the document shall be clearly and uniquely numbered.

1.13.3.7 Language

1.13.3.7.a Each document shall be prepared in the language(s) applicable for this project.

1.13.3.7.b Any translation required shall be done by the BHS Contractor and submissions are not complete before translated documents are included with the original document.

1.13.4 Drawing Formatting Requirements

1.13.4.a The engineering drawings submitted to the Owner for information, review, approval, or construction as part of this project shall contain the information defined below.

1.13.4.b Any reproduction of Contract Drawings for submittal as BHS Contractor's drawings is prohibited. Drawings produced in such a manner will be rejected.

1.13.4.c Drawings shall follow local guidelines and industry standards. Drawings shall be prepared to a high standard of quality such as that set forth in MIL STD 100, ANSI Standard Drafting Manual Y14 or other equivalent Specification.

1.13.4.d The BHS Contractor shall use a drawing naming convention acceptable to the Owner. The convention shall allow identification of building, floor level, building sector, and layout/section/detail from the drawing number assigned.

1.13.4.e Drawings shall be submitted to the Owner in hard copy and electronic format. Hard copies shall be rolled and softcopies submitted on a USB memory stick.

1.13.4.f On each submitted drawing, include a blank space on each sheet, three inches by four inches, in the lower right corner, just above the title block, in which the Owner or the Designer of Record may indicate the action taken.

1.13.4.g The term drawings and drawing sheets shall be treated in the same manner and be considered equal in the following.

1.13.4.1 Title Block

1.13.4.1.a Each drawing shall include a title block and drawing frame to clearly show the extensions of the drawing.

1.13.4.1.b The appropriate paper size for the drawing frame in order to obtain the correct scale shall be included as part of the title block. Only standard paper sizes shall be used such as B, C, D, and E.

1.13.4.2 Project Details and Logos

1.13.4.2.a Each drawing shall include the logos and names of the companies involved in the project. The order and size of these shall be coordinated with the Owner.

1.13.4.2.b Each drawing sheet shall include the project name as defined in the Contract Documents.

1.13.4.3 Drawing Title

1.13.4.3.a Each drawing shall have a drawing title, which clearly describes the contents of the drawing. Drawing titles shall to the extent possible identify sub-system naming, building sections, floor levels, and/or PLC numbering.

1.13.4.4 Drawing Number

1.13.4.4.a Each drawing shall have a unique drawing number following a drawing numbering convention coordinated and approved by the Owner.

1.13.4.4.b When several sheets form part of the same drawing each sheet shall be uniquely identified and the total number of sheets for that drawing shall be clearly identified.

1.13.4.5 Revision Indicator

1.13.4.5.a Each submission of each drawing shall contain a revision number or letter.

1.13.4.5.b The revision number shall be updated every time a drawing has been changed since the last submission.

1.13.4.5.c Changes made in the drawing shall clearly be identified using "clouding" around the area of the

drawing that has been changed since the last submission.

1.13.4.6 Revision History

1.13.4.6.a Each drawing shall part of the title block contain a tabular list of revisions of that particular drawing. The list shall clearly identify each change made to the drawing and the particular revision the change was executed.

1.13.4.7 Electronic File Name

1.13.4.7.a The drawing shall include the file name of the electronic version of the drawing.

1.13.4.7.b When drawings are stored in folders and sub-folders the relevant path details shall be provided as part of the electronic file name.

1.13.4.8 Date

1.13.4.8.a Each drawing shall contain information specifying the date the drawing was completed. The date format used shall follow the Owner's convention.

1.13.4.9 Drawn/Prepared By

1.13.4.9.a Each drawing shall contain information specifying the person, who prepared the drawing for submission.

1.13.4.10 Approved By

1.13.4.10.a Each drawing shall contain information specifying the person, who reviewed and approved the drawing for submission.

1.13.4.11 Scale

1.13.4.11.a Drawings shall be to scale following industry standard drawing scales and the applied drawing scale shall clearly be identified as part of the drawing title block.

1.13.4.12 Parts List

1.13.4.12.a Drawings depicting assemblies and manufacturing details shall contain a parts list detailing the different parts and components included and their quantities.

1.13.4.13 North-South Direction

1.13.4.13.a Each drawing shall contain a clear indicator of true North direction.

1.13.4.14 Key Plan

1.13.4.14.a Each drawing shall contain a reduced size overview of the complete airport/terminal grounds with the project defined sector numbers.

1.13.4.14.b The specific sector, which the particular drawing covers, shall be identified using a hatching or other means of identification.

1.13.4.15 Grid Lines & References

1.13.4.15.a Each drawing shall include building grid lines and grid line balloons as defined by the Owner.

1.13.4.16 Floor Designation and Elevation

1.13.4.16.a Each drawing shall include a base elevation reference and floor designations for each floor level above base elevation.

1.13.4.17 Architectural Details & Other Trades

1.13.4.17.a Each layout, elevation and section drawing shall contain the relevant architectural details superimposed as part of the CBIS/BHS technical drawing such that it is possible to identify interferences with the building or other trades.

1.13.4.17.b Section and elevation drawings shall show vertical clearances between CBIS/BHS equipment and building structure and other trades.

1.13.4.17.c The architectural details and engineering details from other trades as part of coordination drawings shall use a line thickness and weight less than the CBIS/BHS details.

1.13.4.18 Equipment Identification

1.13.4.18.a Each equipment components and sub-systems shall be provided with unique identification according to the agreed naming convention.

1.13.4.19 3rd Angle Projection

1.13.4.19.a Detail drawings shall be prepared using 3rd angle projection when appropriate.

1.13.4.20 Line Types and Thicknesses

1.13.4.20.a Each drawing shall be plotted/printed using industry standard line thicknesses and line styles such that the drawings are easy to review.

1.13.4.21 Plotting

1.13.4.21.a Each drawing shall be submitted in the correct paper size such that the drawing scale is accurate.

1.13.4.21.b The use of colors which does not allow for black and white photocopying shall not be permitted, e.g. yellow. The use of color shall not justify the elimination of line weights and line thicknesses.

1.13.5 Submission Deliverables

1.13.5.1 General

1.13.5.1.a Submit drawings as required in as per Division 1 Section 01 33 00 for each conveyor system and all of its components, including layout, typical details of assembly, erection, and anchorage.

1.13.5.1.b Included in the drawings shall be the location, type and load of supports and lateral bracing; the location, dimensions and rating of drive units.

1.13.5.1.c Drawings shall identify each part in reference to a Bill of Materials which shall indicate each part name, number, description, quantity, size, gauge, model name and purchase number, component, and reference to detail part drawings or assembly drawing, if required for fabrication.

1.13.5.1.d Assemble drawings into coordinated submittals and all drawings shall be complete, orderly, and applicable to this installation only. Standard drawings properly referenced to assembly drawings are acceptable.

1.13.5.1.e Only drawings stamped with approval by the Owner's representative shall be used for fabrication and installation.

1.13.5.1.f All electronic submittals provided must be scanned for viruses as of the date the submittal is provided.

1.13.5.2 Documents

1.13.5.2.a Reports, documents, letters and the like prepared in a word processor program shall be provided to the Owner in MS Word 365 or 2019 format (.docx).

1.13.5.3 Spreadsheets

1.13.5.3.a Calculations, summaries, lists, reports and the like prepared in a spreadsheet program shall be provided to the Owner in MS Excel 365 or 2019 format (.xlsx).

1.13.5.3.b All spreadsheets shall be searchable, filterable, and sortable.

1.13.5.4 Presentations

1.13.5.4.a Presentations and the like prepared in a presentational program shall be provided to the Owner in MS PowerPoint 365 or 2019 format (.pptx)

1.13.5.5 Portable Document Format

1.13.5.5.a The BHS Contractor shall in addition to the original file format, provide the Owner with a Portable Document Format (PDF) file of each submission such that it is possible for the Owner to reproduce each submission identical to the original submission provided by the BHS Contractor.

1.13.5.5.b The creation of PDF shall be done directly from the original source document to PDF electronically. The use of scanning devices to created PDFs shall be avoided.

1.13.5.5.c The PDF file shall have security set to "No Security" and commenting, printing, adding photos, form fields and document signing must be allowed.

1.13.5.5.d PDF submittals shall be one continuous file. No external links are allowed.

1.13.5.5.e All individual components of submittals shall be bookmarked inside the PDF file.

1.13.5.5.f All individual components of submittals shall be oriented for ease of reading and legibility.

1.13.5.5.g Failure to comply with these requirements will result in a return of file to the BHS Contractor for

immediate revision.

1.13.5.5.h The PDF file will allow the Owner to provide review comments embedded in the PDF file, which can be returned to the BHS Contractor for his action.

1.13.5.5.i Documents, letters, calculations, and the like shall be prepared for printing to 8.5” x 11” paper size.

1.13.5.5.j Engineering drawings shall be prepared for printing to 22” x 34”.

1.13.5.6 Drawings

1.13.5.6.a The BHS Contractor shall perform the system design using full scale 3D CAD models that use a fixed, common reference point throughout the project as defined by the Owner. The 3D CAD model shall be built in AutoCAD and the model source file (DWG) shall be submitted to the Owner with every drawing submission and/or upon request.

1.13.5.6.b Typical stand-alone detail drawings can be 2D CAD files using AutoCAD. Such CAD files shall be provided in AutoCAD 2019 format (DWG).

1.13.5.6.c The layer structure, Revit Family structure and Building Information Management (BIM) requirements shall be coordinated with the Owner.

1.13.5.6.d The use of DWG or DXF format is not acceptable unless approved by the Owner in writing.

1.13.5.7 Schedules

1.13.5.7.a The construction schedule shall be provided to the Owner in MS Project format (.mpp).

1.13.5.7.b Schedules shall be printed using landscape and all activities shall be eligible with a minimum font size of Arial 8 pt. Schedules shall be printed with both activities, start date, finish date, duration, and Gantt chart with appropriate calendar unit. The Gantt chart shall as minimum be allocated half the page width.

1.13.5.8 Submission Quantities

Table 3 Submission Deliverables

	Hardcopy		Softcopy		
Document Type	**Qty**	**Paper Size**	**Qty**	**Paper Size**	**File Format**
Mechanical Drawings (AutoCAD)	3	22”x34”	1 1	22”x34” 11”x17”	DWG PDF
Mechanical Drawings (Other)	3	11”x17”	1 1	22”x34” 11”x17”	DWG PDF
Electrical GC Drawings (AutoCAD)	3	22”x34”	1 1	22”x34” 11”x17”	DWG PDF
Electrical CBIS/BHS Drawings (AutoCAD)	3	11”x17”	1 1	11”x17” 11”x17”	DWG PDF
Electrical Drawings (Other)	3	11”x17”	1 1	11”x17” 11”x17”	DWG PDF
Documents/Reports (MS Word)	3	8.5”x11”	1 1	8.5”x11” 8.5”x11”	DOC PDF
Calculations and Lists (MS Excel)	3	8.5”x11”	1 1	8.5”x11” 8.5”x11”	XLS PDF
Presentations (MS PowerPoint)	3	8.5”x11”	1 1	8.5”x11” 8.5”x11”	PPT PDF
Construction Schedule	3	11”x17”	1 1	11”x17” 11”x17”	MPP PDF
Catalogue Cuts	3	8.5”x11”	1	8.5”x11”	PDF

1.13.6 Owner Reviews

1.13.6.a The BHS Contractor shall address, update, and resubmit submissions within thirty (30) calendar days after receipt of review comments from the Owner as defined in the Division 1 General Conditions of Contract.

1.13.7 Deadlines for Submissions

1.13.7.a The following submission schedule indicates when submissions shall be made to the Owner at the latest.

Table 4 Submission Milestones

Description	Deadline	Details
Draft Construction Schedule with Critical Path	10 days after NTP.	Part 1 § 1.12
Construction Schedule narrative	10 days after NTP.	Part 1 § 1.12
Detailed Construction Schedule with Critical Path	Monthly until construction commences. Weekly once construction commences until Substantial Completion. Monthly once Substantial Completion is achieved until completion of all Works (includes punch-list, submittals, etc).	Part 1 § 1.12
Safety Plan	20 days after NTP.	Part 3 § 3.4
Draft controls Architecture	20 days after NTP.	Part 1 § 1.13.9.12
Power Distribution Design Data	20 days after NTP.	Part 1 § 1.13.9.12
MCP Construction Schedule	20 days after NTP.	Part 1 § 2.8.7
Phasing Plan	20 days after NTP.	Part 1 § 1.12.1.4
Quality Control Plan	20 days after NTP.	Part 3 § 3.1.2
Configuration Management Plan	20 days after NTP.	Part 3 § 3.1.12
Draft Functional Design Specification and Catalogue Cuts	20 days after NTP.	Part 1 § 1.13.9.12
Vibration Schedule	20 days after NTP.	Part 1 § 1.16.12
Equipment Naming Convention	30 days after NTP.	Part 1 § 1.17
Product Samples	30 days after NTP.	Part 1 § 1.13.9.27, 1.13.9.28, and 1.13.9.29
Final Functional Design Specification	30 days after NTP or prior to manufacturing MCP's.	Part 1 § 1.13.9.12
Draft Detail Design Specification (DDS)	45 days after NTP.	Part 1 § 1.13.9.13
Expected Drawing List (Updated lists)	20 days after NTP.	Part 1 § 1.13.8.4
Material Flow Diagram (MFD)	20 days after NTP.	Part 1 § 1.15.4
Power Source Diagram (3 phase and single phase)	20 days after NTP.	Part 1 § 1.13.9.24
Motor list	40 days after NTP.	Part 1 § 1.13.9.12
Power calculations and feeder sizes	40 days after NTP.	Part 1 § 1.13.9.24
Engineering Design Details	40 days after NTP.	Part 1 § 1.13.9
Structural/Support Drawings	40 days after NTP.	Part 1 § 1.13.9.4
Structural Steel Product Data	40 days after NTP.	Part 1 § 1.13.9.5
Mechanical Layouts	40 days after NTP.	Part 1 § 1.13.9.2
Mechanical Elevations & Sections	40 days after NTP.	Part 1 § 1.13.9.3
E-Stop Zoning Layout	40 days after NTP.	Part 2 § 2.7.4
E-Stop Location Layout	40 days after NTP.	Part 2 § 2.7.4
Cable Tray & Conduit Route/Layout	40 days after NTP.	Part 1 § 1.13.9.7
Typical Mechanical Installation Drawings	40 days after NTP.	Part 1 § 1.13.9.6
Typical Electrical Installation Drawings	40 days after NTP.	Part 1 § 1.13.9.8
Typical User/Operator Interface Drawings (HMI)	40 days after NTP.	Part 1 § 1.13.9.9
Control Station (Operator Panel) Drawings	40 days after NTP.	Part 1 § 1.13.9.11
Mechanical Installation Drawings	40 days after NTP.	Part 1 § 1.13.9.6
Electrical Installation Drawings	40 days after NTP.	Part 1 § 1.13.9.8
Electrical Device Layout	50 days after NTP.	Part 1 § 1.13.9.7
Certification of Installation Compliance	30 days after installation	

Description	Deadline	Details
Detailed controls Architecture	40 Days after NTP and prior to installation.	Part 1 § 1.13.9.12
Manufacturing & Shop Drawings	30 days prior to manufacturing.	Part 1 § 1.13.9.19
General purpose power outlet architecture (small power)	40 days after NTP.	Part 1 § 1.13.9.12
Paint chip samples	Prior to manufacturing.	Part 1 § **Error! Reference source not found.**
Electrical Schematics / Wiring Diagrams	30 days prior to installation.	Part 1 § 1.13.9.26
Post-Installation Checkout forms	60 days after NTP.	Part 3 § 3.25.1.d
System Acceptance Plan	60 Days after NTP and prior to installation.	Part 1 § 1.19.1.d
Test Procedures	60 days after NTP and prior to each test	Part 1 § 1.19
Test Data and Test Reports	7 days after each test.	Part 1 § 1.19
Noise plan	Prior to installation.	Part 1 § 1.13.9.25
Carousel In-fill support structure detailed design	Prior to installation.	Part 2 § **Error! Reference source not found.**
Training Schedule	30 days prior to training.	Part 3 § 3.27.2
Training Workbooks	30 days prior to training.	Part 1 § 1.13.13.1.c
Draft Operations and Maintenance Manual	Prior to commissioning.	Part 1 § 1.13.10
Spare Parts List	Prior to commissioning.	Part 1 § 1.13.12
Noise test results	Upon completion of Commissioning	Part 3 § **Error! Reference source not found.**
Vibration test results	Upon completion of Commissioning	Part 3 § **Error! Reference source not found.**
List of lubricants	30 days prior to Practical Completion	Part 1 § 1.13.9.20
Testing Schedule	30 days prior to commencement of testing.	Part 1 § 1.12.7
Certificate of Test Compliance	30 days after tests	Part 1 § 1.19.2.2
Training Material	Prior to System Acceptance Testing.	Part 1 § 1.13.13
Punch-list	Weekly during System Acceptance Testing, monthly after Final Acceptance or beneficial use whichever occurs first	Part 1 § 1.19.5.1
Training Attendance Register	On demand and at the completion of Training.	Part 3 § 3.27.2.i
Final Operations and Maintenance Manual	10 days prior to Practical Completion.	Part 1 § 1.13.10
Warranty Documentation	10 days prior to Substantial Completion.	Part 1 § 1.25
Operations and Installed Software	10 days prior to Practical Completion and as updated thereafter.	Part 1 § 1.13.14
As-built Documents	10 days prior to Substantial Completion.	Part 1 § 1.13.15
As-built Construction Schedule	10 days prior to Substantial Completion.	Part 1 § 1.12.9
Source Code	10 days prior to Practical Completion and as updated thereafter.	Part 1 § 1.13.14
Username and password access list.	At Practical Completion and as updated thereafter.	Part 3 § **Error! Reference source not found.**
Available free memory	At Substantial Completion.	Part 1 § 1.13.14.1.e

Description	Deadline	Details
Software Revision Control	On demand Monthly during System Acceptance Testing. Every 7 days after System Acceptance Testing until Final Completion and Acceptance. As modified during the Warranty periods.	Part 3 § 3.29
Operations monitoring report	3 days after the successful completion of the Start-up Support period.	Part 3 § 3.32.2.a below

1.13.8 Recurring Submittals

1.13.8.1 Progress Reports

1.13.8.1.a The BHS Contractor shall each week during the construction provide a detailed progress report, which shall include a description of the tasks performed in the reporting period along with the planned activities for the next two (2) reporting periods.

1.13.8.1.b The progress report shall include an accurately updated Construction Schedule showing percentage completion of each activity/line item.

1.13.8.1.c The progress report shall include information on staffing levels.

1.13.8.1.d The BHS Contractor shall submit the monthly progress report consisting of a written narrative and various construction schedule reports. This report will be reviewed in a meeting between the BHS Contractor and the Owner.

1.13.8.1.e The narrative report shall describe overall progress of the Works, provide a critical path analysis, discuss significant problems with proposed corrective action, and show the status of major changes and any other changes in sequence of the Works.

1.13.8.1.f The progress reports shall include tabular reports showing the status of resources and earned man-hours for completed and in progress Works items, and for Works items scheduled to start in the next thirty (30) days.

1.13.8.1.g The progress report shall describe coordination issues such as interface issues, engineering/design issues, ROW issues, staffing issues or any other issue identified during the reporting period, which needs to be addressed with the Owner.

1.13.8.1.h Construction photographs shall be submitted to the Owner monthly as part of the Progress Report.

1.13.8.2 Action Item List

1.13.8.2.a Throughout the execution of this contract the BHS Contractor shall maintain an electronic (searchable and filterable) Action Item List (AIL) detailing all observations, conflicts, interferences, deficiencies, non-conformities, defects or other items identified as issues that need the BHS Contractor's immediate action such that progress, quality, safety and contract conformance can be maintained.

1.13.8.2.b The Owner shall have the right to add items to the Action Item List. These shall be communicated to the BHS Contractor through progress meetings or general project correspondence.

1.13.8.2.c The BHS Contractor shall submit an accurate and up-to-date Action Item List (AIL) to the Owner as requested by the Owner and with each Progress Report.

1.13.8.2.d The BHS Contractor shall ensure that the Action Item List is completed and there are no outstanding items prior to commencement of System Acceptance Testing.

1.13.8.3 Software Revision Log

1.13.8.3.a The BHS Contractor shall maintain a software revision log, which shall be submitted to the Owner as part of each progress report from commencement of commissioning until completion of Warranty requirements.

1.13.8.4 Drawing List

1.13.8.4.a The BHS Contractor shall with each submittal containing drawings include a copy of the latest

Drawing List.

1.13.8.4.b The Drawing List shall besides the drawing name, number and revision include details on the Owner review status (1, 2, 3, 4 or 5) and resubmission dates.

1.13.8.5 Submittal Schedule

1.13.8.5.a The Submittal Schedule shall be related to the CPM schedule, shall identify all the submittals.

1.13.8.5.b The submittal schedule shall be updated every two (2) weeks by the BHS Contractor and submitted with the progress payment request.

1.13.8.6 Submission Log

1.13.8.6.a The BHS Contractor shall create and maintain a submission log, which shall allow tracking of each submission.

1.13.8.7 Software Log Submissions

1.13.8.7.a The BHS Contractor shall submit his software log as defined in Part 3 § 3.29

1.13.8.8 Shut-Down/Lock-out Look-ahead Schedule

1.13.8.8.a The BHS Contractor shall maintain an on-going one (1) week look-ahead schedule of shutdown/lockout requests. This look-ahead schedule shall be provided daily to the Owner and the airlines representatives.

1.13.9 Engineering Design Details

1.13.9.a The BHS Contractor shall prepare and submit documents describing the design, functionality, interfaces, operation, and maintenance of the baggage handling system for review and acceptance by the Owner.

1.13.9.b The BHS Contractor shall prepare and submit drawings detailing the baggage handling system design for review and acceptance by the Owner.

1.13.9.c The BHS Contractor shall comply with all requirements of the Contract Documents and shall in particular ensure that the design incorporate the Engineering Design Requirements defined in Part 1 § 1.16.

1.13.9.1 Professional Engineer (PE) Requirements

1.13.9.1.a The BHS Contractor shall at his own cost engage a Professional Engineer (PE) to design, review, verify and certify for compliance to all code and specification requirements for all CBIS/BHS required work including necessary temporary works and supports.

1.13.9.1.b The PE shall be licensed in the jurisdiction where the work is to be completed.

1.13.9.1.c The BHS Contractor shall submit any additional signed and sealed drawings, calculations and submissions required by local, state, or federal codes.

1.13.9.1.d As a minimum, the BHS Contractor shall provide the following drawings, calculations, and submissions signed, stamped, and sealed by a PE:

1.13.9.1.1 Mechanical/structural

1.13.9.1.1.a All structural attachment details for the BHS.

1.13.9.1.1.b All design computations for the BHS.

1.13.9.1.1.c All structural support details for the BHS.

1.13.9.1.1.d All structural support computations for the BHS.

1.13.9.1.1.e Structural drawings and computations of all structural attachment points to the building. Include imposed load on the building.

1.13.9.1.1.f Drawings detailing all structural attachment types and supports and the locations (generic details are not acceptable for this purpose).

1.13.9.1.2 Electrical

1.13.9.1.2.a All new and modified BHS PDPs.

1.13.9.1.2.b All MCP connected load calculations.

1.13.9.1.e Provide all PE signed and sealed documents in two separate submittals “For Construction” and

Final “As-Built”.

1.13.9.d All system design layouts and sections shall be derived from the BHS Contractor’s full scale 3D CAD model of the complete Works to ensure design accuracy such that interferences are identified, and prober coordination can be performed. The drawings shall contain sufficient detail to accurately depict the design including, but not limited, to the following.

1.13.9.e Detail drawings such as structural support drawings, mechanical and electrical installation drawings and some electrical layouts can be 2D drawings when such details are not included in the full scale 3D CAD model.

1.13.9.2 General Arrangements / Layouts (Plan Views)

1.13.9.2.a Mechanical general arrangement isometric drawings

1.13.9.2.b Mechanical general arrangement layout of the system including equipment segmentation.

1.13.9.2.c Positioning of motors.

1.13.9.2.d Positioning and maintenance access envelope for provision of future screening machine.

1.13.9.2.e Location of maintenance platforms, stairs, ladders, crossovers, etc. (as applicable).

1.13.9.2.f Position of impact protection and bollards

1.13.9.2.g Location, positioning, and access to MCP’s.

1.13.9.2.h Maintenance access and escape routes

1.13.9.2.i Operator access and escape routes

1.13.9.2.j Drawings shall include conveyor nomenclature, speed, direction of baggage travel and TOB reference at all changes in elevation as a minimum requirement.

1.13.9.2.k For stacked equipment on top of each other (e.g. double or triple stacked) the BHS Contractors shall develop methodology to easily identify the direction of baggage flow, TOB elevation, speed, nomenclature of each layer of equipment.

1.13.9.2.l A building overlay shall be attached to show in general terms walls, doors, columns, and other structural members.

1.13.9.2.m Drawing showing locations and type of safety signage

1.13.9.3 Elevations and Sections

1.13.9.3.a Provide elevation and/or section of each conveyor line.

1.13.9.3.b Show the baggage clearance envelope and clear height for personnel.

1.13.9.3.c Include angle of all components, which have changes in elevation including conveyors, stairs, etc.

1.13.9.3.d Device clearances to fixed items (floors, beams) for equipment requiring maintenance including conveyors, doors, diverters, vertical sorters (as applicable), etc.

1.13.9.4 Structural/Support Drawings

1.13.9.4.a All structural drawings shall be approved by a licensed and registered Professional Engineer (PE) acceptable to the Owner.

1.13.9.4.b Provide details of loading on the building and the type of attachment anchor device used.

1.13.9.4.c Provide loading of individual attachments.

1.13.9.4.d Floor support attachments.

1.13.9.4.e Vibration isolation attachments and project references for the vibration isolation type proposed.

1.13.9.5 Structural Steel Product Data

1.13.9.5.a Structural steel including certified copies of mill reports covering chemical and physical properties

1.13.9.5.b High-strength bolts including nuts and washers

1.13.9.5.c Structure steel primer paint

1.13.9.5.d Shrinkage-resistant grout

1.13.9.5.e Welding electrodes

1.13.9.5.f Fully traceable certificates of compliance with ASTM

1.13.9.6 Typical Mechanical Installation Details

1.13.9.6.a Guardrails/Impact Protection

1.13.9.6.b Bracketry including attachment/adjustment details.

1.13.9.6.c Hatches and/or panels required in adjacent walls/structures for maintenance access.

1.13.9.6.d Conveyor infill/structure.

1.13.9.6.e Stairs, ladders, crossovers, safety gates, etc.

1.13.9.6.f Sway bracing.

1.13.9.6.g Conveyor side guard cutouts as applicable for maintenance access (crossovers, removable guards), operations access to get to scanners.

1.13.9.6.h Power turns

1.13.9.6.i Queues

1.13.9.6.j Stainless steel cladding details in public view

1.13.9.7 Electrical Layouts

1.13.9.7.a E-stop zoning layouts showing the sub-systems uniquely shaded and color coded based on the given E-stop zone. The layout shall show interlocks between zones and location of E-stop push buttons and lanyards. The E-stop zoning shall be superimposed onto the system design model.

1.13.9.7.b Electrical device layout showing placement of electrical hardware including but not limited to PEC, shaft encoders, limit switches, safety disconnect switches, control stations, beacons, horns, motors superimposed onto the system design model.

1.13.9.7.c Drawings shall include electrical hardware nomenclature, bag tracking details, encoder locations as a minimum requirement.

1.13.9.7.d PLC control system in block diagram format including data communication between all PLCs, servers, and remote I/O units.

1.13.9.7.e Wire way / Cable tray route layout

1.13.9.7.f Server / Computer / peripheral hardware rack layout drawings

1.13.9.7.g Operator stop layout and locations

1.13.9.7.h Control Station layouts

1.13.9.7.i MCP and power panel layouts

1.13.9.7.j Power source distribution (single line schematic for three (3) phase and single phase power)

1.13.9.7.k Drawing showing locations and type of safety signage

1.13.9.8 Typical Electrical Installation Drawings

1.13.9.8.a Wire way/cable tray position in relation to mechanical equipment and steel works.

1.13.9.8.b MCP and field power distribution panels in relation to mechanical equipment and steel works.

1.13.9.8.c Metal conduit installation

1.13.9.8.d PEC and shaft encoder installation

1.13.9.8.e Soft Starter and VFD installation

1.13.9.8.f Disconnector installation

1.13.9.8.g Control Station installation

1.13.9.8.h E-stop lanyard and push button installation

1.13.9.9 Typical User/Operator Interface Drawings (HMI)

1.13.9.9.a Provide detailed HMI operator interface drawings showing relevant ergonomic details such as

loading heights, work space, clear heights, location of control stations, E-stops, and lanyards for the following minimum locations.

1.13.9.9.b All HMI operator interface drawings shall be coordinated with other trades including but not limited to building lighting, sprinkler systems, fire, drainage, and building architecture.

1.13.9.9.c All HMI operator interface drawings shall be derived from the BHS Contractor's full scale 3D CAD model and be prepared in 3rd angle projection with dimensions relevant for the ergonomics of the design.

1.13.9.9.1 Minimum HMI Interfaces

1.13.9.9.1.a Ticketing conveyor

1.13.9.9.1.b Make-up laterals

1.13.9.9.1.c Claim devices / carousels

1.13.9.10 Motor Control Panel (MCP) Drawings

1.13.9.10.a Provide MCP layouts depicting enclosure size, the type of device utilized, their color, labeling, power requirements, enclosure component general arrangement, and respective placement.

1.13.9.10.b Provide detailed diagram representing the internal layout of all components within each power panel.

1.13.9.10.c Provide details of PLC installation and details of touch screen status monitors.

1.13.9.10.d Provide details of I/O list for each PLC and identify I/O assignments with equipment item numbers.

1.13.9.11 Control Station (Operator Panel) Drawings

1.13.9.11.a Provide control station layouts depicting the type of device utilized, their color, labeling, and respective placement.

1.13.9.12 Functional Design Specification (FDS)

1.13.9.12.a The Functional Design Specification (FDS) shall describe how each part of the system works, shall describe the high-level design, system architecture, controls, system monitoring, performance levels and the physical, functional, and operational interfaces.

1.13.9.12.b A functional description of each system element shall be provided.

1.13.9.12.c The FDS shall be written for an intended audience who are familiar with the technical aspects of sophisticated control systems.

1.13.9.12.d The FDS shall be broken down into distinct areas for ease of reading, including but not limited to the following list;

1.13.9.12.1 Chapters of the FDS

1.13.9.12.1.a Ticketing area.

1.13.9.12.1.b Provision for screening sub-system and CBRA operation.

1.13.9.12.1.c Make-up area.

1.13.9.12.1.d Inbound sub-system.

1.13.9.12.1.e LLC system (hardware, functions)

1.13.9.12.1.f E-stop (hardware, functions, interlock, safety)

1.13.9.12.1.g SCADA (Visualization/Dialogues)

1.13.9.12.1.h Information reporting.

1.13.9.12.1.i User Management and User Rights

1.13.9.12.e The FDS shall cover all operational procedures (e.g. start/stop/shut-down, jam rest, E-stop reset, operational stop, maintenance call and security processes as appropriate)

1.13.9.12.f The FDS shall cover all fallback operations and procedures.

1.13.9.12.g As part of the FDS design review process the BHS Contractor shall submit catalogue cuts for the Owner's review and approval. Catalogue cuts shall be provided for all parts and components, which cannot be provided as a sample.

1.13.9.12.h The catalogue cuts must be completely legible and have the specific items used in the system highlighted for easy identification by the reader. The BHS Contractor shall provide catalogue cuts in both hardcopy and softcopy.

1.13.9.13 Detail Design Specification (DDS)

1.13.9.13.a The BHS Contractor shall develop a Detailed Design Specification for each element of the system which provides detailed functional and performance information from an operational point of view.

1.13.9.13.b The DDS shall describe the computer system and details of all man-machine interfaces together with predicted response times for computing command and control of the complete system.

1.13.9.14 Software Design Specification (SDS)

1.13.9.14.a The SDS shall describe the content and structure of the software from the highest to lowest levels (modules). The SDS shall use diagrams to describe data flows and relationships.

1.13.9.15 Test Plan

1.13.9.15.a The BHD Contractor shall produce a Test Plan which sets out the overall approach, structure, and schedule for testing. The objective of the Test Plan shall be to demonstrate that the requirements have been met for the corresponding design phase as described in the project lifecycle. The Plan shall identify roles and responsibilities for testing plus methods, environments, locations, and resources.

1.13.9.16 Test Specifications

1.13.9.16.a A specification shall be produced for each test to be conducted and each test shall reference the design item within the design documentation which is being tested. The specification shall describe the test to be performed, the test configuration and expected outcome.

1.13.9.17 Test Reports

1.13.9.17.a The BHS Contractor shall prepare a test report for each test conducted. The report shall list the results, metrics, any unexpected issues, and non-conformances and shall identify any follow-up actions required with timescales.

1.13.9.18 Verification Reports

1.13.9.18.a At the completion of each stage in the design the BHS Contractor is required to produce a verification report to verify that the output of the phase meets the requirements of the previous phase. The verification process shall enable tracking of requirements through each design phase to ensure full traceability and continuity.

1.13.9.19 Manufacturing & Shop Drawings

1.13.9.19.a Provide Manufacturing & Shop Drawings prior to manufacturing

1.13.9.20 List of Lubricants

1.13.9.20.a Provide details of recommended lubricants.

1.13.9.21 External Interfaces

1.13.9.21.a Provide detail drawings showing all interfaces between the CBIS/BHS and external systems. Such drawing shall include connection type, communication protocol, software protocol, transmission media, location of connections, and other required information.

1.13.9.22 General Purpose Power Outlet Architecture

1.13.9.22.a The BHS Contractor shall provide to the Owner for review and approval an architecture drawing detailing the locations of general-purpose outlets for maintenance purposes. All general purpose power outlets for maintenance shall be identified.

1.13.9.23 Equipment Powered by BHS Power Outlets

1.13.9.23.a The BHS Contractor shall provide to the Owner for review and approval an architecture drawing detailing the locations of dedicated power outlets required to operate the CBIS/BHS equipment.

1.13.9.23.b Drawings identifying outlets/quantity in relation to the conveyors and/or rooms that the equipment is located shall be sufficient.

1.13.9.23.c Identify circuits, their IDs, quantity, and power draw for each circuit.

1.13.9.24 Power Distribution

1.13.9.24.a The BHS Contractor shall finalize his power loads to each sub-system and verify the feeder sizes

shown on the Contract Drawings for review and approval of the Owner.

1.13.9.24.b The BHS Contractor shall submit power-distribution design data and calculations indicating the total connected load and greatest demand on the power supply.

1.13.9.24.c Provide a power source diagram based on the material flow diagram showing the redundancy incorporated into the design through the use of the power sources.

1.13.9.25 Noise Plan

1.13.9.25.a A noise measurement plan and Specification shall be submitted by the BHS Contractor for review and approval by the Owner.

1.13.9.25.b The plan shall detail what methods and procedures the BHS Contractor shall employ when working in close proximity to other persons, to ensure that noise levels as a result of construction/installation Works performed by the BHS Contractor and/or their sub-contractors are acceptable and within applicable safe guidelines.

1.13.9.25.c Special attention shall be given to methods/procedures when working adjacent to occupied areas.

1.13.9.25.d The Noise Plan shall also identify how and when the BHS Contractor will demonstrate to the Owner that the provided equipment operates within the specified noise levels.

1.13.9.26 Wiring Schematics

1.13.9.26.a The BHS Contractor shall submit his electrical wiring diagrams in AutoCAD file format. The preparation of such wiring diagrams shall be done using a dedicated electrical software program such as E-Plan or similar as accepted by the Owner in order to ensure a high design quality.

1.13.9.27 Mechanical Product Samples

1.13.9.27.a As part of the design review process the BHS Contractor shall submit the following mechanical product samples for the Owner's review and approval. The BHS Contractor shall provide three (3) samples of low-cost items, while it is accepted that a single sample is provided for high-cost items.

1.13.9.28 Electrical Product Samples

1.13.9.28.a As part of the design review process the BHS Contractor shall submit the following electrical product samples for the Owner's review and approval. The BHS Contractor shall provide three (3) samples of low-cost items, while it is accepted that a single sample is provided for high-cost items.

1.13.9.29 LLC Product Samples

1.13.9.29.a As part of the design review process the BHS Contractor shall submit the following LLC product samples for the Owner's review and approval. The BHS Contractor shall provide three (3) samples of low-cost items, while it is accepted that a single sample is provided for high-cost items.

1.13.10 Operating & Maintenance Manuals

1.13.10.1 General

1.13.10.1.a The purpose of the O&M Manuals is to provide operational and maintenance personnel with a thorough understanding of the complete system. This includes the layout, functionality, special features, contingencies, operational requirements, maintenance requirements, spare parts, warranty information, and safety information.

1.13.10.1.b The manuals shall include graphics/pictures/illustrations when possible, to ease the comprehension of the O&M Manual.

1.13.10.1.c The BHS Contractor may submit his standard O&M Manual provided such standard documentation provides the information required and documents are suitable for the purpose. The BHS Contractor shall submit a draft version of the proposed O&M Manuals for the review and approval of the Owner. The Owner shall indicate his approval or any comments related thereto and return the draft to the BHS Contractor.

1.13.10.1.d The O&M manual shall be divided into two (2) main sections; Operating Instructions and Maintenance Instructions.

1.13.10.1.e Each of these sections shall be sub-divided into logical volumes and sections separated by page dividers with properly labeled margin tabs.

1.13.10.2 Formatting Requirements

1.13.10.2.1 General Copies

1.13.10.2.1.a The BHS Contractor shall prepare an original and the number of copies/sets of the manuals, clearly marking each one as: "ORIGINAL", "COPY NO. 1", "COPY NO. 2", etc., as appropriate.

1.13.10.2.2 Quantities

1.13.10.2.2.a For the draft O&M Manuals the BHS Contractor shall submit two (2) hardcopies and two (2) softcopies.

1.13.10.2.2.b For the final O&M Manuals the BHS Contractor shall submit six (6) hardcopies (one (1) original and five (5) copies) and three (3) softcopies of their manual including drawings, appendences and supporting documentation.

1.13.10.2.3 Softcopy

1.13.10.2.3.a The electronic file version and the hard copy version must be identical.

1.13.10.2.3.b File names and folder structure shall follow the same structure as the hardcopy, i.e., file names shall be numbered following the chapter numbers and folders for each volume shall be maintained.

1.13.10.2.3.c Provide softcopy in both PDF and the original source files such as Word, Excel, PowerPoint, Vision and AutoCAD.

1.13.10.2.3.d The softcopy shall be provided on a USB memory stick clearly marked with the project and details of the proposal.

1.13.10.3 Operating Instructions

1.13.10.3.a The operating instructions shall describe how personnel shall operate the system in a safe and efficient manner. The descriptions shall cover normal operations, special circumstances, fallback, and contingency operation.

1.13.10.3.b The contents of the manual shall be easy to understand for personnel not familiar with the system and provide sufficient detail and explanation to make such personnel able to operate the system upon reading the operating instructions.

1.13.10.4 Maintenance Instructions

1.13.10.4.a The maintenance instructions shall describe how personnel shall maintain the system in a safe and efficient manner. The descriptions shall cover routine inspections, servicing activities, scheduled maintenance and break-down repair activities, and typical trouble shooting.

1.13.10.4.b The contents of the manual shall be easy to understand for personnel not familiar with the system and provide sufficient detail and explanation to make such personnel able to maintain the system upon reading the operating instructions.

1.13.10.4.c Provide maintenance schedules and procedures.

1.13.10.4.0.a Lubrication details including frequency and type of lubricant (recommended supplier).

1.13.10.4.0.b Maintenance schedule for all components in the CBIS/BHS identifying frequency grouped by the following disciplines;

1.13.10.4.1 OEM Literature

1.13.10.4.1.a Include brand specific OEM manufacturer’s literature, sources of purchase and similar information including, but not limited to the following;

1.13.10.4.2 As-Built Drawings

1.13.10.4.2.a Exploded view isometric drawings, diagrams and photographs shall be provided in addition to step-by-step disassembly and assembly instructions.

1.13.10.4.2.b Illustrated parts detailing graphically (exploded views) and numerically (quantity, suppliers part number, etc.) the components in each major assembly.

1.13.10.4.2.c Provide a full set of the As-built drawings.

1.13.10.4.3 Spare Parts List

1.13.10.4.3.a Final Spare Parts List

1.13.10.4.d Provide troubleshooting and fault isolation procedures.

1.13.10.4.4 Troubleshooting Content

1.13.10.4.4.a The troubleshooting guides shall be provided in a chart format, where personnel can identify the trouble experienced, it probable cause and associated corrective action.

1.13.10.4.e Provide name, address, telephone numbers, fax numbers, email, cell phone numbers of the BHS Contractor, suppliers, installers along with manufacturers nearest representatives.

1.13.10.4.f Provide copies of guarantees and warranties issued to, and executed in the name of, the Owner. Provide details of warranty period and procedures for return faulty items under warranty.

1.13.10.4.g Provide empirical reading results of the acceptance testing as a reference for maintenance personnel.

1.13.10.4.h Provide inspection and adjustment procedures.

1.13.10.4.i Provide pre-operating procedure.

1.13.10.4.j Provide start-up and shut-down procedures.

1.13.10.4.k Provide equipment lock-out and tag-out procedure.

1.13.10.4.l Provide removal, disassembly, re-assembly, and installation procedures. Such information shall be brand specific for the equipment used.

1.13.10.4.m Provide test procedures to verify the adequacy of repairs.

1.13.10.4.n Provide calibration procedures.

1.13.10.4.o Provide details of where measurements are to be made.

1.13.10.4.p Provide list of special tools and test equipment required for the operation, maintenance, adjustment, testing and repair of the equipment, instruments, and components.

1.13.10.4.q Provide scale and corrosion control procedures.

1.13.10.4.r Provide torque values, belt and drive chain tensioning procedures and values.

1.13.10.4.s Provide component lists for all major equipment components.

1.13.11 Periodic Maintenance Inspection and Lubrication Chart

1.13.11.a The BHS Contractor shall besides the O&M Manuals provide a standalone master chart or series of charts illustrating the recommended periodic maintenance inspections, lubrications, and component replacements.

1.13.11.b The chart(s) shall contain cross-references to the O&M Manual for the specific detail procedures.

1.13.12 Spare Parts List

1.13.12.a The BHS Contractor shall present a proposed list of spare parts for the CBIS/BHS for review by the Owner.

1.13.12.b The list shall include all components and parts both for mechanical, electrical and control items, which are subject to wear and tear and/or failure. The spare parts list shall also include any type of consumables such as oil, oil pads, CBRA swipes, and so on.

1.13.12.c The list shall be arranged in separate divisions based on the necessary spare parts to support the CBIS/BHS for the following periods:

1.13.12.1 Divisions of Spare Parts List

1.13.12.1.a Spares needed for the BHS Contractor’s Warranty Period.

1.13.12.1.b Spares needed for the first five (5) years of operation of the system.

1.13.12.d Each division of the list shall be separated into two (2) sections; Proprietary parts manufactured by the BHS Contractor and parts supplied by OEM suppliers.

1.13.12.e The list shall be categorized by the following sub-sections. Provide summary totals for each section, division, and a grand total for the entire list.

1.13.12.1.1 Spare Part Categorization

1.13.12.1.1.a Mechanical components.

1.13.12.1.1.b Electrical components.

1.13.12.1.1.c Control components (LLC)

1.13.12.1.1.d Miscellaneous (any other items that do not fit into the above categories).

1.13.12.f As a minimum, the list shall include the following information for all sections, categories, divisions and all parts;

1.13.12.2 Contents of Spare Parts List

1.13.12.2.a Part category

1.13.12.2.b Description of part/component.

1.13.12.2.c Part number

1.13.12.2.d Unit price, current for a minimum period of twelve (12) months after Final Acceptance.

1.13.12.2.e Recommended stock levels

1.13.12.2.f Minimum stock levels

1.13.12.2.g Line-item total price (unit price multiplied by the recommended quantity).

1.13.12.2.h Maximum delivery time (lead time)

1.13.12.2.i Maximum repair time

1.13.12.2.j Total quantity of type installed in the CBIS/BHS by the BHS Contractor (feet /pieces)

1.13.12.2.k Storage area required for the part (ft^3)

1.13.12.2.l Type: Consumable or wear/tear part

1.13.12.2.m Classification: Component, part, or assembly

1.13.12.2.n OEM Manufacturer name

1.13.12.2.o OEM Manufacturers part number

1.13.12.3 OEM Manufacturer Details

1.13.12.3.a Address

1.13.12.3.b Phone number

1.13.12.3.c Contact person.

1.13.13 Training Material

1.13.13.a Refer to Part 3 § 3.27 below for execution requirement related to training.

1.13.13.b Submit training material for review and approval by the Owner.

1.13.13.c Schedule detailing each discipline, date of training, start and end times.

1.13.13.d Reference material.

1.13.13.e Personal operations workbook.

1.13.13.f Reference material shall include all manuals relating to any equipment and or operation being trained on, including but not limited to the following;

1.13.13.1 Reference Material

1.13.13.1.a Operations and maintenance manual.

1.13.13.1.b Detailed drawings included exploded views.

1.13.13.1.c Operations workbook.

1.13.13.g A workbook shall be provided to each person being trained.

1.13.13.h Workbooks shall include exercises detailing the exact operation/functions required to complete a task (e.g. clearing a Jam).

1.13.13.i Pictures/photographs of a typical installation shall be included (jam operator station).

1.13.14 Operations Software

1.13.14.a Source code for all software that was custom designed/built or customized for the project shall be provided to the Owner.

1.13.14.b The BHS Contractor shall submit to the Owner ten (10) days prior to Practical Completion of the system and/or ten (10) days prior to Final Completion and Acceptance by the Owner whichever occurs first, the following items;

1.13.14.1 Source Code Supply

1.13.14.1.a PLC programming software installed on a User workstation and/or other platform under direction from the Owner.

1.13.14.1.b SCADA development software installed on a User workstation and/or other platform under direction from the Owner.

1.13.14.1.c All current PLC, SCADA, and HLC source code in electronic format, installed on storage media under direction from the Owner.

1.13.14.1.d All third-party programming software required to program any customized third-party devices on a User workstation and/or other platform under direction from the Owner.

1.13.14.1.e Documentation verifying available free memory and PLC scan times in each PLC in accordance with requirements detailed elsewhere in this Specification (refer to Part 1 § 1.14.5.1 below for specific requirements).

1.13.14.c The Owner shall have the right to use the provided source code in any way or form to support to operation and maintenance of the system.

1.13.14.d Installation media for all software installed in the CBIS/BHS by the BHS Contractor, including but not limited to the following;

1.13.14.2 Installation Media

1.13.14.2.a Operating systems.

1.13.14.2.b Licenses.

1.13.14.2.c Service packs.

1.13.14.2.d Patches.

1.13.14.2.e Applications.

1.13.15 As-Built Documentation

1.13.15.a The As-Built Documentation shall as a minimum include the following.

Table 5 Overview of As-Built Documentation Deliverables

	Hardcopy		Softcopy		
Document Type	**Qty**	**Paper Size**	**Qty**	**Paper Size**	**File Format**
Mechanical Drawings (AutoCAD)	2	22”x34”	3 3	22”x34” 11”x17”	DWG PDF
Electrical Drawings (AutoCAD)	3	22”x34”	3 3	22”x34” 11”x17”	DWG PDF
Electrical Drawings (Other)	3	11”x17”	3 3	11”x17” 11”x17”	DWG PDF
Network Diagram	3	11”x17”	3 3	11”x17” 11”x17”	DWG PDF
Documents (MS Word)	3	8.5”x11”	3 3	8.5”x11” 8.5”x11”	DOC PDF
Final Functional Design Specification (FDS)	3	8.5”x11”	3 3	8.5”x11” 8.5”x11”	DOC PDF
Final Detail Design Specification (DDS)	3	8.5”x11”	3 3	8.5”x11” 8.5”x11”	DOC PDF
Calculations (MS Excel)	3	8.5”x11”	3 3	8.5”x11” 8.5”x11”	XLS PDF

	Hardcopy		Softcopy		
Document Type	**Qty**	**Paper Size**	**Qty**	**Paper Size**	**File Format**
Power Demand	3	8.5”x11”	3 3	8.5”x11” 8.5”x11”	XLS PDF
Presentations (MS PowerPoint)	3	8.5”x11”	3 3	8.5”x11” 8.5”x11”	PPT PDF
Final Construction Schedule	4	11”x17”	4 4	11”x17” 11”x17”	MPP PDF
PLC Program (including ladder logic)	2	8.5”x11”	2 2	N/A 8.5”x11”	Code PDF
SCADA and HLC Programs	0	N/A	2	N/A	Code
Software Licenses	1	N/A	1 1	original copy	
Source Code for all software that was custom designed/built or customized for the project.	N/A	N/A	2	Code	

1.13.15.b All As-Built drawings shall be stamped by a licensed and registered Professional Engineer (PE) acceptable to the Owner.

1.14 GENERAL REQUIREMENTS (NON-FUNCTIONAL REQUIREMENTS)

1.14.1 Safety Aspects

1.14.1.1 General

1.14.1.1.a The BHS Contractor shall be responsible for all aspects of jobsite safety. The Owner does not have any responsibility or risk for means and methods used by the BHS Contractor for performing the Works.

1.14.1.1.b A Safety Plan shall be submitted and approved prior to commencing any Works on-site as per “Division 1, Section 01110 Construction Safety” in addition to the requirements listed herein.

1.14.1.1.c The BHS Contractor shall through his design use mechanical, electrical and control methods to provide the highest level of safety for operations and maintenance personnel and minimize the potential damage to equipment and baggage.

1.14.1.2 System Safety

1.14.1.2.a The BHS Contractor shall guarantee that the System and its components satisfy all legal safety requirements.

1.14.1.2.b The system shall be provided with failsafe techniques to prevent unsafe conditions.

1.14.1.3 Personnel Safety

1.14.1.3.a All safety measures must protect the working staff of the CBIS/BHS from injuries. This includes work platforms, tug & dolly operation, guardrails/impact-protection as well as all other areas of the CBIS/BHS where only maintenance staff has access and is working.

1.14.1.3.b All safety measures must be in accordance with and follow federal as well as local OSHA and/or other safety regulations. The BHS Contractor is fully responsible to investigate and incorporate into their design any additional safety features and/or requirements which may be required by the local authority and/or the Owner.

1.14.1.3.c The system shall be easy and simply to use to minimize the risk of personnel injury due to operational errors. The system shall be provided with emergency system shutdown (E-stop).

1.14.1.3.d Equipment shall be provided with lock-out/tag-out capabilities.

1.14.1.3.e All moving parts shall be provided with protective guarding.

1.14.1.3.f The system shall be provided with protection against falling objects in all work areas, drive aisles and maintenance access areas located below CBIS/BHS equipment.

1.14.1.3.1 Access Routes

1.14.1.3.1.a The BHS Contractor shall provide Personnel Access Route drawings for each discipline listed

below showing the normal personnel access routes to be used. Separate drawings shall be provided as coordinated with the Owner.

1.14.1.3.1.b The provisional access route for TSA personnel shall be as direct and non-obstructive as possible and have a minimum clear height of 7' .

1.14.1.3.2 Escape Routes

1.14.1.3.2.a The BHS Contractor shall develop and submit an Escape Route Concept. This concept shall be submitted to the Owner for approval.

1.14.1.3.2.b The maximum length of escape routes from non-manned areas anywhere in the CBIS/BHS to the nearest building escape path, corridor or door shall be less than 130 ft .

1.14.1.3.2.c The maximum length of escape routes from manned areas in the CBIS/BHS to the nearest building escape path, corridor or door shall be less than 65 ft or as defined by the Owner depending on the number of people in the area. This requirement also applies to the EDS screening machines, which may at times be manned.

1.14.1.3.2.d The Escape Route Concept shall include detailed drawings (in plan view and elevation sections) such that it is possible for the Owner and relevant authorities to review the concept proposed. The BHS Contractor shall ensure that an agreement has been reached with the Owner and the responsible authorities prior to the start of installation.

1.14.1.4 Warning Devices

1.14.1.4.a Audible and visual warning shall operate along the length of the CBIS/BHS equipment lines and at each MCP for a default configurable time (typically eight (8) seconds) prior to the starting or re-starting following a fault condition (any reason) of any sub-system equipment.

1.14.1.4.b Such audible and visual warnings shall be spaced no further than 50 ft apart or as required per line of sight.

1.14.1.4.c In public areas, the location and quantity of the warning devices shall be coordinated with and approved by the Owner.

1.14.1.5 Warning Labels

1.14.1.5.a Labels in accordance with OSHA requirements shall be installed in the CBIS/BHS area in clear view of any actual and/or potential hazards. Labels shall be installed at both sides of equipment visible to maintenance and operational personnel. Labels shall include but not be limited to;

1.14.1.5.1 Minimum Warning Labels

1.14.1.5.1.a Automatic operation of equipment by safety codes.

1.14.1.5.1.b Nip and/or catch points.

1.14.1.5.1.c Head knockers.

1.14.1.5.1.d Electrical hazards.

1.14.1.5.1.e Exposure to radiation (laser, x-rays and/or other).

1.14.1.5.1.f Authorized Personnel Access Only

1.14.1.5.b Labels shall be oil resistant and properly attached to the CBIS/BHS equipment such that they remain in view, and do not peel and/or fall off.

1.14.1.5.2 Public View Warning Labels

1.14.1.5.2.a Warning labels and signage for public areas shall be coordinated with the Owner. Dimensions, engraved/sticker type, material, font, and wording shall be approved by the Owner.

1.14.1.6 Floor Markings

1.14.1.6.a Color coded floor markings shall be provided to assist personnel to the manned areas of the BHS. Provide unique coding for the following work areas;

1.14.1.6.1 Floor Markings Classifications

1.14.1.6.1.a Make-up/Claims work area and cart staging

1.14.1.6.b Floor markings shall be oil resistant, non-slip, durable and visible under low light conditions. Markings shall be provided on building floor as well as steel works (platforms, catwalks, and stairs) provided under this Contract.

1.14.2 Service-Proven Technology

1.14.2.1 General

1.14.2.1.a The system technology chosen for the components shall be reliable and proven equipment.

1.14.2.1.b The use of prototype components and the inherent risk of such must be excluded.

1.14.3 Life Expectancy

1.14.3.a The system shall have a life expectancy of minimum twenty (20) years with the herein defined system availability. It must be guaranteed that the appropriate application of low levels of routine servicing and maintenance will ensure the specified service life for the entire system.

1.14.3.b The BHS Contractor shall ensure that mechanical and electrical components and the installed control system will be available and also expandable during the service life of the system.

1.14.3.c The service life of computer equipment such as Hard Drives, monitors, CPU, graphic cards shall be ten (10) years except auxiliary equipment such as keyboards and mouse, which are exempt from an expected service life beyond normal warranty.

1.14.3.d The BHS Contractor shall ensure that the control system, PCs, and processors, allow full forward or backwards compatibility for updates on hardware and software over time.

1.14.3.e Individual components shall have a minimum life of fifty thousand (50,000) hrs. or six (6) years of operations, whichever occurs first based on an approved maintenance cycle of no more than three (3) months unless an alternative maintenance cycle is specified in the Maintenance Manual and brought to the attention of the Owner at time of proposal.

1.14.3.f The BHS Contractor shall guarantee that all components used for HLC equipment will be available for ten (10) years and all LLC components will be available for twenty (20) years. If the BHS Contractor cannot comply with this condition, then they must indicate alternative sources of supply. The functionality and compatibility of spare parts from an alternate source of supply must be guaranteed by the BHS Contractor.

1.14.4 System Architecture

1.14.4.a The CBIS/BHS must be of modular construction, i.e., the whole CBIS/BHS must consist of various functional areas each assembled from functional modules.

1.14.4.b Each functional area or module always carries out the same functional task. The required modularity refers not only to mechanical CBIS/BHS components, but also to the associated hardware and software. Functional areas include but are not limited to the following:

1.14.4.c Identical modules must be designed the same, for examples separate CBRA areas must be designed with the same basic design and functionality.

1.14.5 Expandability and Flexibility

1.14.5.a The mechanical, electrical/power, control and computer systems must be designed in such a manner that they can be easily expanded and reconfigured in the future without the need to completely replace the provided components under this Contract.

1.14.5.b Overall controls must cater for minimum forty percent (40%) expansions, i.e., through addition of new sub-systems beyond this Contract, and twenty five percent (25%) reconfigurations, i.e. modifications and/or add additional equipment within the provided sub-systems of this Contract. For example, in the event that the design is based on ten (10) sub-systems (includes all defined future provisions) the Owner shall be able to add an additional four (4) sub-systems without the need to upgrade the architecture.

1.14.5.c The LLC and HLC design shall be modular such that the system can be easily and economically expanded. Limitations in the LLC and HLC systems must be avoided. It must be possible to increase the size of the control system such that additional bags can be tracked by at least adding additional modules (MCP's, PLC's, I/O etc.) while maintaining the existing architecture.

1.14.5.d The airport is expected to be provided with a CT80dr+ EDS machine by TSA prior to the end of this project.

1.14.5.1 Motor Control Panels (MCP)

1.14.5.1.a Each MCP installed shall have a minimum of twenty five percent (25%) of usable spare space after

project completion to allow for expansion.

1.14.5.1.b The BHS Contractor shall pay special attention in the case of areas which involve single components (power supplies, etc.) such that additional components can be installed as required.

1.14.5.1.1 Spare Main Switch

1.14.5.1.1.a The BHS Contractor is required to provide each MCP main switch with twenty five percent (25%) spare capacity or ensure that there is sufficient space available in the MCP to upgrade and install a bigger main switch.

1.14.5.1.2 Communication Rack

1.14.5.1.2.a Each communication rack shall have a minimum of twenty five percent (25%) of usable space to allow for expansion.

1.14.5.1.2.b The BHS Contractor may, in lieu of providing each communication rack with twenty five percent (25%) spare usable space, provide space within the panel for additional communication racks equaling twenty five percent (25%) of the total length of racks in the panel.

1.14.5.1.c It shall be possible to increase the quantity of MCP's (and associated PLC's and I/O) while maintaining the existing architecture.

1.14.5.2 Programmable Logic Controller (PLC)

1.14.5.2.a PLC's memory (by PLC) shall have a minimum forty percent (40%) expansion capability (free memory in lieu) without the need to upgrade the processor to cater for the 40% system expansion.

1.14.5.2.b At least twenty five percent (25%) free memory shall be available in each PLC CPU when accepted at Practical Completion and Final Completion and Acceptance by the Owner. The BHS Contractor shall provide the Owner with suitable documentation detailing the exact amount of free memory as part of the acceptance process.

1.14.5.2.c Each individual PLC shall have at least twenty five percent (25%) I/O expansion capability by adding additional I/O modules without the need to upgrade the PLC.

1.14.5.2.d Each I/O card shall have twenty-five per cent (25%) spare capacity for expansion.

1.14.5.2.e The BHS Contractor shall inform the Owner in writing about any particular limitations for future expansion such as software limits (licenses), hardware limits (memory, bandwidth), etc.

1.14.5.3 Reporting Functions

1.14.5.3.a It shall be possible for the Owner to create and define new reports using the recorded data available. Any additional reports should not diminish the system performance.

1.14.5.4 Visualization

1.14.5.4.a It shall be possible to add a minimum of forty percent (40%) additional sub-system central visualization screens and I/O points (tags) to the HLC without the need for any hardware or software upgrades besides the creating of the new status screens and their implementation.

1.14.5.5 Conduit

1.14.5.5.a Provide space for twenty five percent (25%) additional conduit.

1.14.6 Maintainability

1.14.6.a The BHS Contractor shall provide components that are maintenance free and lubricated for life, where possible.

1.14.6.b All installation shall be done in a way that provides optimal accessibility for maintenance and repair purposes. Provide at least 36" access width to all equipment.

1.14.6.c The BHS Contractor must in their design assure that maintenance or repair of one part or element of the system does not affect any other part or element (i.e., the maintenance of the lower conveyor in a situation where two (2) conveyors are on top of the other, must not disturb the operation of the upper one).

1.14.6.d The system components must permit easy and rapid maintenance and servicing. Hardware shall be of the plug-in type such that maintenance personnel can easily change out hardware (e.g., a sensor) without the need to rewire the device.

1.14.6.e The BHS Contractor shall ensure that unnecessary equipment dismantlement is avoided for routine maintenance tasks. Furthermore, the equipment in the CBIS/BHS is to be selected such that rapid access is available to those components known to have a higher-than-normal susceptibility to wear and tear or faults.

1.14.6.f Parts or components, which require routine inspection shall be provided with clear Plexiglas protective covers where required such that maintenance staff does not unnecessarily have to remove protective covers to inspect the condition of such parts or components.

1.14.6.g To achieve optimum CBIS/BHS management, data, and information from the handling procedures and CBIS/BHS equipment must be made available for preventive maintenance purposes via report functions built into the Information Reporting system (HLC).

1.14.6.h The BHS Contractor must submit a detailed Operator Access Plan and Escape Route plan and Maintenance Access plan of all building areas with CBIS/BHS installations. It must be possible to access all equipment components that need routine inspection and maintenance without the use of scissor lifts or similar.

1.14.6.i For all parts of the CBIS/BHS installation, the BHS Contractor must assure that the entry and exit corridors are not limited by building components (i.e., columns, walls) and/or any other equipment (i.e. air conditioning, sprinklers, elevators, escalators, drainage etc.).

1.14.6.j The BHS Contractor must make the required provisions for the installation and future replacement/removal of large or heavy equipment such as EDS machines, even if the temporary openings utilized as part of this Contract have been closed. The BHS Contractor shall in his engineering drawings identify such provisions, which shall include plug 'n' play connectors.

1.14.6.k The BHS Contractor shall provide spare part hoists/lifts for the handling and lifting of large or heavy spare parts.

1.14.6.l Equipment shall be designed and installed in such a manner that any single component can be replaced by two (2) suitably qualified maintenance personnel with a maximum down time of two (2) hours. An allowance of fifteen (15) minutes to fetch replacement parts must be factored in and shall be included in the allowed down time. The BHS Contractor shall bring to the attention of the Owner any equipment that cannot be replaced within this time frame and schedule a demonstration during the Design Phase prior to on-site installation of such equipment. After the demonstration, the Owner and BHS Contractor shall coordinate and agree upon the necessary design improvements to the component and/or equipment in order to minimize the time needed to replace the component to an absolute minimum.

1.14.6.m Equipment shall be designed with preference to reliability and maintainability rather than ease of manufacture.

1.14.6.n All motors, bearings, rollers at ticketing conveyors shall be assessable from the public area without the need to remove the belt. Special access points in stainless steel shall be provided as required. Provide quick disconnects on motors in public area to aid replacement.

1.14.6.o All weather protection guarding shall be easily removable without the need to disassemble the equipment to gain access for maintenance.

1.14.7 Reliability

1.14.7.a The system shall be capable of operating continuously without fault.

1.14.7.b The system components must be chosen with the highest possible reliability in mind.

1.14.7.c The individual equipment units used for this project must have proven their reliability in other airport systems of similar size for a minimum of three (3) years prior to NTP.

1.14.7.d Equipment not satisfying above clause shall be clearly identified by the BHS Contractor in the offer and must at time of offer have passed rigorous BHS Contractor testing trials. Proof of such test trial results shall be enclosed with the offer and is subject to review by the Project Manager. The BHS Contractor may be asked to substitute offered equipment with service proven equipment.

1.14.8 Redundancy

1.14.8.a The implementation of redundancy through design must consider mechanical elements as well as needs of power supplies, control systems, and any other part of the system. Redundancies are always to be regarded as a whole, i.e., covering the mechanical, electrical, and LLC systems.

1.14.8.b A fault condition within the CBIS/BHS shall not affect external systems or non-related systems.

1.14.8.c The different building power sources shall be utilized in a way that supports and provides system redundancy.

1.14.8.d Single point of failures within the LLC system shall not affect the system operation beyond the sub-system with the fault condition. Sensor equipment faults shall simply stop the particular component where applicable, e.g., conveyor. A PLC CPU or memory fault condition will stop the complete sub-system controlled by that particular PLC (unless Hot Back-up is provided), but the remaining sub-systems shall continue operation unaffected.

1.14.8.1 Hot Back-up

1.14.8.1.a Provide Hot Back-up for the complete Outbound system.

1.14.8.2 Layout Redundancies

1.14.8.2.a Provide a working system with the bag routes depicted in the Contract Drawings. A single point of failure shall not bring down more that the particular bag route in question.

1.14.8.3 Power Redundancies

1.14.8.3.a When designing the power distribution the BHS Contractor shall consider the various power sources and utilize these to ensure that sufficient available power during a power outage continues to allow baggage to be processed within a zone.

1.14.8.3.b The power available from different transformers within a Load Center shall be used to support the system redundancy.

1.14.9 Equipment Substitution

1.14.9.a If the BHS Contractor during the execution of this Contract obtains access to new unproven equipment, which the BHS Contractor wishes to utilize for this Contract, the BHS Contractor shall submit a Request for Substitution explaining the operational and maintenance disadvantages/advantages to the Owner along with any cost implications. The BHS Contractors shall as part of the Request for Substitution provide documentation of his rigorous in-house testing and proof of the proposed equipment's reliability.

1.14.9.b The BHS Contractor shall demonstrate the functionality, reliability, and maintainability of such equipment through prototype testing as defined in Part 3 § 3.10.

1.15 KEY PERFORMANCE INDICATORS (KPI)

1.15.1 General

1.15.1.a All performance requirements defined herein shall be proven by the BHS Contractor using the test baggage defined in Part 1 § 1.20.

1.15.1.b Individual system elements and components have to handle considerably larger peak demands than the overall throughput requirement defined below.

1.15.1.c The performance requirements must be attained, as an absolute minimum, without fail and form part of the acceptance testing.

1.15.1.d The CBIS/BHS must be capable of continuous operation at full capacity, i.e., must be able to tolerate any number of daily peaks.

1.15.1.e All performance requirements always refer solely to the system technical performance, i.e., the time required for the function and operation of the equipment/component alone. Any Operator imposed time is not included.

1.15.2 Overall System Design Throughput Criteria

1.15.2.a The following table shows the minimum system design throughput criteria, which must be met or exceeded by the BHS Contractor for sixty (60) consecutive minutes of operation. The BHS Contractor shall ensure that the selection of components that comprise the CBIS/BHS as well as the integration of those components are capable of processing the minimum system design throughput within sixty (60) consecutive minutes of baggage operations.

Table 6 Overall System Design Throughput Requirements

System Area	Throughput [bph]
Total Ticketing Throughput	1275
Total Arrival Throughput	1275

1.15.2.b The defined System Design Throughput shall apply at all times.

1.15.3 Component Throughput Criteria

1.15.3.a The following table shows the minimum throughput criteria for individual components, which are to be met or exceeded by the BHS Contractor. It is required that individual equipment components and elements can process considerably higher loads than the individual line throughputs in order to achieve the system design throughput defined above.

1.15.3.b The operational sort-rate of individual components such as diverters, vertical sorters, merges, and other associated equipment must be maximized. This must be done while still maintaining reliable and gentle transport of baggage.

1.15.3.c The BHS Contractor shall demonstrate to the Owner that the individual throughput requirements below are met or exceeded every minute for fifteen (15) consecutive minutes of operation.

1.15.3.d Values below are not cumulative.

Table 7 Equipment Component Throughput Requirements

System Area	Peak 15-min Throughput [bpm]*	Sustained Hourly Throughput [bph]**
Ticketing Take-Away Conveyor	25	1275
Transport conveyor (tracked/non-tracked)	40	2040
Transport conveyor from Screening (cleared bags)	25	1275
Queue Conveyors (metering)	60 start/stop operations/min	2550

1.15.3.e * This rate shall be achieved for every minute and sustained for a continuous period of fifteen (15) minutes.

1.15.3.f ** This rate shall be achieved and sustained for a continuous period of sixty (60) minutes. This rate is approximately 85% of the peak 15-min throughput to allow for system variations and bag transition delays.

1.15.3.g A ”cycle” is defined as the travel from “home to divert to home” position.

1.15.4 System Availability

1.15.4.a The objectives of this Specification are to provide a System, tolerant of faults and capable of automatically compensating for faults (e.g., by alternative routings), and still allow manual intervention as desired from the control room.

1.15.4.b The BHS must exhibit extremely high system availability. This affects not only the purely technical availability of the System, but also availability from the System usage at the interfaces to the baggage-handling areas, for example at the CBRA when retrieving bags and loading baggage. Attention must be paid to ensure a large degree of redundancy when designing the System, this to permit the controls and mechanical systems to continue operation even when irregularities and faults occur.

1.15.4.c The System must meet or exceed the following availability or up-time.

1.15.4.d All availability calculations shall be based on a minimum scheduled up-time of eighteen (18) hours of operation a day.

1.15.4.e Refer to Part 1 § 1.4.19 above, for information regarding the definition of down-time.

1.15.4.f The systems availability is defined as follows:

1.15.4.g Where:

1.15.4.h As = System availability

1.15.4.i SOT = Scheduled Operating Time

1.15.4.j DT = Down-Time

$$As = \frac{SOT - DT}{SOT}$$

1.15.4.k It must be possible to route bags from the Ticketing areas to the sortation areas at all times without exception.

1.15.4.l Scheduled down-time for maintenance activities shall not be regarded as down-time in the availability calculations provided that following are fulfilled;

1.15.4.1 Down-Time Exceptions

1.15.4.1.a Maintenance Works can be completed during non-operational hours.

1.15.4.1.b Maintenance Works can be completed without affecting the throughput.

1.15.4.2 Baggage System

1.15.4.2.a The baggage system must meet or exceed the following availability. It must be possible to route bags automatically and without any manual intervention, from any input to any output, ninety nine percent (99%) of the time that the system is scheduled to be operational on a monthly basis.

1.15.4.2.b The combined downtime shall not exceed eleven (11) minutes within any operational eighteen (18) hour period (18 hrs. x 60 x (1-0.99)).

1.15.4.2.c The combined downtime shall not exceed five hours and twenty-four minutes (5 hrs. 24 min) within any consecutive thirty (30) day period (30 days x 18 hrs. x (1-0.99)).

1.15.4.3 Control (LLC) System

1.15.4.3.a The PLC and LLC systems must meet or exceed the following availability.

1.15.4.3.b The LLC system shall be operational 99.5% of the time on a daily basis. And the combined downtime shall not exceed twenty (5) minutes within any operational eighteen (18) (18) hour period (18 hrs. x 60 x (1-0.995)).

1.15.4.3.c The LLC system shall be operational 99.95% of the time on a monthly basis. And the combined downtime shall not exceed sixteen (16) minutes within any consecutive thirty (30) day period (30 days x 18 hrs. x 60 x (1-0.9995)).

1.15.4.3.1 Down-Time Limitations

1.15.4.3.1.a The LLC is allowed no more than one (1) unplanned failure on any combination of PLCs in one (1) calendar year.

1.15.4.3.1.b The LLC is allowed no more than one (1) unplanned failure on any combination of I/O modules in one (1) calendar year.

1.15.4.3.1.c The LLC is allowed no more than one (1) PLC reset and/or restart on any combination of PLCs in one (1) calendar year.

1.15.5 Equipment Speeds

1.15.5.a All equipment speeds and performance standards always refer solely to the system technical performance, i.e., the time required for the function and operation of the equipment/component. Any operator-imposed time will not be included, for example in the manual loading of odd size trays.

1.15.5.b It is the BHS Contractor's responsibility to design, install and commission the CBIS/BHS equipment using the below listed equipment speeds, while ensuring that the system performs to the specified criteria without jams, bottlenecks, excessive wear, noise, and vibration under full load conditions. Any discrepancy not brought to the attention of the Owner during the Contract negotiations and specifically listed in the Compliance Matrix shall be solved by the BHS Contractor at no cost to the

Owner. No additional time will be grated to rectify such issues and shall solely be completed by the BHS Contractor to the satisfaction of the Owner.

Table 8 Equipment Speeds

Equipment Type	Speed [ft/min]
Take-Away/Collector Belt Conveyor	60 - 90
Transport Belt Conveyors	300 - 400
Queues	90 - 400
Make-up Lateral	60 - 90
Claim Carousel	60 - 90

1.15.5.c The transitions in belt speeds between any two (2) consecutive belts shall not exceed 30 ft/min or ten percent (10%) between adjacent equipment components, whichever is greater so as not to affect the stability, orientation, or spacing of bags, while still maintaining accurate bag tracking and minimize the risk of bag jams.

1.15.5.d Where the maximum allowed speed differentials cannot be achieved, conveyors shall operate automatically with two (2) speeds such that the conveyor operates at one speed as bags are transferred onto the conveyor and another speed as bags are transferred off of the conveyor such that the transitional speed between conveyors does not exceed 30 ft/min. The BHS Contractor shall identify such locations in writing to the Owner for his approval.

1.15.6 Visualization Status Updates

1.15.6.a The performance of the LLC system and associated communication with the plant shall be such that operators can quickly and effectively monitor the system without delay. The BHS Contractor shall provide an operational system that delivers the following minimum performance in terms of equipment status visualization.

1.15.6.1 General

1.15.6.1.a User input shall be detected within half a (0.5) second such that a User does not attempt a second operation thinking that the first attempt failed. As an example of slow operation, a delay in detection could cause the operation to fail from the Users perspective as two (2) attempts could result in the operation toggling for [OFF], to [ON] and back to [OFF] such that the User never recognized the requested operation taking place.

1.15.6.2 Local Visualization (PLC Status Maps)

1.15.6.2.a Life/safety inputs shall be detected immediately through latching circuits and reported to the local visualization within two (2) seconds (e.g., Emergency stop, fire signal, etc.).

1.15.6.2.b Operational safety inputs shall be detected immediately through latching circuits and reported to the local visualization within three (3) second (jams, motor overload, encoder faults, door faults, etc.).

1.15.6.2.c Operational states shall be reported to the local visualization within five (5) seconds (system stop, oversize, cascade, energy save, etc.)

1.15.6.2.d Operational states that change [ON]/[OFF]/[ON] within detection periods and are not reported shall be regarded as a defect.

1.16 DESIGN REQUIREMENTS

1.16.1 General

1.16.1.a The BHS Contractor shall ensure that the engineering design requirements defined in these Specifications are included and described in the submittals provided to the Owner for review and approval. Refer to Part 1 § 1.13 for requirements on submittals.

1.16.1.b The BHS Contractor shall provide components, parts, and equipment to match existing installation(s) and spare-parts inventory. In the event that parts and equipment have been superseded or replaced with newer models, the BHS Contractor shall detail this replacement/substitution and make sure that such replacements are compatible with all local and overall controls and systems.

1.16.1.c The components must comply with the state-of-the-art and represent current industrial standards. They must belong to tried and tested product families of ensured continuity and must be widely available.

1.16.1.d All components employed in the system must be suitable for use under harsh environmental conditions (e.g., temperature, soiling, electrically contaminated environs, vibrations/shocks, high humidity, high altitude climate). Compensatory measures are, as far as possible, to be avoided. If compensatory measures are unavoidable, these must be described detailed and separately.

1.16.1.e Design all parts and sub-assemblies in accordance with good commercial practice and assure safe, efficient, and practical design in keeping with requirements peculiar to this type of system.

1.16.1.f The BHS Contractor shall design, manufacture, and install in accordance with the Planning Guidelines and Design Standards for Checked Baggage Inspection Systems provided by the TSA and assure one hundred percent (100%) EDS screening of all checked baggage.

1.16.1.g Ensure a one hundred percent (100%) failsafe operation. No malfunction of any device shall allow baggage to by-pass any individual screening level without proper clearance. That means for the example of a High-Speed Diverter (HSD) sorting bags to CBRA that it must return to its failsafe position after every single sortation-event.

1.16.1.h The system shall provide controlled and safe handling of 'in gauge' bags and 'out of gauge' (odd size) bags along with controlled and safe handling of Oversize bags.

1.16.1.i The baggage shall not be subjected to any damage. The design, manufacture and installation shall be to eliminate such damage to bags.

1.16.1.j Electrical circuit design shall employ failsafe techniques such that when power is removed from a section of the control system (blown fuse), unexpected operation, unsafe operation, potential injury and/or a life-threatening situation is not created independent of the system being in manual or automatic operation.

1.16.1.k Electrical design must be complementary to the mechanical design (vis-a-vis), to ensure that redundancy provisions provided by the mechanical and electrical design are properly maintained. An example being the breakup of conveyors such that electrical control of conveyors allows parallel systems to provide redundancy.

1.16.2 Design Coordination

1.16.2.a The BHS Contractor is required to perform the necessary coordination with the Owner, Airlines, Authorities, Main Contractor and other trades to successfully complete the project on time and without interferences between trades. The BHS Contractor shall designate a Coordination Manager for coordination. The Coordination Manager shall have the authority to make decisions on behalf of the BHS Contractor and shall have binding signatory power for changes in Works. The Coordination Manager shall be on site at all times during Work's activity.

1.16.2.b No additional costs shall be considered for coordination activities throughout this project. The BHS Contractor shall in his proposal include all costs for coordination of all activities.

1.16.2.c Prior to fabrication or installation of any Works, participate in detailed coordination planning meetings with all other building utilities system trades, under the direction of the Main Contractor, so as to completely establish routings, elevations, space requirements, and coordination of access, layout, and suspension requirements in relationship to the building structure and the Works of all other trades.

1.16.2.d Ensure that sprinkler pipes and drainage pipes are running along and parallel with CBIS/BHS equipment rather than across CBIS/BHS equipment unless the required clear height for baggage and personnel is maintained.

1.16.2.e Coordinate and install all sprinkler requirements for sprinklers both above and below CBIS/BHS equipment to satisfy fire codes. E.g., double-stacked lines, solid surface or otherwise as defined by fire codes.

1.16.2.f Coordinate and install all sprinkler requirement for special and additional sprinklers in areas with high concentrations of flammable materials or congested CBIS/BHS equipment. E.g., as defined by fire codes.

1.16.2.g If an EDS machine is provided by TSA during this project, Coordinate with the EDS device provider as required to provide the necessary interfaces between the CBIS/BHS and EDS in order to

successfully accomplish the intended operation described herein. The BHS Contractor shall, in all cases, be responsible for any wiring between the CBIS/BHS and EDS that are required for the interfaces.

1.16.2.h Comply with the TSA planning guidelines in force at the time of the contract award in all areas unless specific exceptions have been granted at time of award.

1.16.2.i All dimensions on structural drawings shall be field verified and checked against the architectural drawings. Any discrepancies shall be reported to the Owner immediately. In case of conflict between notes, details, plans and Specifications the most rigid requirements shall govern until such time as a clarification is issued by the Owner.

1.16.2.j The BHS Contractor shall refer to architectural, mechanical, plumbing, electrical, and any other specialty drawings for size and location of openings, sleeves, curbs, inserts, slopes, depressions, or other items for the design coordination of the Works.

1.16.2.k The BHS Contractor shall notify the Owner of any obviously damaged structure not noted on the drawings prior to proceeding with related or affected construction. Likewise, the BHS Contractor shall notify the Owner of any discrepancies between the assumed existing structure shown on the drawings and that found at the construction site.

1.16.2.l All temporary and final equipment supports shall be designed, engineered and installed so as not to infringe on the airport and the Owner's operational areas, drive aisles or cart staging areas. All CBIS/BHS equipment supports and installations in part or whole must not interfere with the ROW of any existing or future equipment designated for installation.

1.16.3 Building Interface/Coordination

1.16.3.a The BHS Contractor shall perform the necessary coordination with the Main Contractor, Architect, Owner, Stakeholders, Local and Governing Authorities, other trades and others involved in the execution of this Contract to ensure that the project is completed on time and interferences are avoided. The BHS Contractor is required to seek solutions and make sure progress is never halted due to interface or coordination disputes.

1.16.3.b Coordinate that the building lighting is installed in optimum locations such that walk ways, and CBIS/BHS transport equipment is well lit and maintenance activities can be performed without the need for additional lighting.

1.16.4 PLC Zoning

1.16.4.a The BHS Contractor shall ensure that the design of the PLC zones are logical and supports the sub-system borders such that mechanical equipment redundancy is maintained through PLC zoning.

1.16.5 Baggage Characteristics

1.16.5.a Design the system to transport baggage of the following characteristics.

1.16.5.1 Bag Types

1.16.5.1.a The system must be able to handle all types of bags (without exception) experienced in modern airports. This includes, but is not limited to, hard-cases, soft-cases, crates (wood, plastic, steel, aluminum, etc.) back-packs, plastic bags, paper-wrapped boxes, cardboard, plastic, nylon, wood, steel, aluminum, canvas, cotton, or other materials commonly used for baggage.

1.16.5.1.b The system must be able to handle straps, handles, tags, banding, wraps, as commonly seen on baggage without causing jams.

1.16.5.1.c The use of plastic film for wrapping bags to prevent theft shall not pose any degrades in the handling and processing of such bag and it shall not be necessary to place such bag in a baggage tub.

1.16.5.1.d The system must be able to handle baggage in airline tubs.

1.16.5.2 Normal In-gauge (IG) Bags

Table 9 Normal Baggage Characteristics

Characteristic	Minimum	Maximum
Weight	2 lbs.	72 lbs.
Width	3”	36”
Height	3”	36”
Length	9”	72”

1.16.5.3 Oversize (OS) Bags

Table 10 Out-of-Gauge Baggage Characteristics

Characteristic	Minimum	Maximum
Weight	5 lbs.	120 lbs.
Width	5”	40”
Height	5”	34”
Length	12”	98”

1.16.6 Baggage Clearances

1.16.6.a Maintain a minimum of 36” baggage clearance from the top of the conveyor belt (TOB) to the nearest overhead obstruction. The BHS Contractor is responsible to ensure that this is maintained throughout the installation and equipment from other trades does not conflict with this requirement.

1.16.6.b The BHS Contractor shall pay special attention and ensure sufficient baggage clearance is provided at changes in elevations such that a maximum size bag can be transported without obstruction. The BHS Contractor shall denote on their coordination drawings any additional clearances required to properly transport a maximum size bag without any obstruction.

1.16.7 Operational Clearances

1.16.7.a Maintain a minimum of 10 ft clear from finished floor level to the nearest overhead obstruction above all make-up parking positions, transfer input points and arrival input points to allow for opening of ULD containers with top hinged doors. The BHS Contractor is responsible to ensure that this is maintained throughout the installation and equipment from other trades does not conflict with this requirement.

1.16.7.b Maintain a minimum of 8 ft clear from finished floor level to the nearest overhead obstruction throughout all baggage cart traffic aisles/routes. The BHS Contractor is responsible to ensure that this is maintained throughout the installation and equipment from other trades does not conflict with this requirement.

Table 11 Baggage Cart Traffic Aisle Dimensions

Location	Dimension
Make-up/Claims work area and staging width adjacent to device	10’ 0”
One-way drive aisle	10’ 0”
Two-way drive aisle	20’ 0”
Turn radii	10’ 0”
One-way bypass lane adjacent to Make-up, or arrival inputs	10’ 0”

1.16.8 Dynamic Load

1.16.8.a All drives shall have a motor/reducer sized to permit start up under full load conditions as per specified loads and start/stop cycles.

Table 12 Dynamic Load Requirements

Equipment Type	Dynamic Load
Conveyors capable of containing only a single bag	72 lbs. per conveyor
Conveyors capable of containing more than one (1) bag	40 lbs. per linear foot proportional to a speed of 90 fpm
Flat plate carousels	40 lbs. per linear foot of center line carousel
Stairs/ladders	75 lbs. per linear foot

1.16.8.b The proportional dynamic load for equipment shall be based on the following calculation: Load per linear foot = 40 lbs. per linear foot * (90 ft/min / actual belt speed)

1.16.9 Static Load

Table 13 Static Load Requirements

Equipment Type	Static Load
Conveyors capable of containing only a single bag	150 lbs. per linear foot or a single concentrated load of 300 lbs.
Conveyors capable of containing more than one (1) bag	75 lbs. per linear foot or a single concentrated load of 300 lbs.
Flat plate carousels	150 lbs. per linear foot or a single concentrated load of 300 lbs.
Stairs/ladders	75 lbs. per linear foot

1.16.10 Changes in Elevation

1.16.10.a All changes in elevation shall be kept to a minimum and comply with the following maximum requirements.

Table 14 Maximum Changes in Elevation

Equipment Type	Comment	Slope
Belt Conveyor	Non-tracked inbound (arrival) transport	+/- Eighteen degrees (18°)
	Non-tracked outbound transport outside TSA areas	+/- Eighteen degrees (18°)
	Tracked outbound transport outside TSA areas	+/- Twelve degrees (12°)
	Non-tracked lines within TSA areas (CBIS/BHS and CBRA)	+/- Fifteen degrees (15°)
	Tracked lines within TSA areas (CBIS/BHS and CBRA)	+/- Twelve degrees (12°)

1.16.10.b The BHS Contractor shall minimize the change in elevation whenever possible based on the building constraints. The BHS Contractor shall bring to the attention of the Owner all locations with a change in elevation greater than +/- fifteen (15°) degrees and obtain approval from the Owner in writing.

1.16.10.c Any exceptions to the above requirements shall be submitted for review and approval by the Owner in writing, prior to manufacturing and installation.

1.16.11 Noise Levels

1.16.11.a Under no circumstances is the CBIS/BHS equipment allowed to increase the general ambient noise level by more than fifteen (15) dB(A) and the noise emitted by the CBIS/BHS shall throughout the system not exceed the following levels.

Table 15 Maximum Noise Levels

Area	Comment	Limit
Public areas	All Ticketing and Claim areas	60 dB(A)

Area	Comment	Limit
Non-public areas immediately adjacent to offices	Measured anywhere within the adjacent office space	50 dB(A)
CBRA Area	Anywhere within the CBRA room	65 dB(A)*
Non-manned non-public areas	General CBIS/BHS areas	70 dB(A)
Manned non-public areas	Input positions, Make-up area	60 dB(A)

1.16.11.b * or as per PGDS V7.0 for TSA area noise requirements. Whichever is the lowest.

1.16.11.c The maximum allowed difference between the continuous sound pressure level and any impulsive sound pressure level shall not exceed three (3) dB(A).

1.16.11.d Noise testing shall be performed by the BHS Contractor as defined in Part 3 § **Error! Reference source not found.**.

1.16.12 Vibration

1.16.12.a The system installed by the BHS Contractor shall not produce or induce objectionable vibrations into the building structure. Vibration levels induced by the system and/or its components shall not be injurious to the system or the building structure or be harmful or annoying to passengers and/or employees.

1.16.12.b There must be no vibration noticeable in public and/or office spaces.

1.16.12.c The baggage system equipment excitation frequencies shall be safely separated from the fundamental modes of vibration of the structure.

1.16.12.d The BHS Contractor shall provide any and all necessary vibration isolation devices or techniques required to eliminate vibrations from being transmitted to the building. Such vibration and/or noise dampening elements shall be made of rubber, neoprene, silicone, or other similar material.

1.16.12.e The BHS Contractor shall mount all equipment supported from structural elements, floor supports or hangers on vibration isolators to eliminate such vibrations from being transmitted to the building. These should be fitted either where the equipment support structure mounts to the building structure, or where the equipment frame attaches to the equipment support structure.

1.16.12.f The equipment that is surface mounted using header steel to building elements and/or mezzanines shall not transmit any vibration to these structures. Such items must be fitted with vibration isolators to eliminate vibration. This fitting will be at no cost to the Owner.

1.16.12.g Vibration testing shall be performed by the BHS Contractor as defined in Part 3 § **Error! Reference source not found.**. The BHS Contractor shall at the start of the project submit the vibration test schedule to the Owner for review and all test results shall be submitted to the Owner upon completion of the BHS Contractor's Commissioning activities.

1.16.13 Seismic Zone

1.16.13.a All equipment, header steel, hangers, supports and other equipment that spans across seismic zones shall be installed in accordance and be fully compliant with all Local, City & County, State and Federal seismic codes and approved by the Owner.

1.16.13.b The BHS Contractor shall in the design consider seismic requirements and accommodate the building expansion zones.

1.16.14 Baggage Separation

1.16.14.a Baggage separation techniques shall be capable of separating bags, which overlap by not more than 6" side by side. This shall be achieved by mechanical methods through speed differentials between adjacent conveyors.

1.16.14.b The bag separation shall be maintained on all tracked lines to allow accurate bag tracking.

1.16.15 Equipment in Public View

1.16.15.a Equipment which is visible to the public shall have all exteriors and cladding manufactured in Stainless Steel (SS304 minimum) with a No.4 brush horizontal grain finish on vertical panels and grain finish in the direction of baggage flow for all horizontal panels.

1.16.15.b Finish and grain of stain steel to be coordinated with the Owner prior to manufacturing.

1.16.15.c The cladding shall be attached with a minimum of visible fasteners, subject to approval by the Owner prior to installation.

1.16.15.d Joints in stainless steel cladding shall be flush with gapping of not more than 1/32". Stainless steel supports shall be provided directly behind all joints to ensure a rigid, smooth and continuous edge to edge finish.

1.16.16 Equipment in Non-Public Areas

1.16.16.a All provided equipment shall be provided in painted or powder coated finishes as defined in Part 1 § 1.16.17.

1.16.17 Paint Colors & Finishes

1.16.17.a The exterior color of the CBIS/BHS equipment shall be coordinated with the Owner and approved in writing before the BHS Contractor commences any manufacture or construction. If the BHS Contractor has more than one shade of the colors defined below, the BHS Contractor shall provide choices to the Owner for approval.

1.16.17.b The exterior color of the CBIS/BHS equipment shall match existing equipment and be coordinated with the Owner and approved in writing before the BHS Contractor commences manufacturing.

1.16.17.c A paint-chip sample shall be submitted for the Owner's approval as defined in Part 1 § 1.13.7 prior to commencing any painting at the BHS Contractor's manufacturing facility.

Table 16 Equipment Coloring

Equipment Type	Comment	Color
Outbound Belt Conveyor	BHS Contractor to submit color for Owner approval.	TBC
Safety guarding, bearing covers, handrails and guardrails, bollards		Safety yellow
All equipment in public view	Stainless steel material brush #4 finish	SS

1.16.17.d All equipment sections, frames, drives, supports, and sideguards shall be painted according to the colors defined above.

1.16.17.e Motors and gearboxes shall be provided in matching color according to the manufacturer's standard color.

1.16.18 HMI Ergonomic Requirements

1.16.18.a The BHS Contractor shall in his design ensure that the following requirements are fulfilled in order to provide the desired ergonomics and work conditions when personnel interact with the CBIS/BHS.

Table 17 HMI Ergonomic Requirements

CBIS/BHS Work Area	TOB Above Operator Work Level	Sideguard	
		Operational Side	Non-Operational Side
Ticketing Take-away Belt	13"	None	21"
CBRA worktable	30"	N/A	N/A
CBRA Clear Line	28"	None	12"
Make-up Lateral	30"	None	21"
Flat Plate Claim Carousel	12"	None	12"
Personnel Crossovers/bridges	N/A	6"	N/A

1.16.18.b The distance that TSA personnel must transport baggage within CBRA is to be minimized at all times and shall at no circumstance exceed 8'.

1.16.19 Unload Areas

1.16.19.a Single sided unloading areas shall be provided with standard sideguards on the non-operational side. Motor and gearboxes shall be placed on the non-operational side of the conveyor.

1.16.19.b The front of the conveyor shall be adequately guarded so that there are no catch points for clothing and/or baggage, e.g., by having a piece of wood or steel along the frame of the conveyor.

1.16.20 Ambient Conditions

1.16.20.a The systems shall be able to operate under the following ambient conditions.

1.16.20.b The BHS Contractor shall consider the base altitude of the airport when selecting equipment. All equipment shall be able to operate and provide the defined lifetime in the industrial environment seen at airports and baggage operations.

Table 18 Ambient Conditions

Area	Temperature	Relative Humidity
Public Areas	50 to 105 F	5% to 95%
Non-conditioned Make-up Area	15 to 130 F	5% to 95%
Conditioned CBIS/BHS Area	50 to 105 F	5% to 95%
Control Room(s)	50 to 105 F	5% to 95%
Baggage Tunnels	23 to 130 F	5% to 100% non-condensing

1.16.21 NEMA & IP Rating

1.16.21.a All panels, control stations, racks and other protection for electronics and power equipment shall be rated at minimum NEMA 3.

1.16.22 Power Provisions

1.16.22.a The BHS Contractor shall on his drawings show the electrical power requirements (amperage) at each of the power panels. Each sub-system shall be independent and shall be provided with its own power panel.

1.16.22.b The BHS Contractor shall calculate his power loads to each sub-system and verify the feeder sizes shown on the Contract Drawings for review and approval of the Owner.

1.16.22.c Beyond each distribution panel, the BHS Contractor shall furnish and install all services, feeders, and fused disconnects for branch circuits to each control panel as specified and shall provide and install all panels boxes, wire-ways, conduits, conductors, transformers, fuses, equipment, and materials required to complete the electrical power distribution for the operation of the system.

1.16.22.1 EDS Machines

1.16.22.1.a 208 VAC, three (3) phase, sixty (60) Hz power is available at the distribution panels with amps as shown on the electrical drawings at locations in each electrical room or load center adjacent to the baggage operation areas (power panels may be up to 200 feet from the distribution panels). The BHS Contractor shall supply each EDS machine from this point.

1.16.22.1.b The BHS Contractor shall provide kWh power monitoring meters in each MCP such that the power consumption can be determined.

1.16.22.1.c The BHS Contractor shall coordinate with the EDS supplier and install power from the main-switch to the EDS machine (via an UPS or power conditioner as necessary).

1.16.22.1.d The BHS Contractor shall coordinate with the EDS machine installer for connection to the EDS, testing and energizing.

1.16.22.1.e The BHS Contractor shall provide fiber/data cabling and junction boxes for each potential EDS machine. Coordinate with the EDS OEM for location, type, and quantity.

1.16.22.2 CBIS/BHS Equipment

1.16.22.2.a 208 VAC, three (3) phase, sixty (60) Hz power is available at the distribution panels as shown on the electrical drawings at locations in each electrical room or load center adjacent to the baggage operation areas (power panels may be up to 200 feet from the distribution panels). The BHS Contractor shall supply CBIS/BHS panels from this point.

1.16.22.3 Motor Control Power

1.16.22.3.a All motor control power shall be 208V

1.16.22.4 Low Level Control Power

1.16.22.4.a The LLC shall use 24 VDC or 120 VDC.

1.16.22.5 Single Phase Power

1.16.22.5.a The BHS Contractor shall source all 120 VAC single phase power required for the installation. Power is available at the distribution panels as shown on the electrical drawings at locations in each electrical room, which may be up to 200 feet from the baggage operation areas. The BHS Contractor shall provide all power from this point.

1.16.22.5.1 General Purpose Outlets

1.16.22.5.1.a The BHS Contractor shall provide 120 VAC single-phase general-purpose duplex power outlets along the CBIS/BHS equipment such that maintenance personnel have access to and can work on all CBIS/BHS equipment using powered tools with extension cords of no greater length than 50 ft.

1.16.22.5.1.b The BHS Contractor shall ensure that maintenance personnel do not have to run extension cords under/over operating CBIS/BHS equipment.

1.16.22.5.2 Auxiliary Power for CBIS/BHS Equipment

1.16.22.5.2.a MCP lighting.

1.16.22.5.2.b MCP power outlets.

1.16.22.5.2.c MCP power supplies.

1.16.22.5.2.d Local Visualization Touch Screen Status Maps

1.16.22.5.2.e Future CBRA equipment.

1.16.23 Grounding (Earthing)

1.16.23.a The equipment and its installation shall be completely grounded for all sources of energy including protective grounding and potential bonding to equipment.

1.16.23.b The connection between earth and the power-supply equipment (generator or transformer) shall be a direct connection with earth. The connection between earth and the electrical device being supplied shall be a direct connection with earth.

1.16.24 Radio & Electromagnetic Interference (EMI)

1.16.24.a The equipment provided or its installation shall not cause interference with communications within the airport or between the airport and aircraft or ground vehicles. CBIS/BHS equipment shall not emit EMI noise.

1.16.24.b All electrical and electronic equipment, including interconnecting wires and cables shall be designed to operate without malfunction in the presence of normal electro-magnetic emissions generated by other equipment installed or used at the airport.

1.16.24.c Normal airport environments will include various electrical motors and controls, power tools (including welders), radar, automotive vehicles, communications equipment, etc. Isolation transformers and line suppression, if required, shall be provided by the BHS Contractor.

1.16.24.d All CBIS/BHS equipment shall not interfere with the proper operation of any wireless airport systems.

1.16.25 Harmonic Interference

1.16.25.a Equipment provided by the BHS Contractor shall not generate harmonics that affect the operation of other equipment within the CBIS/BHS, airport, aircrafts or terminal/building electrical equipment. The BHS Contractor shall ensure that adequate filtering and shielding is provided at the BHS Contractor’s point of electrical supply to comply with this requirement.

1.16.25.b All electrical/electronic equipment shall meet or exceed IEEE 519; limit individual harmonic voltage distortion (HDV) to three percent (3%) and total harmonic voltage distortion (THDV) to five percent (5%).

1.16.26 Minimum Equipment Controlled by VFD

1.16.26.a The BHS Contractor shall provide the following equipment with VFD controllers and suitably matched motors and gear boxes;

Table 19 Minimum Equipment Controlled by VFD

Item	Equipment
1	Conveyors in the screening lines to allow for future EDS changes
2	Queues/metering belts
3	Equipment operating at two (2) speeds
4	Any equipment required to do more than 10 stop/start per minute under normal operating conditions

1.16.26.b The BHS Contractor shall demonstrate that it is cost beneficial to the Owner to use conventional brake motors for the remaining equipment rather than VFD controlled equipment and there is no adverse effect from harmonic interference.

1.16.27 Standard/Interchangeable Components

1.16.27.a The system must be designed using the least possible number of different components in order to simplify operation, maintenance and minimize the requirements for spare part inventory. The BHS Contractor shall provide a list of the required components for the Owner's review and approval.

1.16.27.b Used components must be interchangeable in all parts of the system. This includes equipment provided by Sub-Contractors or OEM suppliers to the BHS Contractor. Whenever possible the use of the Supplier's standard components is mandatory.

1.16.27.c The BHS Contractor shall ensure that selected components are identical or interchangeable with existing components wherever possible.

1.17 EQUIPMENT NAMING CONVENTION

1.17.1 General

1.17.1.a The BHS Contractor shall follow the existing naming convention.

1.17.1.b The BHS Contractor shall submit a naming convention document as part of the FDS. This shall cover all equipment (including but not limited to mechanical, electrical, control, IT, network, power, E-stop) provided.

Table 20 Sub-system Naming

ID	Sub-system Name
TC	Ticket Counter
IB	Inbound

1.18 DESCRIPTION OF OPERATION (SUB-SYSTEM OPERATION & FUNCTIONALITY)

1.18.1 General

1.18.1.a The BHS Contractor shall ensure that the operation and functionality within each sub-system comply with the requirements defined below. These sub-system descriptions define the general typical functions and processes; however, specific requirements are listed under the individual component sections of these Specifications.

1.18.2 Material Flow Diagram (MFD)

1.18.2.a The BHS Contractor shall provide a CBIS/BHS that provides the functionality and bag routes defined in the Material Flow Diagram (MFD) of the Contract Documents.

1.18.3 Ticketing

1.18.3.a Ticketing lines shall be 'primed' for operation through an Airport Security Authorization System provided by the Owner. The BHS Contractor must interface with this system to ensure only authorized ticketing personnel is allowed to start the ticketing conveyors.

1.18.3.1 External Interfaces

1.18.3.1.a Refer to Part 2 § 2.11.2 below for information relating to Airport Security Authorization System external interfaces.

1.18.3.1.b Refer to Part 2 § 2.11.3 below for information relating to security door external interfaces.

1.18.3.b The BHS Contractor shall coordinate with the Owner to determine the interface protocol between the CBIS/BHS and the Airport Security Authorization System.

1.18.3.c Key-switch over-rides (of the Airport Security Authorization System) with the key removable in both positions (one (1) key-switch per ticketing line) shall be provided that allows an authorized person to operate the ticketing conveyors as if the Airport Security Authorization system had been activated. When the key-switch override is active, an alarm shall be generated and reported on the Graphic system.

1.18.3.d A minimum of two (2) start control stations shall be provided, located adjacent to the end of each ticketing line. Final positioning of control stations shall be approved by the Owner.

1.18.3.e Authorization from the Airport Security Authorization System shall be provided when the following condition have been met;

1.18.3.2 Conditions to Authorize Operation

1.18.3.2.a A valid User had been activated by a ticketing counter card reader.

1.18.3.2.b Card readers shall be associated with ticketing belts.

1.18.3.2.c After authorized personnel have gained access to the ticketing system;

1.18.3.2.d The CBIS/BHS 'START' pushbuttons shall be 'primed' and flash.

1.18.3.2.e When a ticketing agent activates a 'primed' 'START' pushbutton;

1.18.3.2.f A local warning device in the ticketing area shall operate for a default configurable time of no less than six (6) seconds, to alert personnel in the area that conveyors are about to start.

1.18.3.2.g If conveyors downstream of the security door are not running, local warning devices adjacent to conveyors downstream of the security door shall operate for a default configurable time of no less than six (6) seconds, to alert personnel in the area that conveyors are about to start.

1.18.3.2.h When local warning devices downstream of the security door are complete, the conveyors downstream of the security door shall start, not including the conveyor directly under the security door.

1.18.3.2.i When the local warning device in the ticketing area is complete;

1.18.3.2.j The security door shall open.

1.18.3.2.k The ticketing conveyors shall start when the security door has opened (without fault) and the downstream conveyors are operating.

1.18.3.2.l When the ticketing conveyors are operating, the 'START' pushbuttons in the ticketing area shall illuminate continuously.

1.18.3.3 De-activation

1.18.3.3.a De-activation of the Airport Security Authorization System when a Ticketing line is active shall deactivate authorization for that Ticketing line (refer to Part 1 § 1.18.3.b above).

1.18.3.3.b When a ticketing agent deactivates authorization of the ticketing operation,

1.18.3.3.c The 'START' pushbuttons in the ticketing area shall flash.

1.18.3.3.d The public-side conveyors (excluding the conveyor under/immediately upstream of the door) if running shall stop immediately.

1.18.3.3.e The conveyor under/immediately upstream of the security door if running shall operate for its entire length until all bags have been transferred to the downstream conveyor and a clear space under the

door is detected in which case the conveyor shall stop.

1.18.3.3.f Or the clear space photocell detects a jam in which case the conveyor shall stop, an alarm shall be generated (jam and door failed to close) and the door shall not close.

1.18.3.3.g If the conveyor under the door is clear of baggage and no faults have been generated, the security door shall close.

1.18.3.3.h When the ticketing conveyors are stopped and the security door is closed (without fault), the 'START' push buttons in the ticketing area shall no longer be illuminated.

1.18.3.3.i Once the door is closed, conveyors downstream of the security door shall purge themselves of all baggage (last bag shutdown) and then complete a shutdown operation.

1.18.3.4 Operational STOP

1.18.3.4.a Provide an operational 'STOP' pushbutton at each ticketing operator station such that a User can stop the ticketing belts in the public area (associated with the operator station) to remove a bag without the need to activate an Emergency Stop device.

1.18.3.4.b An operational 'STOP' shall be alarmed on the SCADA system whenever active for more than a User Configurable time (default two (2) minutes) to alert operational personnel about the misuse of the operational stop.

1.18.3.4.c If an operational 'STOP' is active for a User Configurable time (default five (5) minutes), the conveyor under the security door shall stop immediately (if running) and the security door shall close in order to secure the Airside barrier.

1.18.3.4.d An alarm shall be generated on the SCADA system.

1.18.3.4.e The alarm shall only reset after the stopped conveyors have been restarted.

1.18.3.4.f Authorization to restart the conveyors shall require the following before the conveyors can be restarted.

1.18.3.4.g An active Airport Security Authorization System to be cycled (User badges out and then back in) or the over-ride key-switch to be cycled.

1.18.3.4.h An operational 'STOP' shall be illuminated 'Blue' and shall flash whenever active.

1.18.3.4.i An operational 'STOP' shall be reset by pressing the 'START' pushbutton. Once a valid start has been initiated, the operational 'STOP' illuminated pushbutton shall extinguish. Conveyors stopped by the operational 'STOP' shall restart after activation of warning devices.

1.18.3.5 External Interfaces

1.18.3.5.a Refer to Part 2 § 2.11.2 below for information relating to Airport Security Authorization System external interfaces.

1.18.3.5.b Refer to Part 2 § 2.11.3 below for information relating to security door external interfaces.

1.18.3.f The BHS Contractor shall coordinate with the Owner to determine the interface protocol between the CBIS/BHS and the Airport Security Authorization System.

1.18.3.g When the Airport Security Authorization System has granted access the 'START' pushbutton shall be 'primed' and flash. The 'prime' condition shall remain active for a configurable time (default sixty (60) seconds). If the 'START' pushbutton is not pressed by the Ground Handler within the configurable time, the system shall revert to an 'unprimed' condition requiring the Ground Handler to swipe the Airport Security Authorization System card reader again to request authorization to start the equipment.

1.18.3.h The functionality of E-stop, jam detection and jam reset, manual control of the security/fire shutter doors, over-height and over-length detection shall follow description within Part 2 § 2.9.11 to provide a fully functioning Sub-system.

1.19 VERIFICATION & ACCEPTANCE OF THE WORKS

1.19.1 General

1.19.1.a It is necessary to establish a systematic, carefully documented process to monitor and record the progress of verification and acceptance. Such a systematic process is the purpose of the System Acceptance.

1.19.1.b For each design and validation stage of the project lifecycle the Contractor shall submit a verification plan to establish the means by which each stage can be verified against the previous stage.

1.19.1.c The Owner will accept the system when all aspects of the system have been verified to comply with the requirements of the Contract Documents. As specified hereafter, verification will be accomplished by analysis, inspection, and testing. As a consequence, verification and acceptance is a step-by-step process, which takes place throughout the life of the Contract.

1.19.1.d The Owner's will define the System Acceptance Test Plan to be performed by the BHS Contractor under the Owner's direction. Upon receipt of the System Acceptance Test Plan the BHS Contractor shall be responsible to identify, plan, execute and document the analysis, inspection and test activities that are required to conduct the System Acceptance Test Plan.

1.19.1.e The BHS Contractor shall supply test baggage for all verification and acceptance activities.

1.19.1.f The following table provides an overview of the verification and acceptance activities:

Table 21 Verification and Acceptance Activities

Period		Activity
1	Design & Manufacturing	"Analysis" "Qualification Testing" (verifying design of components or sub-systems) "Factory Acceptance Testing" (each component/sub-system prior to dispatch to site)
2	Installation	"Inspections" and "Construction Testing"
3	Commissioning	"Post Installation Checkout" (pre-commissioning) "Sub-system Testing" "System Wide Testing" "On Site Integration Tests" "Availability Testing"
4	System Acceptance Testing	"System Performance Tests" "System Acceptance Tests" "Functional Tests" "System Demonstrations" "Completion of outstanding Works (Punch List)" "Training" "Airport Operational Readiness Tests" "Practical Completion"
5	Start-up System Monitoring & Support	"Beneficial Use" "Substantial Completion" "Defects Liability Period" / "Warranty Period" "Start-up System Monitoring & Support" "System Performance Compliance Report" "Final Completion and Acceptance"
6	Operation & Maintenance	Remaining O&M period beyond "Start-up System Monitoring & Support" period.

1.19.2 Period 1: Design & Manufacture

1.19.2.a During the Design and Manufacturing periods the following activities shall as minimum, but not limited to, form part of the verification and acceptance of the Works.

1.19.2.1 Analysis

1.19.2.1.a Analysis is the review of design data, test data, or other data describing the design and/or function of the CBIS/BHS, its sub-systems, assemblies, and components. Analysis includes the review of

engineering drawings, engineering reports, and test reports, including identification of national standards and/or codes, which an item meets.

1.19.2.1.b Analysis is the method of verification used when rigorous testing is impossible or impractical because of the required environmental or other conditions needed to conduct a realistic test.

1.19.2.2 Qualification Testing

1.19.2.2.a Qualification testing is the controlled testing of individual components or elemental assemblies, prior to incorporation into fabricated parts of the Works, for the purpose of verifying that the design of the tested item satisfies the requirements of the Contract. Through satisfactory qualification testing, basic designs for the project are qualified as meeting specified performance and/or other parameters and are thereby accepted for utilization and incorporation in manufactured and constructed parts of the Works.

1.19.2.2.b The BHS Contractor shall test and qualify the functional performance of selected components, assemblies or sub-systems prior to final construction, installation and/or assembly, as set forth herein. The selection shall be made by the Owner in corporation with the BHS Contractor.

1.19.2.2.c Product, assembly, or sub-assembly qualification tests shall be performed in accordance with applicable industry standard tests, if any, and Specifications and/or quality assurance test Specifications.

1.19.2.2.d Qualification testing may be of one or more of the following types:

1.19.2.2.1 BHS Contractor Testing

1.19.2.2.1.a BHS Contractor testing and submittal of test results that comply and are acceptable to the Owner as evidence that Contract requirements will be met.

1.19.2.2.2 Supplier Testing

1.19.2.2.2.a Supplier testing and submittal by the BHS Contractor of reports of certified test results acceptable to the Owner as evidence that Contract requirements will be met.

1.19.2.2.3 Previous Tests

1.19.2.2.3.a Previous testing of the item and submittal by the BHS Contractor of reports of certified test results acceptable to the Owner as evidence that Contract requirements will be met.

1.19.2.2.4 Owner Witness Testing

1.19.2.2.4.a Testing witnessed by the Owner’s representatives and results acceptable to the Owner as evidence that Contract requirements will be met.

1.19.2.2.5 Service Proven

1.19.2.2.5.a Evidence of service proven equipment with documented results and certification acceptable to the Owner as evidence that Contract requirements will be met.

1.19.2.2.e The Owner shall require qualification testing for all new designs and product modifications for which acceptable data submittals are not provided. In general, sub-system or component qualification test may be waived by the Owner, if acceptable data is available for the same design or identical equipment proven in a similar application or by a prior qualification test. It is not the intent of this requirement to require additional testing where sufficient other qualifying data are available.

1.19.2.2.f The conditions for granting a waiver of qualification testing of a component or sub-system are as follows;

1.19.2.2.6 Waive Qualification Testing

1.19.2.2.6.a The design is identical to a design, which has been qualified by previous qualification testing.

1.19.2.2.6.b If qualified by previous testing, copies of testing documents shall demonstrate results to the same or greater level of detail as described in this section.

1.19.2.2.g When the BHS Contractor plans Qualification Tests to serve as a means of verifying Contract compliance, the BHS Contractor shall specifically identify the test as a "Test for Contract Compliance".

1.19.2.2.h The BHS Contractor shall notify the Owner at least thirty (30) days in advance of the anticipated test date; the Owner shall be notified at least fourteen (14) days in advance of the actual test date. The Owner shall have the right to witness any and all qualification tests.

1.19.2.2.i After the completion of each qualification test, the BHS Contractor shall submit the qualification test data and results of the test in attest report to the Owner for review. The Owner will notify the BHS Contractor in writing that the test results are acceptable, acceptable as noted, or not acceptable and the reason, therefore. Any equipment found not to be in compliance with the Contract Documents during a qualification test may be rejected by the Owner.

1.19.2.3 BHS Contractor's In-House Testing

1.19.2.3.a The BHS Contractor shall perform in-house factory testing of parts, assemblies, and sub-systems whether mechanical, electrical, controls or software based prior to shipment to the site to check and establish proper individual operation.

1.19.2.3.b Prior notification to the Owner of in-house factory tests is not required unless as a result of design review or other information, the Owner requests to be notified.

1.19.2.3.c The Owner shall, however, have the right to witness any factory tests, conducted for whatever purposes, if such test is material to the BHS Contractor's performance of this Contract.

1.19.2.3.d It is the intent of this Section to present the general scope of factory testing to be conducted by the BHS Contractor, but not to prescribe exact methods for conducting such tests. The BHS Contractor may use established test procedures for conducting the factory tests where such procedures are appropriate to meet the Contract requirements.

1.19.2.4 Factory Acceptance Testing

1.19.2.4.a Factory Acceptance Testing (FAT) shall as minimum be conducted at the BHS Contractor's manufacturing facilities for verifying the use of proposed products/parts/components/equipment that did not meet the prequalification requirements at time of bidding. The Owner and/or his representative shall be present at all FAT's.

1.19.2.4.b Should proposed products/parts/components/equipment not fulfill the Contract requirements at time of FAT the BHS Contractor shall use proven products/parts/components/equipment instead at no cost to the Owner. No additional time shall be granted due to such products/parts/components/equipment replacements.

1.19.2.4.c The fulfillment of performance and/or functional requirements at time of FAT shall not relieve the BHS Contractor for demonstrating and fulfilling the same performance and/or functional requirements on-site as part of the integrated system.

1.19.2.4.d The BHS Contractor shall notify the Owner at least thirty (30) days in advance of the anticipated test date; the Owner shall be notified at least fourteen (14) days in advance of the actual test date.

1.19.2.4.e After the completion of each FAT, the BHS Contractor shall submit the FAT data and results of the test in a test report to the Owner for review. The Owner will notify the BHS Contractor in writing that the test results are acceptable, acceptable as noted, or not acceptable and the reason, therefore. Any equipment found not to be in compliance with the Contract Documents during a qualification test may be rejected by the Owner.

1.19.3 Period 2: Installation

1.19.3.a During the installation period the following activities shall as minimum, but not limited to, form part of the verification and acceptance of the Works.

1.19.3.1 Inspections

1.19.3.1.a Inspection is the examination of specific physical elements of the CBIS/BHS, its sub-systems, assemblies, and components and Works under way.

1.19.3.1.b Inspection may include the taking of specific static measurements such as length, width, or height where simple measuring devices are used.

1.19.3.1.c In cases where physical inspection of specific assemblies or components is not possible because of manufacture or construction, inspection is carried out by the review of reports of previously conducted inspections.

1.19.3.1.d Inspections may be carried out in combination with other verification methods, such as testing, where visual observation as well as the taking of measurement data is necessary to verify a particular requirement.

1.19.3.1.e Inspection of construction materials, samples of materials and sub-construction assemblies shall be conducted as construction proceeds at the site to check and establish that construction plans, and

Specifications are met.

1.19.3.1.f Inspection of materials and subassemblies used in the BHS Contractor's Works shall be conducted by the BHS Contractor, supplier, or specialty sub-contractor to verify that the installed materials meet or exceed the Contract requirements.

1.19.3.1.g The Owner, his representative or the Main Contractor may perform inspections to verify quality, progress and/or compliance with the Contract requirements and report any deviations to the BHS Contractor for his immediate rectification.

1.19.3.b Any Works not in conformance with the Specification shall be recorded on the Action Item List and shall be rectified by the BHS Contractor as follows:

1.19.3.2 Installation Rectification Timelines

1.19.3.2.a Any item affecting on-going or planned Works shall be completed within seven (7) calendar days.

1.19.3.2.b Any item affecting the integrity of structure or safety of an area shall be completed within seven (7) calendar days.

1.19.3.2.c All other items shall be completed within thirty (30) calendar days.

1.19.3.c The BHS Contractor shall rectify all Action Item List issues identified during the Installation period before commencing the Commissioning period. Under no circumstances shall non-conformance items affect progress of subsequent activities or jeopardize personnel, system, or equipment safety.

1.19.4 Period 3: Commissioning

1.19.4.a During the Commissioning period the following activities shall as a minimum, but not limited to, form part of the verification and acceptance of the Works.

1.19.4.b Commissioning is the systematic evaluation of performance, safety, functionality, and reliability of the CBIS/BHS as a whole, its sub-systems, assemblies, and components. The BHS Contractor's internal verification shall be accomplished through the BHS Contractor's commissioning activities defined herein.

1.19.4.c Performance parameters are measured using specific instrumentation and recording devices appropriate to that parameter or the employment of testing laboratories.

1.19.4.d All commissioning tests shall be conducted using pre-defined and agreed procedures, which shall be followed in a step-by-step fashion. Test data and results shall be formally recorded and evaluated for conformance to the requirements of the Contract Documents and prepared test procedures.

1.19.4.e On completion of all tests and inspections, documentation verifying that proper testing and inspection has been successfully completed shall be submitted to the Owner

1.19.4.f The following are specific types of commissioning tests that shall be performed by the BHS Contractor. The Owner is to be notified of all BHS Contractor commissioning tests and may witness any and all BHS Contractor commissioning activities.

1.19.4.1 Post-Installation Checkout (pre-commissioning)

1.19.4.1.a Post-installation checkout testing shall be an immediate step following the physical installation and energization of system equipment. The BHS Contractor shall systematically perform post-installation checkouts to verify the proper functional performance of individual items of equipment before the item is integrated with other sub-system or equipment.

1.19.4.1.b Prior notification to the Owner of post-installation checkout activities is required unless, as a result of design review or other information, the Owner requests not to be notified in writing.

1.19.4.1.c The BHS Contractor shall notify the Owner at least five (5) days in advance of the scheduled post-installation checkout date.

1.19.4.2 Sub-system Commissioning

1.19.4.2.a Once individual items have passed the systematic post-installation checkout the BHS Contractor shall perform sub-system commissioning verifying the correct and proper operation and performance of the collective items forming the sub-system.

1.19.4.2.b The sub-system commissioning activities shall verify that each sub-system, and assemblies thereof, are installed and interconnected in accordance with accepted design drawings and installation

instructions, and that they function in accordance with the intended design. The sub-system commissioning shall demonstrate that the sub-system can process the required throughput at peak rate over a minimum sustained period of fifteen (15) minutes excluding any ramp-up and ramp-down time.

1.19.4.2.c The BHS Contractor shall notify the Owner at least fourteen (14) days in advance of the anticipated test date; the Owner shall be notified at least five (5) days in advance of the actual test date.

1.19.4.3 System Wide Commissioning

1.19.4.3.a System Wide Commissioning is the testing performed when all sub-systems are tested together to establish their individual and collaborate performance on site to check and verify that the operation is in accordance with the Contract Documents.

1.19.4.3.b The BHS Contractor shall notify the Owner at least thirty (30) days in advance of the anticipated commissioning test date; the Owner shall be notified at least fourteen (14) days in advance of the actual test date.

1.19.4.3.c All System Wide commissioning shall be completed prior to initiation of System Acceptance Testing of the system.

1.19.4.4 External Interface Commissioning

1.19.4.4.a The integration of the CBIS/BHS with the external systems vital for the airport operation shall be performed by the BHS Contractor as required to meet the schedule.

1.19.4.4.b The External Interface Commissioning shall as a minimum cover the communication and control system of the CBIS/BHS with other airport systems, such as Flight Allocation System, Departure Control System (DCS)/BSM interface, Baggage Reconciliation System (BRS), fire system (subject to instruction from the Owner), Airport Security Authorization System (ASAS), which shall be completely tested and verified prior to initiation of the System Acceptance Testing.

1.19.4.4.c The BHS Contractor shall notify the Owner at least thirty (30) days in advance of the anticipated commissioning test date; the Owner shall be notified at least fourteen (14) days in advance of the actual test date.

1.19.4.g Any Works not in conformance with the Specification shall be recorded on the Action Item List and shall be rectified by the BHS Contractor as follows:

1.19.4.5 Commissioning Rectification Timelines

1.19.4.5.a Any item affecting on-going or planned Works shall be completed within seven (7) calendar days.

1.19.4.5.b Any item affecting the integrity of the system operation or safety shall be completed within seven (7) calendar days.

1.19.4.5.c All other items shall be completed within thirty (30) calendar days.

1.19.4.h The BHS Contractor shall rectify all Action Item List issues identified during the Commissioning period before commencing the System Acceptance period. Under no circumstances shall non-conformance items affect progress of subsequent activities or jeopardize personnel, system, or equipment safety.

1.19.5 Period 4: System Acceptance Testing

1.19.5.a During the System Acceptance Testing period the following activities shall as minimum, but not limited to, form part of the verification and acceptance of the Works.

1.19.5.b Upon completion of the BHS Contractor's commissioning activities and commencement of System Acceptance Testing with the Owner, the BHS Contractor shall stipulate to the Owner that the system is compliant with the Contract Documents.

1.19.5.c The BHS Contractor shall in cooperation with the Owner maintain a detailed Punch List detailing all defects found through the System Acceptance Testing activities. The BHS Contractor shall rectify all defects on the Punch List.

1.19.5.d The Owner shall have the right to add items to the Punch List. These shall be communicated to the BHS Contractor through progress meetings, test observations or general project correspondence.

1.19.5.e The Punch List shall contain information about each defect item, including but not limited to the following;

1.19.5.1 Contents of Punch List

1.19.5.1.a Sub-system name and ID

1.19.5.1.b Location (building, floor level, sector, grid number) of defect/observation/item

1.19.5.1.c Description of the defect

1.19.5.1.d Item categorization (Mechanical, Electrical, Control (LLC), Computer/networking (HLC), Software, Miscellaneous)

1.19.5.1.e Date defect was raised/identified.

1.19.5.1.f Individual raising the defect.

1.19.5.1.g BHS Contractor's planned rectification date (re-inspection)

1.19.5.1.h BHS Contractor status (open/closed)

1.19.5.1.i Date of BHS Contractor completion

1.19.5.1.j BHS Contractor representative closing the defect.

1.19.5.1.k Date(s) available for retesting/re-inspection

1.19.5.1.l Date(s) retested/re-inspected.

1.19.5.1.m Owner status (open/closed)

1.19.5.1.n Date of Owner approval

1.19.5.1.o Owner representative closing the defect.

1.19.5.f The BHS Contractor shall submit an accurate and up-to-date Punch List to the Owner as requested by the Owner and as defined by the submittal requirements in Part 1 § 1.13.

1.19.5.2 System Performance Testing

1.19.5.2.a After the BHS Contractor has performed the commissioning activities defined in Period 3 Commissioning and have determined that the equipment and systems are performing properly, the BHS Contractor shall plan, execute and document System Performance Tests in accordance with the accepted System Acceptance Plan to verify Contract compliance to the Owner.

1.19.5.2.b The Owner shall have the right to define the content and objectives of the acceptance test procedures for System Performance Tests, however the BHS Contractor is responsible for the planning, execution, and documentation of System Performance Tests. For each test, the attendees shall be recorded and form part of the test documentation.

1.19.5.2.c The BHS Contractor shall carry out the necessary preparation and pre-test runs prior to conducting acceptance tests with the Owner to ensure that acceptance tests conducted with the Owner and/or his representative are successful as specified in the Contract and agreed test procedures.

1.19.5.2.d It is the Owner's who solely determines if a test passes or fails based on the pre-defined test criteria in-line with the Contract Documents. It is the BHS Contractor's responsibility to prove to the Owner that tests pass through the documentation of test observations, test results, log files, and posttest analysis/investigation under close monitoring and cooperation with the Owner.

1.19.5.2.e With the submission of the test results to the Owner, the Owner will maintain a summary list over passed, failed and outstanding tests.

1.19.5.2.f A part of the System Performance Tests shall include the System Demonstration described in Part 3 § 3.28.3 below.

1.19.5.g The BHS Contractor shall rectify all Punch List items identified during the System Acceptance Testing within fourteen (14) calendar days of completion of the System Acceptance Testing. Under no circumstances shall defects and Punch List items affect live operation or jeopardize personnel, system, or equipment safety.

1.19.6 Period 5: Start-up System Monitoring & Support

1.19.6.a During the Start-up System Monitoring & Support period, which commences with the live operation and beneficial use of the system the BHS Contractor shall provide monitoring and support as defined in Part 3 § 3.32 and Part 3 § 3.32

1.20 TEST BAGGAGE

1.20.1 General

1.20.1.a The BHS Contractor shall provide test baggage and IATA compliant test bag labels for all testing, Commissioning, System Acceptance Testing, and verification activities. Test bags approved by the Owner shall be provided with the following mix.

Table 22 Test Baggage Characteristics & Mix

Bag Size	Width	Length	Height	Mix
Medium	24”	24”	12”	35%
Large	24”	36”	18”	61%
Very large	24”	54”	24”	4%

1.20.1.b The characteristics of the test baggage shall be representative of the typical baggage seen at the Airport. The weight of the test baggage shall cover the range of allowed baggage weight for the CBIS/BHS with an average weight of 20 lbs. per bag.

1.20.1.c The contents of the test baggage shall be non-destructive to the equipment.

1.20.1.1 Contents of Test Bags

1.20.1.1.a The use of sand shall not be allowed.

1.20.1.1.b The use of water shall not be allowed except for static load testing.

1.20.1.1.c The contents of test bags shall not disrupt the security screening images.

1.20.1.d The BHS Contractor shall clearly and permanently mark each piece of test baggage such that it is easy to distinguish test baggage from live operational baggage.

1.20.1.e Every test bag shall be uniquely numbered in a manner than is easily recognizable while be transported though the CBIS/BHS.

1.20.1.f Bags intended to simulate an alarmed condition from the security screening machine shall be marked in such a manner as to easily identify the bag from other test baggage. The quantity of these bags shall be a typical representation for this airport. Test baggage, which is deemed suspect for a particular security screening level shall be marked such that this is easily identified, and it is easy to observe the correct baggage routing/sorting on-site.

1.20.1.g At time of Substantial Completion, the BHS Contractor shall remove all test baggage from the site except for twenty (20) items, which are to be handed over to the Owner for use by the Maintenance personnel.

1.21 SPARE PARTS

1.21.1 General

1.21.1.a The BHS Contractor is responsible for providing and furnishing spares during the Commissioning and Site Acceptance Testing periods until Substantial Completion has been provided by the Owner. Spares for such activities shall be present on-site no later than at time of commencement of Commissioning.

1.21.1.b The BHS Contractor shall establish and continuously keep spare parts records, for each stock item, where dates and times of parts introduced, used, replaced, exchanged, withdrawn; checking, maintenance, inventory carried out; and any notes or observations are specified. The spare parts records shall be made available to the Owner at any time upon request.

1.21.1.c The BHS Contractor shall, as defined in the requirements for submittals, prepare and submit his recommended spare parts list taking the guaranteed reliability into account.

1.21.1.d The BHS Contractor shall establish and submit to the Owner detailed spare parts lists, for each stock item, indicating item identification, description, date of inclusion (based on revision), and number of units of all spare parts included in the spare parts stock.

1.21.1.e The BHS Contractor shall undertake to make sure that every kind of Spare Part for the System, whether the part is included or not in the Spare Parts stock, shall be available for supply throughout the lifetime of the CBIS/BHS.

1.21.1.f All spare parts provided shall be new. No refurbished parts are acceptable.

1.21.1.g Spare parts purchased by the Owner shall be furnished on-site within the lead time listed and agreed in the spare part list. Delay in delivery less than twenty-four (24) hour is acceptable, while the BHS Contractor shall compensate the Owner for any additional delay.

1.21.1.h The BHS Contractor shall have on-site and provide sufficient warranty spare parts to cover all replacement items until the Owner has issued Substantial Completion for the Works and all warranty items during the Warranty period. In the event that the BHS Contractor's warranty inventory becomes exhausted, any and all spares withdrawn from the Owner's inventory of spare parts to address warranty issues shall be replaced by the BHS Contractor at no cost to the Owner within seven (7) days of such withdrawal. For every single item/component/assembly withdrawn from the Owner's Spare Parts inventory to address the BHS Contractor's warranty obligations, the BHS Contractor shall provide two (2) replacement items/components/assemblies.

1.21.1.i The Owner shall purchase spare parts to replace non-warranty parts such that the system can be kept running and operational after Substantial Completion. Such inventory of non-warranty spares shall not be in lieu of or relief the BHS Contractor from his responsibility of having warranty spares available on-site throughout the Warranty period.

1.21.1.j The Owner or his nominated O&M Service Provider shall manage the inventory of non-warranty spare parts from the date of receipt of inventory by the Owner.

1.22 PARTS AVAILABILITY

1.22.1 BHS Contractor's Manufactured Equipment

1.22.1.a The BHS Contractor shall ensure that all components used including non-standard customized and proprietary parts shall be readily available for immediate delivery to the Owner throughout the lifetime of the system. If the BHS Contractor cannot comply with this requirement or should the price become unreasonably high, the BHS Contractor shall provide the Owner with all required manufacturing and assembly drawings and details for the Owner to have such parts manufactured by a 3rd party.

1.22.1.b The BHS Contractor shall guarantee the functionality, connect ability and interchangeability of spare parts from alternative sources of supply.

1.22.2 OEM Manufactured Equipment

1.22.2.a The BHS Contractor shall ensure that all OEM components used including non-standard customized and proprietary parts shall be readily available for immediate delivery to the Owner throughout the lifetime of the system. If the BHS Contractor cannot comply with this requirement or should the price become unreasonably high, the BHS Contractor shall provide the Owner with alternative equipment at no additional cost to the Owner.

1.22.2.b The BHS Contractor shall guarantee the functionality, connect ability and interchangeability of spare parts from alternative sources of supply.

1.22.3 Software

1.22.3.a The BHS Contractor shall ensure that there is a valid backwards compatible path for all software throughout the lifetime of the system.

1.23 SPECIAL TOOLS

1.23.1 General

1.23.1.a The BHS Contractor shall provide all special tools needed to perform the operation, service, and maintenance of the system.

1.23.1.b The following minimum tools shall be provided as part of the BHS Contractor's scope of supply;

1.23.1.1 List of Special Tools

1.23.1.1.a One (1) belt lacer sufficient to maintain any installed belt

1.23.1.1.b One (1) digital infrared temperature device including calibration certificate.

1.23.1.1.c One (1) tachometer to determine belt speeds including calibration certificate (configurable for ft/min and m/s)

1.23.1.1.d A minimum of two (2) control stations for configuration of VFD parameters.

1.23.1.1.e One (1) analogue/dial Vernier Caliper.

1.23.1.1.f One (1) Fluke clamp type digital multiple (type 355 or similar) capable of measuring AC voltage (1 to 600 V AC), DC voltage (1 to 600 VDC), AC Amps (0.1A to 400A), resistance (0.1 ohms to 40+ kiloohms), continuity tester (<30 ohms).

1.23.1.1.g One (1) fiber media break tester for multimode fibers (Fluke QuickMap or similar)

1.23.1.1.h Any special tool required to service any equipment provided

1.23.1.1.i Minimum one (1) integrated USB keyboard/mouse (track ball or touch-pad in lieu) for connection to Local Visualizations (Status Maps) to allow configuration changes of UI's by maintenance personnel.

1.23.1.c The BHS Contractor shall provide the above list of tools at commencement of System Acceptance Testing.

1.24 TRAINING

1.24.1 General

1.24.1.a The BHS Contractor shall provide operational and maintenance training as defined in Part 3 § 3.27 of this Specification.

1.25 WARRANTIES

1.25.1 General

1.25.1.a The BHS Contractor shall comply with the requirements defined in Division 1, Section 01 78 36 "Warranties and Bond" and Division 1, Section 01999 "Standard Forms". In addition to these requirements the following additional requirements shall apply.

1.25.1.b The BHS Contractor shall warrant the CBIS/BHS equipment for one (1) year against defective parts and labor and shall warrant all CBIS/BHS equipment for five (5) years against defective design, starting on the date of Final Acceptance of the Works.

1.25.1.c The BHS Contractor shall submit two (2) copies of written Warranty, signed by the BHS Contractor, Installer and Designer/Manufacturer, agreeing to repair or replace defective materials and workmanship during the Warranty period.

1.25.1.d Replace, at no additional cost to the Owner, any Works, materials, or equipment, which evidences defects in design, construction, or workmanship within the warranty period.

1.25.1.e Excessive wear shall be considered a defect within the provisions hereof.

1.25.1.f The BHS Contractor shall transfer all warranties to the Owner for materials and equipment received from Sub-Contractors and Suppliers at or before Final Acceptance.

1.25.2 Parts and Labor Warranty

1.25.2.a Provide a parts and labor warranty, which states that the BHS Contractor will proceed with and perform the Works in the best and most workmanlike manner and that the System, materials and equipment furnished and installed will be new and free of defects in materials, workmanship, installation, or incorrect component selection. It will also state that the functionality and technical requirements as specified in these Specifications and Contract Documents have been complied with.

1.25.2.b Any equipment replaced or found defective under the Warranty period that requires a substitution, design change, or modification shall be warrantied as required. All equipment of same type, make, model, etc. shall also receive the same substitution, design change, or modification as part of the BHS Contractor' warranty responsibility.

1.25.2.c Any warranty items requiring substitution, design change, or modification during the Warranty period shall deem the Warranty period to start over from the date of the last piece of like equipment was replaced under Warranty.

1.25.2.d Parts for Warranty work shall be shipped freight pre-paid to the location specified by the Owner. Failed/malfunctioning parts shall be returned to the BHS Contractor FOB within ten (10) days of notification of detection of such failed/malfunctioning parts.

1.25.2.e The parts and labor warranty must state that the BHS Contractor is providing all the necessary materials and labor, which are suitable and correct for the intended use of the system. Further, the warranty must state that the BHS Contractor conforms to all laws, statutes, ordinances, and codes applicable to the site of installation, and that it is suitable for the intended purpose.

1.25.2.1 Warranty Exclusions

1.25.2.1.a This warranty shall not apply with respect to any defects or unsuitable application which is attributed to repair, alteration, misuse or abuse by any person other than the BHS Contractor's personnel or designated Sub-Contractors. The BHS Contractor's liability shall be limited to repairing or replacing defective or non-performing part(s) at no cost to the Owner.

1.25.2.2 Period and Responsibility (Mechanical/Electrical Components)

1.25.2.2.a If within one (1) year from the date of Substantial Completion of the Works or any equipment or material is found in any respect to not conform to the warranty set forth herein, then the BHS Contractor shall within forty eight (48) hours of notification, commence works to correct and repair or replace the fault and/or malfunction, on-site during non-peak operating periods or at such times the Owner may direct without additional costs to the Owner.

1.25.2.2.b The Owner may choose to perform the warranty labor repair work with its maintenance staff at the BHS Contractor's expense. The BHS Contractor shall provide labor for Works related to design deficiencies.

1.25.2.3 Period and Responsibility (Controls/Software/Database)

1.25.2.3.a If within one (1) year from the date of Substantial Completion of the Works or any equipment or material is found in any respect to not conform to the warranty set forth herein, then the BHS Contractor shall in accordance with Off-Site Support requirements defined in Part 3 § 3.32.3, commence works to correct and repair or replace the fault and/or malfunction, on-site during non-peak operating periods or at such times the Owner may direct without additional costs to the Owner.

1.25.2.3.b The Owner may choose to perform the warranty labor repair work with its maintenance staff at the BHS Contractor's expense. The BHS Contractor shall provide labor for Works related to design deficiencies.

1.25.3 Design Warranty

1.25.3.a A design warranty shall be provided by the BHS Contractor guaranteeing the application and overall system design of the CBIS/BHS to be free from faults and defects in design. The design warranty shall be for a period of five (5) years starting on the date of Final Completion and Acceptance of the Works.

1.25.3.1 Design Defect

1.25.3.1.a A design defect shall include product selection, defective materials, workmanship, and installation and is hereby defined to include the following except where incidents are beyond the control of the BHS Contractor, Installer and Designer/Manufacturer:

1.25.3.1.1 Component Replacements of the Same Type

1.25.3.1.1.a More than two (2) failures of the same component within any six (6) months period of use.

1.25.3.1.1.b More than five (5) failures of the same component across any assemblies within any six (6) months period of use.

1.25.3.1.1.c More than two (2) unscheduled replacements of a component within the replacement schedule

defined in the BHS Contractor's O&M manuals even if the component is a wear and tear part.

1.25.3.1.b Consistent performance below required minimums.

1.25.3.1.c Excessive deterioration and/or aging.

1.25.3.1.d Abnormal wear considering intensity of use.

1.25.3.1.e Unsafe conditions and/or unsafe operation.

1.25.3.1.f Continual leakage/seepage of liquid from a seal or seal(s) of similar components performing similar operation.

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

1.25.3.1.h Excessive vibration.

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

1.25.3.1.j The Owner is unable to expand the system as defined in the Contract Documents due to limitations in the design. Examples include, but are not limited to;

1.25.3.1.2 Examples of Expansion Design Defects

1.25.3.1.2.a Inability to obtain/integrate additional required licenses to perform the desired expansion.

1.25.3.1.2.b The need to perform major code changes to expand system capability using existing functions.

1.25.3.1.2.c Inability to expand existing database tables.

1.25.3.1.2.d Inability to add required database tables.

1.25.3.1.2.e Inability to add required IP addresses.

1.25.3.2 Responsibilities of the BHS Contractor

1.25.3.2.a At any time within the five (5) years from Final Completion and Acceptance of the Works, any part of the Works, components or any part of the operating system is determined not to be in compliance with the warranty as described in these Contract Documents, the BHS Contractor, once notified by the Owner of such an issue, will have forty eight (48) hours to begin the necessary procedures to rectify the condition. The BHS Contractor shall as a minimum perform the following activities to rectify the situation:

1.25.3.2.1 BHS Contractor Activities

1.25.3.2.1.a Research the issue and determine the root cause of the failure or issue.

1.25.3.2.1.b Prepare the necessary documentation for submittal to the Owner for review and comments to be provided to the Owner within five (5) working days of notification. Such documentation shall include work to be performed and a detailed timeline for the BHS Contractor to complete the work and for the Owner to inspect the modifications.

1.25.3.2.1.c Incorporate the Owner's comments, or proceed, if the Owner approves the remediation proposed by the BHS Contractor within three (3) working days following comments or approval from the Owner.

1.25.3.2.1.d Ensure that all areas of the system containing or affected by the same design defect shall have the correction or remediation incorporated.

1.25.3.2.1.e The correction or remediation Works shall be coordinated with the Owner so as not to adversely affect the airport operations.

1.25.3.2.b The BHS Contractor shall at his own cost redesign a defective component and provide redesigned replacement components.

1.25.3.2.c The design and the part warranty period, not only for the component, but for the entire sub-system, shall restart with the effective date of the acceptance of the last installed correction or remediation.

2 PART 2 - PRODUCTS & COMPONENTS REQUIREMENTS

2.1 BHS CONTRACTORONTRACTOR QUALIFICATIONS

2.1.1 General

2.1.1.a All conveyor manufacturers can submit their company's qualifications and references thirty (30) days prior to bid for consideration.

2.1.2 BHS Contractor Qualifications

2.1.2.a The BHS Contractor must have completed the design, manufacturing, construction, and certification of at least three (3) PGDS screening systems of similar scope as herein specified within the last five (5) years, within the United States; and who has established a stable organization for service and spare parts.

2.1.3 BHS Installer Qualifications

2.1.3.a Equipment shall be installed by qualified workmen with factory-trained and certified supervisors.

2.1.3.b Supervisory personnel shall each have at least five (5) years of successful experience with the installation of airport conveyor systems and Claim devices of the type specified herein.

2.1.4 BHS Controls Contractor Qualification

2.1.4.a The BHS Controls Contractor must have completed the design, integration, and certification of at least three (3) PGDS screening systems and CBRA projects of similar scope as herein specified within the last five (5) years, within the United States.

2.2 APPROVED CBIS/BHS INTEGRATORS

2.2.1 BEUMER

2.2.1.a 6430 S Fiddlers Green Cir, Suite 250

2.2.1.b Greenwood Village, CO 80111, USA

2.2.1.c Phone: 732-893-2800

2.2.1.d Fax: 732-805-0475

2.2.1.e usa@beumergroup.com

2.2.2 G & S AIRPORT CONVEYOR

2.2.2.a G&S Mechanical Inc.

2.2.2.b 3409 West Harry St.

2.2.2.c Wichita, KS 67213

2.2.2.d info@gsairportconveyor.com

2.2.3 DAIFUKU

2.2.3.a 30100 Cabot Drive

2.2.3.b Novi, MI 48377

2.2.3.c Phone: (847) 565-9235

2.2.3.d Fax: (248) 553-1228

2.2.3.e AWuchte@jerviswebb.com

2.2.4 SIEMENS

2.2.4.a Siemens Energy & Automation inc.

2.2.4.b Infrastructure Logistics

2.2.4.c 2700 Esters Blvd. Suite 200B

2.2.4.d P.O. Box 613209

2.2.4.e DFW Airport, TX 75261

2.2.4.f Phone: 972-947-7100

2.2.4.g Fax: 972-947-7530

2.2.5 VANDERLANDE

2.2.5.a Vanderlande Industries

2.2.5.b 1828 West Oak Parkway

2.2.5.c Marietta, GA 30062

2.2.5.d Phone: 770-250-2800

2.2.5.e info@us.vanderlande.com

2.2.6 DIVERSIFIED CONVEYOR INTERNATIONAL, LLC

2.2.6.a 2163 Airways Blvd. Suite 300

2.2.6.b Memphis, TN 38114

2.2.6.c Phone (901)396-5370

2.2.6.d Sales (901)746-3018

2.2.6.e sales@teamdci.com

2.2.7 AUTOMATIC SYSTEMS Inc.

2.2.7.a Automatic Systems, Inc.

2.2.7.b 9230 E. 47th Street.

2.2.7.c Kansas City, MO 64133

2.2.7.d Phone: 913-530-1664

2.2.7.e ThuyKieu.Hohn@asi.com

2.2.8 ROBSON HANDLING TECHNOLOGY

2.2.8.a Robson Handling Technology USA Inc

2.2.8.b 129 S Main St #260.

2.2.8.c Grapevine, TX 76051

2.2.8.d Phone: 469-300-0410

2.2.8.e Shawn.Jones@robson-usa.com

2.3 APPROVED OEM EQUIPMENT SUPPLIERS

2.3.1 Conveyor Belt

2.3.1.a Forbo-Siegling

2.3.1.b Ammeraal

2.3.1.c Habasit

2.3.1.d Fenner Dunlop Americas

2.3.2 Motors

2.3.2.a SEW/Movimot

2.3.2.b Nord

2.3.3 Clutches

2.3.3.a Warner

2.3.3.b SEW

2.3.3.c Dodge

2.3.4 Reducers

2.3.4.a SEW

2.3.4.b Nord

2.3.5 Brakes (Electric)

2.3.5.a Warner

2.3.5.b SEW

2.3.5.c Dodge

2.3.6 Drum Motor (Motorized Pulleys)

2.3.6.a Van der Graff

2.3.6.b Interroll

2.3.7 Motor Starters

2.3.7.a Allen-Bradley

2.3.7.b Cutler Hammer

2.3.7.c Siemens

2.3.7.d Schneider Electric

2.3.8 Soft Start Devices

2.3.8.a Allen Bradley

2.3.8.b Siemens

2.3.8.c SEW

2.3.8.d Schneider Electric

2.3.8.e Nordic Controls

2.3.9 VFD

2.3.9.a Allen-Bradley

2.3.9.b Siemens

2.3.9.c SEW

2.3.9.d Danfoss

2.3.9.e Nord

2.3.10 PLC’s

2.3.10.a Allen-Bradley

2.3.10.b Mitsubishi

2.3.10.c Siemens

2.3.10.d Schneider

2.3.10.e Omron

2.3.10.f Modicon

2.3.11 Control Communication (Bus Network)

2.3.11.a Ethernet IP

2.3.11.b Profi-Bus

2.3.12 Photoelectric Sensors and Controls

2.3.12.a Allen-Bradley

2.3.12.b Cutler Hammer

2.3.12.c Siemens

2.3.12.d Omron

2.3.12.e Sick

2.3.13 MCP Cabinets/Enclosures

2.3.13.a Rittal

2.3.13.b Hoffman

2.3.14 Fusible Main Switch/Disconnect

2.3.14.a Allen-Bradley

2.3.14.b GE

2.3.14.c Siemens

2.3.14.d Schneider Electric

2.3.15 Circuit Breakers

2.3.15.a GE

2.3.15.b Siemens

2.3.15.c Schneider Electric

2.3.15.d Westinghouse

2.3.16 Motor Switch Disconnect

2.3.16.a Allen-Bradley

2.3.16.b Siemens

2.3.16.c Schneider Electric

2.3.17 Signaling Devices (Audible Alarms/Beacons)

2.3.17.a Edwards Co. Signaling Products Div.

2.3.17.b Allen-Bradley

2.3.17.c Siemens

2.3.18 Operator Devices (push buttons, E-stops, selector, and key switches)

2.3.18.a Allen-Bradley

2.3.18.b Siemens

2.3.18.c Schneider Electric

2.3.19 Relays

2.3.19.a Allen-Bradley

2.3.19.b Siemens

2.3.19.c Schneider Electric

2.3.20 Timers

2.3.20.a Allen-Bradley

2.3.20.b Omron

2.3.21 Draught Curtains

2.3.21.a Necor Corp.

2.3.21.b C&M Associates

2.3.22 Powered Fire/Security Doors

2.3.22.a Overhead Door, TX

2.3.22.b Atlas Door

2.3.22.c Stoebich

2.3.22.d Vigneauex

2.3.23 Servers

2.3.23.a Hewlett Packard

2.3.23.b Dell

2.3.24 Server Enclosure/Racks

2.3.24.a Hewlett Packard 10000 G2 series

2.3.24.b Emcor Isonet series

2.3.24.c APC, Netshelter series or equivalent

2.3.25 KVM Switch (Rack Mountable)

2.3.25.a Avocent

2.3.25.b Belkin

2.3.26 Operator Workstations (office environment)

2.3.26.a Hewlett Packard (Small Form Factor (SFF))

2.3.26.b Dell (Small Form Factor (SFF))

2.3.27 Remote Status Maps (field touch screen workstation)

2.3.27.a Siemens

2.3.27.b Allen-Bradley

2.3.28 Network Switches/Routers

2.3.28.a Cisco

2.3.29 Uninterruptible Power Supplies

2.3.29.a APC, smart UPS series

2.3.30 Printers (Laser type only)

2.3.30.a Hewlett Packard

2.3.30.b Xerox

2.3.30.c Epson

2.3.30.d Canon

2.3.30.e Brother

2.4 GENERAL COMPONENTS

2.4.1 Screws & Nuts & Bolts & Washers

2.4.1.a All screws, nuts, washers, and bolts used in non-public areas shall be electro galvanized or zinc plated.

2.4.1.b All visible screws, nuts, washers, and bolts used in public areas shall be stainless steel.

2.4.1.c Where nuts and bolts are used, they must not loosen through vibration.

2.4.1.d Nuts should be locked with a second nut or spring washer. Nylon locknuts should only be used where there is not the need to remove the nut for maintenance purposes.

2.4.1.e Nylon locknuts (Nylock) and washer shall be used on all floor to prevent the loosening of nuts due to vibration and the inherent compression of the vibration pad material when tightened down. The use of nylon locknuts is not allowed on hanger supports, which shall be provided with double nuts instead.

2.4.2 Use of Adhesives

2.4.2.a Adhesives to attach control components (labels excluded) is not allowed. All components shall be securely fastened either with retaining pins, captive screws or screws and lock-washers.

2.4.2.b Adhesives to attach labels shall be site proven such that labels do not fall off. Labels attached by adhesive that do fall off shall be regarded as a design defect.

2.4.2.c The use of “Loctite” is generally acceptable for the application between nut and bolt to ensure that nuts do not come loose.

2.4.3 Bearings

2.4.3.a All bearings shall be precision, self-aligning, low friction, pre-lubricated sealed-for-life bearings.

2.4.3.b The total number of different bearing sizes and types should be kept to a minimum to reduce the number of different size spares required.

2.4.3.c All bearings shall have a minimum L10 service life of fifty thousand (50,000) hours, based on the manufacturer’s published data, showing the rating of each bearing used against the peak working conditions.

2.4.3.d Bearings shall be mounted in flanged housings. In the event of return rollers, it is also acceptable to have pressed in bearings in the return idle roller.

2.4.3.e Bearing housings shall be securely fixed. Misalignment during operational periods shall not be possible.

2.4.3.f All exposed bearings shall be provided with bearing covers. Snap-on plastic bearing covers are acceptable; however, rigid steel bearing covers are preferred.

2.4.3.g Bearings must be capable of absorbing miss-alignment, machining tolerances and flexing of the shaft. Bearing inner race should be secured to the shaft to prevent concentric and axial movement. Adhesive or welding is not allowed.

2.4.3.h Bearings shall be easily replaced within twenty minutes (20 min). When replacing a bearing the alignment shall be automatically assured.

2.4.4 Vibration Dampers

2.4.4.a The equipment installed by the BHS Contractor shall not produce or induce objectionable vibrations into the building structure. Vibration levels induced by the system and/or its components shall not be injurious to the system or the building structure or be harmful or annoying to passengers and/or employees.

2.4.4.b The BHS Contractor shall mount all equipment on vibration isolators to eliminate such vibrations from being transmitted to the building. There must be no vibration noticeable in public and/or office spaces.

2.4.4.c Equipment and components associated with the CBIS/BHS system and that are surface mounted using header steel to building elements and/or mezzanines, shall not transmit any vibration to these structures.

2.4.4.d All equipment, header steel, hangers and other supports shall be installed in accordance and be fully compliant with all local, City & County, State and Federal seismic codes.

2.4.4.e Nylon locknuts (Nylock) must be used to prevent the loosening of nuts due to vibration and the inherent compression of the pad material when tightened down.

2.4.5 Anchor Bolts

2.4.5.a Anchor bolts shall comply with ASTM A-307 and be of the non-headed type unless otherwise indicated. Minimum size shall be 3/8” in diameter.

2.4.6 Structural Steel

2.4.6.a Structural supports shall comply with local State and Federal requirements.

2.4.6.b The BHS Contractor shall provide the structural and header steel (inclusive of all attachments and fitting) needed for the installation of the Works and provide all necessary materials. Structural steel is that Works defined in American Institute of Steel Construction (AISC) “Code of Standard Practice” and as otherwise shown in the Contract Documents.

2.4.6.c Maximum allowable “Total” imposed load deflection for structural members, including impact and dynamic effects, 1/500th of span for all members. “Total” imposed load is the combined walkway and conveyor system loaded with bags.

2.4.6.d Conveyors and all other mechanical handling elements forming part of the system must be capable of being started and stopped under full load conditions. Lateral forces generated by the system must be considered in the design of the platform.

2.4.6.e No attachments shall be welded to building structural members without written approval from the Owner. All drawings shall clearly denote any welding to the building structure in table form on the drawing.

2.4.6.f Provide product data and installation procedures for the following products (each type used);

2.4.6.g Provide design details and calculations certified and sealed by a licensed Professional Engineer (PE). Calculations shall show all pertinent members and pieces. Installation drawings shall clearly show profiles, sizes, locations of structural members, connections, attachments, anchorages, framed openings, size and type of fasteners, and clearances. Indicate welded connections using standard AWS symbols. Clearly indicate net weld lengths and sizes, root openings, bevel angles, and other information required to satisfactorily complete the welding operations.

2.4.6.h Provide test reports of all tests conducted on shop and field bolted and welded connections. Include information on tests conducted and test results. Test reports shall be submitted to the Owner within forty-eight (48) hours after completion of the test.

2.4.6.i The BHS Contractor shall arrange that his licensed Professional Engineer (PE) perform regular site surveys to inspect and identify discrepancies between actual installation and design. Provide certified survey reports to the Owner showing elevations and locations of all base plates and anchor bolts to receive structural steel and final elevations and locations of major members.

2.4.7 Materials

2.4.7.a The following materials shall be used. Should local standards exist for the below listed materials these shall take precedence over the listed American standards. The use of other materials shall be subject to prior approval by the Owner.

2.4.7.b Structural Steel Shapes, Plates and Bars: ASTM A 36, ASTM A 572 grade 50.

2.4.7.c Hot Rolled Wide Flange Shapes: ASTM A992 grade 50.

2.4.7.d Cold Formed Steel Tubing: ASTM A 500, Grade B.

2.4.7.e Hot Formed Steel Tubing: ASTM A 501.

2.4.7.f Steel Pipe: ASTM A 53, Type E or S, Grade B; or ASTM A 501. Black, except where indicated to be galvanized.

2.4.7.g Steel Castings: ASTM A 27, Grade 65-35, medium-strength carbon steel.

2.4.7.h Headed Stud-Type Shear Connectors: ASTM A 108, Grade 1015 or 1020, cold finished carbon steel; with dimensions complying with AISC Specifications.

2.4.7.i Unfinished Threaded Fasteners: ASTM A 307, Grade A, regular low carbon steel bolts and nuts.

2.4.7.j Provide hexagonal heads and nuts for all connections.

2.4.7.k High Strength Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers, as follows:

2.4.7.l Quenched and tempered medium-carbon steel bolts, nuts, and washers, complying with ASTM A 325.

2.4.7.m Quenched and tempered alloy steel bolts, nuts, and washers, complying with ASTM A 490.

2.4.7.n High strength bolted connections will use one of the following tension control systems.

2.4.7.o Direct tension indicator washers for A325 and A490 bolts. Washers and installation shall comply with ASTM F959-89.

2.4.7.p Electrodes for Welding: Comply with applicable welding codes and Specifications.

2.4.7.q Structural steel primer paint: Comply with applicable codes and Specifications. Alternatively, structural steel may be hot dip galvanized.

2.4.7.r Cement Grout: Portland cement (ASTM C 150, Type I or Type III) and clean, uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix at a ratio of 1.0-part cement to 3.0 parts sand, by volume, with minimum water required for placement and hydration.

2.4.7.s Non-metallic Shrinkage-Resistant Grout: Pre-mixed, non-metallic, non-corrosive, non-staining product containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water reducing agents.

2.4.8 Floor Supports

2.4.8.a Unless otherwise specified, steel floor supports shall be used to support CBIS/BHS equipment, which is installed 8’-0” or less above the floor (platform/mezzanine) level.

2.4.8.b All floor supports shall be of the H-type design and shall, if possible, not be wider than the equipment being supported to avoid trip points.

2.4.8.c The floor supports shall be located at the splice point or within 12” of the splice point for intermediate equipment sections. Maximum spacing between supports shall be no more than 10’-0” apart. Supports at head and tail end of conveyors shall be no more than 12” from the center of the end roller.

2.4.8.d Floor supports at conveyors used for loading applications, e.g., arrival and transfer inputs, shall have supports no more than 5’-0” apart.

2.4.8.e Floor supports shall be constructed of no less than #10-gauge formed or rolled mild steel and fitted with footplates and conveyor attachment brackets manufactured of no less than #10-gauge steel.

2.4.8.f The floor supports must allow for a vertical height adjustment in the field of no less than +/- 4”. All floor supports shall be true vertical.

2.4.8.g All floor supports shall be anchored to the floor with a minimum of two (2) anchors per support. No welding of floor supports to conveyor frame or building structures is permissible.

2.4.8.h Floor supports shall be limited to a maximum load of 750 lbs. each.

2.4.8.i All floor supports must be fitted with vibration dampers located either at the attachment point to the CBIS/BHS equipment frame or where they attach to the building structure.

2.4.8.j Floor supports, which are installed adjacent to building expansion zones (movement joints) and designed to allow for lateral movement between the building and CBIS/BHS equipment shall not be

anchored to grating or floor, but rather rest on a smooth steel plate of minimum #10-gauge thickness. The resting plate shall be fixed to the floor or grating. The floor support shall be braced.

2.4.9 Sway Bracing & Cross-Bracing

2.4.9.a All equipment shall be provided with sufficient sway bracing to eliminate lateral and longitudinal movement providing a rigid construction.

2.4.9.b Cross-bracing shall be provided between floor supports and hanger supports to ensure rigidity and eliminate lateral movement and vibration of the CBIS/BHS installation.

2.4.9.c Cross-bracing shall not obstruct access routes or pass under CBIS/BHS equipment.

2.4.9.d Cross-bracing shall be manufactured of a minimum 1-1/2” x 1-1/2” angle iron with welded nuts located at each end. A threaded rod of no less than 3/4” diameters and of no longer length than 2’-0” shall be screwed into these nuts allowing for adjustment at each end of the cross-bracing.

2.4.10 Protective Guarding

2.4.10.a All moving parts shall be protected by guarding to prevent personnel injury.

2.4.10.b All drive units shall be equipped with suitable guards to prevent unintentional entry by personnel into areas with moving parts. These shall be designed for easy removal for maintenance access and fabricated from a minimum #14-gauge painted mild steel.

2.4.10.c All guards shall comply with applicable OSHA standards and shall have expanded metal screen windows to allow for inspection of parts and belts where appropriate without removal of the total guard.

2.4.10.d Paint all such guarding as approved by the Owner.

2.4.10.1 Shaft Encoder Guards

2.4.10.1.a The guarding for shaft encoders and pulse generators shall allow visual inspection of the encoder or pulse generator.

2.4.11 Protective Curbing & Guardrails & Bollards

2.4.11.a In areas where CBIS/BHS equipment might be subject to damage from tugs, dollies and/or vehicles, the BHS Contractor shall install the necessary and appropriate guardrails and bollards (impact protection) to minimize or eliminate such damage.

2.4.11.b The impact protection shall be able to withstand impact from a tug containing four (4) fully loaded carts/dollies at a speed of 2 mph without damage to the equipment being protected.

2.4.11.c Guardrails shall be installed where baggage is loaded/unloaded, and the equipment is susceptible to damage from traffic.

2.4.11.1 Locations of Guardrails and Bollards

2.4.11.1.a Adjacent to Claim carousels, and Make-up devices

2.4.11.1.b Vehicle access doors

2.4.11.1.c Along staff walkways adjacent to vehicle traffic

2.4.11.1.d Protection of the building and columns against baggage vehicles.

2.4.11.d The design and installation of guardrails shall always be positioned with consideration for the areas being protected, including but not limited to;

2.4.11.2 Guardrail Design Considerations

2.4.11.2.a Maximize workspace including manned areas

2.4.11.2.b Maximize walkways.

2.4.11.2.c Maximize drive isles.

2.4.11.2.d Maximize turn radius.

2.4.11.2.e Avoid restrictions in maintenance access.

2.4.11.3 Load/Unload Areas

2.4.11.3.a The top of the guardrail shall be positioned 1/4” higher than the conveyor with a tolerance of +/- 1/8” such that a dolly/cart or other device riding the guardrail does not impact with the conveyor.

2.4.11.3.b At all times, the installation shall minimize the height that personnel have to lift baggage above the TOB in order to clear the guardrails.

2.4.11.3.c Installation methods in these areas shall take into consideration that the floor may not be level relative to the conveyor TOB and guardrails shall be manufactured for these areas such that the leveling process and height matching to the conveyor TOB can be accomplished with final welding done on-site.

2.4.11.3.d The distance between the conveyor and the guardrail shall be minimized to avoid personnel having to reach long distances to collect baggage, resulting in potential hazards and/or injuries.

2.4.11.4 Near Drive Units

2.4.11.4.a Guardrails installed adjacent to drive units and/or parts of the conveyor requiring maintenance shall be manufactured such that portions of the guardrail is easily removable in order to allow maintenance of the equipment, as necessary.

2.4.11.4.b Removable guardrails in these locations shall be manufactured of lengths sufficient to cover the area requiring maintenance only.

2.4.11.5 At Corners

2.4.11.5.a Guardrails at corners shall be manufactured such that snag points are not created.

2.4.11.5.b They shall be welded to adjacent guardrails so that the force of impact is absorbed by adjacent guardrails.

2.4.11.e The BHS Contractor shall employ a method that ensures nuts for anchors do not come loose due to continual vibrations from operating equipment, tug traffic, or otherwise, adjacent to or in the immediate area. Acceptable methods include but are not limited to;

2.4.11.6 Guardrail Fastening

2.4.11.6.a Thread locking fluid, thread locker (Loctite or equivalent).

2.4.11.6.b Lock washers.

2.4.11.6.c Captive nuts (Nyloc nut).

2.4.11.6.d Lock nut, Jam nut or similar.

2.4.11.f Guardrails not exposed to outside weather shall be painted safety yellow, while guardrails exposed to weather shall be hot-dipped galvanized.

2.4.12 Bollards

2.4.12.a To protect stand-alone columns or personnel access doors bollards shall be provided.

2.4.12.b The bollards shall be made of 8” steel pipe in diameter with a minimum thickness of ¼” The bollard shall be anchored to the concrete flooring with a minimum of four (4) anchor bolts of 6” length.

2.4.12.c Once the bollard has been installed it shall be filled with concrete.

2.4.13 Metal Under-Guarding

2.4.13.a All moving equipment, which is subject to personnel crossing underneath shall be provided with metal under-guarding. Under-guarding shall be provided on equipment less than 7’-6” from personnel access level.

2.4.13.b The maximum size of each under-guarding panel shall be no more than 60” x 40”. The minimum thickness shall be #14-gauge painted mild steel.

2.4.13.1 Fixed Metal Under-Guarding

2.4.13.1.a Locations with minimal personnel crossing underneath the equipment shall be provided with fixed metal under-guarding.

2.4.13.1.b The under-guarding shall be attached to the equipment with butterfly nuts on both sides.

2.4.13.2 Hinged Metal Under-Guarding with Slice Lock

2.4.13.2.a Locations with frequent personnel crossing underneath the equipment such as main maintenance access routes shall be provided with hinged metal under-guarding rather than fixed metal under-guarding.

2.4.13.2.b The under-guarding shall be hinged and attached with quick release safety slide lock pins on both sides.

2.4.13.c The BHS Contractor shall coordinate with the Owner where fixed and hinged under-guarding is provided.

2.4.14 Drip Pans

2.4.14.a Provide drip pans underneath all drives and other equipment subjective to oil leaks.

2.4.14.b Drip pans shall be capable of containing all fluid that might escape from the gearbox due to a seal failure.

2.4.14.c Pans shall cover the entire area that fluid may drip from. The drip pan shall be minimum 8” x 10” and have a minimum thickness of #14-gauge mild painted steel in the same color as the conveyor.

2.4.14.d The BHS Contractor shall provide a drain plug in each drip pan unless each drip pan is equipped with oil soaking pads.

2.4.15 Gap Pans/Debris Trays

2.4.15.a Provide gap pans underneath the transition between two (2) adjacent conveyors or where a gap is created between two (2) different types of BHS technology equipment such that the gap pan can collect debris from the operation.

2.4.15.b Gap pans shall cover the entire width of the conveyor/equipment.

2.4.15.c Gap pans shall slide in and out to one side only. The gap pan shall slide out to the side of the equipment where motors, and sensors are installed.

2.4.15.d The gap pan shall be minimum 8” wide, 1-1/4” deep and have a minimum thickness of #14-gauge mild painted steel in the same color as the conveyor.

2.4.15.e The gap pan shall be installed at a maximum distance of 4”-6” below the end rollers.

2.4.16 Control Station Stanchions

2.4.16.a Where required provide stanchions made of round or square steel tubing (stainless steel in lieu of mild steel in public areas) as coordinated with the Owner, to allow convenient installation of control stations.

2.4.16.b The location of stanchions shall not pose any risk of personnel injury or obstruction of baggage flow.

2.4.16.c The stanchions shall be rigid and securely fastened such that flex and movement of the stanchion is eliminated. Provide intermediate support where necessary.

2.4.17 Over-Size Restrictor Bar

2.4.17.a At all input points and load belts provide a mechanical over-size restrictor bar to stop over-height bags from entering the system. The following minimum locations are identified;

2.4.17.1 Locations of Restrictor Bar

2.4.17.1.a Immediately down-stream of ticketing take-away conveyors

2.4.17.1.b Immediately down-stream of arrival input point

2.4.17.b The restrictor bar shall use a combination of bag size detection and simple mechanical stop to prevent over-height bags from entering the system.

2.4.17.c The mechanical stop bar shall be positioned 4” higher than the maximum allowed bag height. The over-height detection shall be performed by a PEC and associated reflector mounted at the appropriate height above the TOB to ensure that the maximum height bag can enter the system, while bigger bags trigger the sensor.

2.4.17.d The restrictor bar shall be made of 2” round or square tubing security fastened to the floor, platform or mezzanine.

2.4.18 Painting

2.4.18.a All structural parts, except those surfaces coated with a galvanized coating, and those that would normally be unpainted (such as rollers, shafts, sprockets, bearings, pulleys, chains, nameplates etc.) shall be painted with two (2) coats of rust inhibiting enamel applied under controlled factory conditions. This includes all supports structure, bed undersides, drive structures, pulley guards, walkways, mezzanines, etc.

2.4.18.b Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.

2.4.18.c Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.

2.4.18.1 Prime Coats

2.4.18.1.a Before application of finish coats, apply a prime coat of material as recommended by the manufacturer to material that is required to be painted or finished and has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to assure a finish coat with no burn through or other defects due to insufficient sealing.

2.4.18.2 Stipple Enamel Finish

2.4.18.2.a Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling such as laps, irregularity in texture, skid marks, or other surface imperfections.

2.4.18.3 Pigmented (Opaque) Finishes

2.4.18.3.a Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

2.4.19 Powder Coating

2.4.19.a Alternative to painting the BHS Contractor may provide powder coated components/parts.

2.4.20 Equipment Identification

2.4.20.a The only permissible identification marking on any CBIS/BHS equipment is to be the specific equipment identification number for this project in public areas. Any other form of identification or markings on the equipment is not acceptable and must be removed, including but not limited to manufacturers name, brand, model number etc.

2.4.20.b All CBIS/BHS equipment shall be identified by its own discrete ID number on both sides of the equipment. Individual conveyor segments shall have their own unique ID. Each name plate shall contain a human eligible ID and associated barcode for handheld barcode readers.

2.4.20.c The identification must be in line with current equipment nomenclature and marking, if any. The BHS Contractor shall submit the naming convention as part of the FDS submittal. This shall cover all equipment (mechanical, electrical, control, IT, network, power, E-stop).

2.4.20.d In non-public areas the identification shall be made with permanent paint or in form of stencils and be black in color. Each character shall be nominally 4” in height and be located in a conspicuous location on both sides of the conveyor/equipment (adjacent to the conveyor drive in the case of a conveyor).

2.4.20.e Identification in public areas shall coordinated with and be approved by the Owner in writing.

2.4.20.f Conveyor data identification plates shall be clearly positioned adjacent to the drive, recording as installed / commissioned details of speed, motor type, serial no., belt type and belt length, no load running figures and pulley and belt configuration diagram. Similar data identification plates shall be provided for other equipment as applicable for this technology.

2.4.20.g All CBIS/BHS equipment numbering and MCP numbering shall be consecutive with no missing numbers. In the event of additions or deletions prior to each system completion, renumbering is required to adhere to this requirement. The BHS Contractor shall ensure that such renumbering is done thoroughly, and it is reflected in the drawings, controls, SCADA, documentation, and manuals.

2.4.20.h The BHS Contractor shall completely remove any temporary markings on new equipment associated with manufacture, shipping, or installation. In the event of temporary markings for the purpose of manufacture, shipping, or installation, assure that such markings are made using a medium, which is easily removable with water or any readily available solvent, so that they may be removed without requiring any refinishing of the surface on which they appeared.

2.4.20.i All device identification mounted on and/or adjacent to a conveyor, or TRS shall contain the conveyor, or TRS ID as a portion of the device ID as defined in Part 1 § 1.17.

2.4.20.1 Wire and Cable Marker

2.4.20.1.a For wire/cables smaller than No. 2/0 use manufacturer's standard vinyl-cloth self-adhesive cable/conductor markers of wrap-around type, either pre-numbered plastic-coated type, or write-on type with clear plastic self-adhesive cover flap are to be used and numbered to show circuit identification.

2.4.20.1.b All markings shall be machine printed. Handwritten markings are not allowed.

2.4.20.1.c All electric wire and cable shall be color coded and shall have the wire numbers as shown on the electrical drawings affixed to both ends of each cable and wire approximately 2” from the termination point to prevent obstruction of the label.

2.4.20.1.d For cables No. 4 AWG and larger heat shrink sleeving is to be used for phase color coding.

2.4.20.2 Plasticized Tags

2.4.20.2.a Provide manufacturer's standard preprinted accident prevention and operational tags, on plasticized card stock with matte finish suitable for writing, approximately 3-1/4” x 5-5/8”, with brass grommets and wire fasteners, and with appropriate preprinted wording including large-size primary wording, e.g., DANGER, CAUTION, DO NOT OPERATE in all appropriate locations.

2.4.20.3 Baked Enamel Danger Signs

2.4.20.3.a Provide manufacturer's standard "DANGER" signs of baked enamel finish on #20-gauge steel; of standard red, black, and white graphics; 14” x 10” size except where 10” x 7” is the largest size, which can be applied where needed; with recognized standard explanation wording, e.g., XXXX VOLTS, KEEP AWAY, BURIED CABLE, DO NOT TOUCH SWITCH, etc in all appropriate locations.

2.4.20.4 Engraved Plastic-Nameplates

2.4.20.4.a All electrical equipment shall be identified unless stated otherwise.

2.4.20.4.1 Nameplate Colors

2.4.20.4.1.a Nameplates for emergency equipment shall be laminated phenolic white letters on a red background.

2.4.20.4.1.b Nameplates for all other equipment shall be laminated phenolic black letters on a white background.

2.4.20.4.b Embossed plastic adhesive (Dymo) tape will not be accepted for nameplates.

2.4.20.4.c Nameplates shall be attached using a method that is affective and reliable and name plates do not fall off. The thickness shall be 1/16” for nameplates up to 20 square inches or 8” in length, and 1/8” for larger nameplates.

2.4.20.4.d Provide phenolic nameplates with a minimum letter height as indicated below. Examples are given below for the size of letters to use for a given application and this not a list of the equipment to be identified. All equipment is required to be identified.

2.4.20.4.2 Letter Sizes of Equipment Designations

Table 23 Letter Sizes of Equipment Designations

Equipment Designations	Size [inch]
Switchboards and motor control centers	0.5
Panel boards	0.25
For voltage, bus amperage, feeder source, and circuit number	0.125
Individual circuit breakers and or motor starters in motor control centers: Equipment designation and section number	0.25

Equipment Designations	Size [inch]
Individual circuit breakers and or motor starters in motor control centers: load served and location of load	0.125
Individual breakers in switchgears and switchboards: for breaker number (address number) and equipment designation	0.25
breaker frame size and trip setting	0.125
Individual circuit breaker and spaces in panel boards: for numbers (section number)	0.25
Individual circuit breakers in distribution panel boards for panel being fed	0.25
Individual circuit breakers in distribution panel boards for its location	0.125
Transformer equipment designation and size	0.25
Transformer primary and secondary voltages, primary source and circuit number, secondary load, and its location	0.125
Individual remote indicating lights, meters, instruments, and control switches (indicate unit, equipment, or fire detector being monitored and condition indicated by illumination)	0.125
Individual switches and pilots (identify mechanical unit being served)	0.125
Disconnects, relay panels, lighting contactors for voltage and source circuit number	0.125

2.4.20.4.e All junction (J) boxes and pull boxes shall be labeled to identify the circuits of the enclosed conductors.

2.4.20.4.f All control stations shall be labeled with the equipment controlled by the applicable E-stop zoning.

2.4.21 Draught Curtains

2.4.21.a Draught curtains shall be provided at all wall and floor penetrations to prevent draughts and unobstructed views of the baggage system beyond. The draught curtain shall completely cover the opening and shall not impede or interfere with normal operations (e.g., false trigger of photo-sensors).

2.4.21.b Draught curtains shall be made from overlapping flame retardant, oil resistant, sound damping, black plastic strips with teardrop edges. Teardrop edges shall be provided to avoid twisting of curtains. In areas with high draft, two (2) curtains behind each other shall be provided to minimize draft.

2.4.21.c Draught curtains shall have the fire-retardant properties.

2.4.21.d The draught curtain shall consist of strips in two (2) staggered layers with 4” overlap. Each curtain strip shall be 8” wide by 1/8” thick.

2.4.21.e The strips shall be full length, i.e., shall end only approximately ¼” above top of equipment surface.

2.4.21.f The draught curtain shall be installed by use of a stainless-steel frame in public areas. The SS frame shall be made of 2” wide angled strip, #14-gauge thick, and all sharp edged shall be removed. Use countersunk screws.

2.4.22 AC Motors & Gearboxes/Reducers

2.4.22.1 General

2.4.22.1.a The BHS Contractor shall furnish drive packages consisting of hollow shaft slip on C-face radial mounted right angle gear motor with torque arm in lieu of a drive train with individual components.

2.4.22.1.b The BHS Contractor shall furnish drive packages matching existing drive packages. The number of different combinations of motor and gearbox/reducer shall be minimized.

2.4.22.1.c All drives shall have a motor/reducer sized to permit start up under full load conditions as per specified loads and start/stop cycles.

2.4.22.1.d Inspection holes (motor/gearbox coupling for example) shall be positioned at the front for ease of inspection.

2.4.22.1.e Nameplates shall be orientated such that they are easily visible from the side or front. Nameplates that are covered by fixtures (drip pans for example) shall be relocated.

2.4.22.1.f Equipment shall be sized based on the dynamic and static loads defined in Part 1 § 1.16.8 and § 1.16.9 such that the equipment can be started, run, and stopped under full load conditions.

2.4.22.2 Minimum Equipment Controlled by VFD

2.4.22.2.a The BHS Contractor shall provide the following equipment with VFD controllers and suitably matched motors and gear boxes;

Table 24 Minimum Equipment Controlled by VFD

Item	Equipment
1	Conveyors in the screening lines to allow for future HBS changes
2	Queues/metering belts
3	Equipment operating at two (2) speeds
4	Any equipment required to do more than 10 stop/start per minute under normal operating conditions
5	Drives powering carousels
6	All drive motors with a rating greater than 4.0 kW

2.4.22.2.b The BHS Contractor shall demonstrate that it is cost beneficial to Owner to use conventional brake motors for the remaining equipment rather than VFD controlled equipment and there is no adverse effect from harmonic interference.

2.4.22.2.c Motors controlled by Variable Frequency Drives (VFD) shall be fitted with braking resistors for braking operations capable of controlled stopping the equipment under full load.

2.4.22.3 Motors

2.4.22.3.a Motors shall be mounted in a vertical orientation unless otherwise approved in writing by the Owner (location specific).

2.4.22.3.b All motors shall have a minimum service factor of 1.15.

2.4.22.3.c All motors shall be rated for continuous running duty (type S1) as specified per standard IEC 60034-1, i.e., one hundred percent (100%) duty factor, twenty-four (24) hours a day, seven (7) days a week, three hundred sixty-five (365) days a year.

2.4.22.3.d All motors shall achieve IE3 levels of energy efficiency either through compliance with IEC60034-30 (2008) Efficiency Level IE3, or using an IE2 motor in combination with a variable speed drive (VFD).

2.4.22.3.e All motors shall be NEMA Design “C”.

2.4.22.3.f All motors shall be High Starting Torque Continuous

2.4.22.3.g All motors shall be constant speed, continuous service, ball bearing type.

2.4.22.3.h All motors shall be Class “B” insulation (double insulated), totally Enclosed Fan-Cooled (TEFC) and thermal overload protection.

Table 25 NEMA Design Class

NEMA	Max Slip	Start Current	Locked rotor torque
Design C	5%	Low	High

2.4.22.3.i Motor size shall be limited between 0.33 HP and 7.5 HP. Provide all motors designed for the following power supply:

Table 26 Motor Power Supply Requirements

Specification	Rating
Voltage level [VAC]	208
Phases	3
Frequency [Hz]	60
Rotational speed (Asynchronous) [rpm]	1740
Rotational speed (Synchronous) [rpm]	1800

2.4.22.3.j All motors rated at less than 2 HP shall be high efficiency type (IE2) as per IEC 60034-30, while motors over 2 HP shall be premium efficiency type (IE3) as tested in accordance with IEEE Standard 112B and CSA 390 testing protocol, using accuracy improvement by segregated loss improvement as specified in NEMA Standard MG1-12.53a.

Table 27 IE3 Efficiency Levels in Percent

HP	kW	2 poles 50 Hz / 60 Hz	4 poles 50 Hz / 60 Hz	6 poles 50 Hz / 60 Hz
1	0.75	80.7 / 77.0	82.5 / 85.5	78.9 / 82.5
1.5	1.1	82.7 / 84.0	84.1 / 86.5	81.0 / 87.5
2	1.5	84.2 / 85.5	85.3 / 86.5	82.5 / 88.5
3	2.25	85.9 / 86.5	86.7 / 89.5	84.3 / 89.5
5	3.75	- / 88.5	- / 89.5	- / 89.5
7	5.5	89.2 / 89.5	89.6 / 91.7	88.0 / 91.0

2.4.22.4 Gearboxes & Reducers

2.4.22.4.a Gearboxes/reducers shall be mounted in accordance with manufacturers recommendation.

2.4.22.4.b Gearboxes/reducer leaks are not allowed.

2.4.22.4.c All provided gearboxes shall be of a spur gear, bevel gear, helical gear, or hypoid gear type to maximize efficiency of the gearbox. The use of worm gear is not acceptable and shall not be provided.

2.4.22.4.d All reducers shall have a minimum service factor of two (2).

2.4.22.4.e Reducers shall be rated to suit the arduous operating conditions and shall be sized for Class II application as minimum.

2.4.22.4.f Where gearboxes are fitted with a keyway, the key shall span the entire width of the gearbox hollow shaft. Keys shall be adequately contained such that they do not work loose.

2.4.22.4.g Gearboxes shall be sized such that the exterior temperature of the gearbox under normal operations does not pose a hazard to personnel through contact. A maximum temperature of one hundred and twenty (120° F) degrees is allowed.

2.4.22.4.h The reducer shall be shaft mounted with torque arm brackets for easy removal and replacement.

2.4.22.4.i The torque arm fixing shall be securely fixed through a shock absorbing mounting.

2.4.22.5 Electrical Brakes

2.4.22.5.a The brake shall be selected according to the motor manufacturer.

2.4.22.5.b Brakes shall have a mechanism to allow a manual release of the brake under loss of power conditions. The release shall be easily and readily accessible without special tools, components and/or disassembly. Once released, the brake must be capable of being re-engaged without the use of special tools, components and/or assembly/disassembly.

2.4.23 Clutches

2.4.23.a Clutches should be avoided where possible. VFD shall be the preference to provide proper control.

2.4.23.b Clutches shall be fitted to equipment where a VFD cannot provide proper control. The clutch shall be capable of handling two (2) times the full torque of the motor.

2.4.23.c The clutch shall be a dry-friction, mechanical disc type. No asbestos material is allowed.

2.4.23.d The clutches shall be capable of start/stop cycling rate of sixty (60) cycles/minute.

2.4.23.e The clutch shall be fitted between the motor and the input shaft of the right-angle shaft mounted gear reducer.

2.4.24 Brakes

2.4.24.a A brake shall be fitted to equipment where a VFD cannot provide proper control and where frequent start/stop cycling and bag tracking are used.

2.4.24.b The brake shall be of the dry friction, spring set and solenoid release type and be integral with the drive motor.

2.4.24.c The brake shall at a minimum have a torque rating equal to the drive motor.

2.4.24.d The brake shall be capable of cycling start/stop at the same rate as the conveyor to which it is applied.

2.4.24.e Brakes shall have a mechanism to allow a manual release of the brake that is easily and readily accessible without special tools, components and/or disassembly. Once released, the brake must be capable of being re-engaged without the use of special tools, components and/or assembly/disassembly.

2.4.24.1 Holding Brakes

2.4.24.1.a A holding brake shall be provided on all incline and decline conveyors with a greater than five (5º) degree slope.

2.4.25 Clutch/Brakes

2.4.25.a Where conveyor function requires a clutch and a brake, a single integrated clutch/brake unit shall be installed. Separate clutch and brake modules shall not be allowed.

2.5 BELT CONVEYOR EQUIPMENT

2.5.1 General

2.5.1.a The following requirements are intended as minimum requirements for regular transport belt conveyors within the system.

2.5.1.b Conveyors shall be designed for continuous operations. All moving parts, bearings and wearable parts shall have a proven life of fifty thousand (50,000) hours, based on average loading and proper belt tensioning.

2.5.1.c The conveyor design shall use horizontal flushed transfers between adjacent conveyors. The height difference from the head end (discharge) of the conveyor to the tail end on the receiving conveyor shall be 0” to allow for smooth baggage transition and photo eye detection of “bunched” bags from one conveyor to the next.

2.5.1.d Conveyors shall be capable of handling the maximum load requirements without fault.

2.5.1.e Conveyor sideguards and slider bed shall not damage baggage or belts.

2.5.1.f All metalwork on the conveyor shall have a smooth finish, free of any projecting fasteners, weld metal or sharp edges.

2.5.1.g All conveyors shall be fitted with a right-angle shaft mounted motor gearbox/reducer capable of a start/stop cycling of twenty (20) cycles/minute under full operational load unless otherwise specified within these Specifications.

2.5.1.h Unless otherwise stated, all belt conveyors shall have the following dimensions.

Table 28 Conveyor Dimensions

Type of Conveyor	Outside Width	Width between Sideguards	Belt Width
Standard conveyor	42”	39”	36”
Power/spiral turn	42”	39”	39”

2.5.1.i The maximum length of any conveyor shall not exceed 60’.

2.5.1.j Conveyors shall be designed such that they can be maintained without complete disassembly.

2.5.1.k Conveyors in the screening area shall be equipped with pluggable electrical connectors (quick disconnects) to allow fast access to EDS equipment (refer to Part 1 § **Error! Reference source not found.** for additional electrical requirements).

2.5.1.l All conveyors shall be equipped with photocells for jam detection.

2.5.1.m The conveyors shall be electrically grounded to protect against electrostatic build-up.

2.5.1.n Positive lock set screws shall not be used to lock bearings/hubs to pulley/roller shafts that might result in damage/burs on the shaft and restrict easy removal of equipment components from shafts (require puller and/or replacement of shaft).

2.5.2 Belts

2.5.2.1 General

2.5.2.1.a Belting shall be of a robust, flexible, and durable construction with low elongation properties and shall comply with the fire-retardant properties defined in .

2.5.2.1.b The Owner is interested in installing the most energy efficient operation possible and should the BHS Contractor elect to use belting other than the types specified below, the BHS Contractor shall provide sufficient information to demonstrate that the selected belting will provide equivalent or better energy efficiency.

2.5.2.2 Belting Material

2.5.2.2.a All belts shall have sealed edges.

2.5.2.2.b All belts shall be minimum two (2) ply with a low friction impregnated bottom surface and a top surface as per above application requirements. Minimum top surface thickness shall be 1/16", while the total belt thickness shall be 3 mm. PVC/rubber coated belts should be constructed with two plies of polyester mono filament. One ply of spun fabric should be included on the back of the belt.

2.5.2.2.c The material shall be capable of providing continuous service without showing appreciable wear, cracking, or fraying.

2.5.2.2.d All belts shall have low noise characteristics and shall not mark baggage.

2.5.2.2.e The carrying side of the belts shall be black color.

2.5.2.2.f The BHS Contractor shall submit his proposed belt selections for approval by the Owner prior to purchasing, supplying, or installing belts on site.

2.5.2.3 Belt Surfaces

2.5.2.3.a Belt surfaces shall be selected and suitable for the application as per the following table.

Table 29 Approved Types of Belt Surfaces

Type of Conveyor	Elevation	Belt Type
Level transport belt conveyors	(up to 5°)	Smooth top
Inclined/declined transport belt conveyor	(5° - 18°)	Rough top (RT) or Longitudinal Groove (LG)*
Queuing/metering/merge belt conveyors	Horizontal	Rough top or longitudinal groove
Powered power curves/spiral curves	As applicable	Rough top or longitudinal groove
Ticketing take-away conveyor	Horizontal	Smooth top
Receiving conveyor in 90° Butt turn configuration	Horizontal	Smooth top

2.5.2.3.b * LG is only recommended for incline/decline belts where low noise is a requirement.

2.5.2.4 Belt Joining

2.5.2.4.a The BHS Contractor shall be allowed to use either clipper lacing or alligator lacing for joining belts. The lacing shall be either Clipper "Unibar" or Anchor "Safety Belt Hook" type as per manufacturer's recommendation. Lacing shall not cause damage to conveyor components. In non-public areas the belts shall allow for quick removal and replacement for maintenance purposes.

2.5.3 Pulleys/Rollers

2.5.3.a All pulleys are to be statically balanced when operating at speeds in excess of two hundred (200) rpm, and dynamically when operating at speeds in excess of four hundred (400) rpm.

2.5.3.b Shaft diameters for all rollers shall be the same size to minimize gearbox model sizes required for spare parts. The range of pulleys shall be minimized.

2.5.3.c Pulleys shall be easily removable from the conveyor frame. Where it is required to remove conveyor pulleys there should be sufficient room to withdraw the pulley, complete with its shaft, at one side of the conveyor.

2.5.3.d Pulley diameters shall not be smaller than the belt manufacturer's recommendations.

2.5.3.e Pulleys and rollers shall support the belt for its entire width. All pulleys and rollers except for head and tail pulleys shall be at least 1" wider than the belt.

2.5.3.1 Pulleys/Shafts

2.5.3.1.a The maximum shaft run-out of all assembled pulleys, shafts and bearings under a no-load condition, measured from the centerline of the bearing to the end of the shaft farthest from the conveyor shall not exceed 0.0075" per inch.

2.5.3.1.b Maximum pulley run-out shall not exceed 0.060".

2.5.3.1.c All Pulleys and Shafts shall be designed to CEMA Standard No. B105.1-2009.

2.5.3.2 Head & Tail Pulleys

2.5.3.2.a Head and tail pulleys shall not be used as the drive pulley.

2.5.3.2.b All non-powered head and tail pulleys shall be of steel, equipped with compression type hubs and 1-7/16" minimum diameter shafts in accordance with CEMA Standard No. B105.1-2009 mounted in eccentric locking or taper lock type precision and ground flange type ball bearing units.

2.5.3.2.c All head and tail pulleys will be 6" diameter minimum with a #10-gauge wall thickness.

2.5.3.2.d Pulleys shall be of a single piece electric weld steel construction and have steel discs attached to the rim by continuous welding.

2.5.3.2.e Gap between adjacent end pulleys will not exceed 1" with ½" as the design objective.

2.5.3.2.f All head and tail pulleys used for belt tracking shall be equipped with jacking bolts to provide a total combined adjustment of 1-1/2" per conveyor. Jacking bolts are to be equipped with jam nuts to prevent jacking bolts from loosening.

2.5.3.2.g Pulley crowning shall be as recommended by the selected belting manufacturer.

2.5.3.3 Drive Pulleys

2.5.3.3.a All drive pulleys shall be equipped with compression type or taper lock hubs with 1-7/16" minimum diameter shafts. Drive pulleys shall be securely fixed to the shaft.

2.5.3.3.b The shaft shall be mounted in eccentric locking, compression or taper lock, precision, and ground flange type ball bearing units.

2.5.3.3.c Type of lagging and pulley crowning shall be as recommended by the selected belting manufacturer. The lagging material shall be compatible with the selected belting to reduce the potential for reversion.

2.5.3.3.d Minimum acceptable belt wrap on drive pulleys shall be nominal two hundred ten (210°) degrees to ensure the belt does not slip-on start-up with a fully loaded belt. The drive pulley shall not damage the belt surface and vice versa.

2.5.3.3.e Drive pulleys shall have a snub pulley to increase the angle of wrap to the required angle. Where the tension roller is behind the drive pulley this shall also be snubbed to maintain a constant angle of wrap.

2.5.3.3.f The drive should not be from the head pulley. Conveyor belts shall be driven on the underside of the belt.

2.5.3.3.g Reversible conveyors shall be driven from a separate drive pulley mounted centrally between the head and tail pulleys.

2.5.3.3.h Drive pulleys shall not be less than 6-3/4" in diameter. Drive shaft diameters shall be calculated per CEMA Standard No. B-105.1-2009, based on specified loads, conveyor width and type of shafting material used. These calculations shall be furnished to the Owner on request.

2.5.3.3.i Drive pulleys shall not be subjected to belt pulls greater than 50 lbs. per inch of width. Refer to Part 1 § 1.16.8 for dynamic load requirements.

2.5.3.4 Take-up Pulleys

2.5.3.4.a All take-up pulleys shall be a minimum of 4" diameter, steel, and equipped with compression type hubs with 1-7/16" minimum diameter shafts mounted in eccentric locking type precision and ground flange type ball bearing units.

2.5.3.4.b Pulleys will be mounted on threaded take-up devices with steel guides with a minimum of 6"

adjustment.

2.5.3.5 Belt Return Rollers

2.5.3.5.a Belt return rollers shall be of precision bearing design, minimum 3” diameter, #11-gauge steel equipped with a sealed, permanently lubricated caged ball, semi-precision type ball bearings.

2.5.3.5.b Return rollers shall be located on centers not to exceed 8’-0”, with spacing being reduced in areas where belting may drag against the floor or conveyor structure.

2.5.3.5.c A return roller shall be provided at the tail end of conveyors to assist with belt tracking.

2.5.3.5.d All return rollers shall be equipped with jacking bolts (adjustable retainers) at both sides of the conveyor to facilitate adjustment.

2.5.3.6 Snub Rollers

2.5.3.6.a Snub rollers shall be a minimum of 3-½” diameter, #11-gauge steel equipped with fixed (welded) 1-7/16” minimum diameter shaft mounted in eccentric locking-type precision and ground flange-type ball bearings.

2.5.3.6.b All snub rollers used for belt tracking shall be equipped with jacking bolts (adjustable retainers) at both sides of the conveyor to facilitate adjustment.

2.5.3.6.c Quantity and location shall be as recommended by manufacturer to ensure positive belt tracking.

2.5.3.6.d Reversible conveyors shall be provided with snub rollers at both head and tail ends.

2.5.3.7 Lagging

2.5.3.7.a Drive pulleys for end-type, drum motors or center drives shall be lagged with a minimum of 3/8” thick vulcanized lagging of 50-60 durometer,

2.5.4 Slider Bed

2.5.4.a Conveyor slider bed shall be continuous and of sturdy construction and made of minimum #11-gauge steel with a strong and well braced frame consisting of a minimum of 5” x 1-½” x #11 gauge formed channel frame rails with cross braces and a maximum of 3’-4” centers on transport lines and 2’-6” centers on input/load conveyors.

2.5.4.b Cross braces shall be located so as not to contact the belt run under any operational circumstances.

2.5.4.c Slider beds shall be arranged to keep the gap between the end section and the end pulley to a minimum.

2.5.4.d Conveyor bed sections that belting slides over shall remain unpainted for the entire surface area that the belt is likely to contact during normal operations.

2.5.4.e A method for eliminating a sticking effect between belt and slider bed shall be provided. Air holes or other means to accomplish this is subject to Owner review and approval.

2.5.5 Sideguard

2.5.5.1 General

2.5.5.1.a Sideguards shall consist of formed channel of minimum #14-gauge thick steel with stiffeners (bracing) on a maximum of 3’-4” centers on transport lines and 2’-6” centers on input lines.

2.5.5.1.b Unless otherwise noted, sideguards shall be provided on both sides of the conveyor.

2.5.5.1.c The top rail of all sideguards shall be formed with ¾” double folds to eliminate exposed sharp edges and snag points.

2.5.5.1.d Adjacent conveyors shall be bolted together. Welding is not permitted as an assembly technique.

2.5.5.1.e No conduits or cableways or permanently fixed services shall be installed on removable side guards.

2.5.5.2 Heights

2.5.5.2.a The height of sideguards (whether integral to the frame or separate) at manned areas shall following the ergonomic requirements listed in Part 1 § 1.16.17, while the height at all other locations shall follow below requirements.

Table 30 Sideguard Heights

CBIS/BHS Area	Height from TOB
General transport belts, horizontal power curves, queues	12”

2.5.5.2.b Ensure that the height of adjacent sideguards is properly aligned and within 1/16” maximum height difference.

2.5.5.3 Transitions

2.5.5.3.a All sideguards must blend smoothly with adjacent conveyors’ sideguards, and in doing so, eliminate the possibility of creating any catch points.

2.5.5.3.b Bolted butt type coupling joints shall be installed between adjacent sideguards. Lapped sideguards are not allowed.

2.5.5.3.c Any openings in sideguards in connection with security screening machines or other equipment in-line shall be flared open in the direction against the flow. Potential snag points created by the flared guard shall be eliminated through the installation of a fill in.

2.5.5.3.d Any openings in sideguards shall be flared open in the horizontal direction for proper operation and to avoid potential snag points.

2.5.5.3.e Whenever there is a height difference in adjacent sideguards e.g., at access points (e.g. in-feed, & out-feed of EDS machines, cross-overs, etc.), provide transitions at a maximum of sixty (60°) degrees to the horizontal to match the height of the sideguard of the downstream conveyor to eliminate potential snag points.

2.5.5.3.f Provide transitions at a maximum of sixty (60°) degrees to the horizontal up to 12” height where a conveyor without a sideguard transitions to downstream conveyors with side guards to eliminate potential snag points.

2.5.5.4 Sensor Holes

2.5.5.4.a All sensor holes in sideguards shall be press dimpled from the inside and outwards such that catch points are avoided.

2.5.5.4.b All sensor holes shall be deburred to avoid burrs and sharp edges. Exposed bare metal shall be properly painted.

2.5.5.4.c Unused sensor holes are not allowed and shall be filled with welded steel plate ground smooth and painted.

2.5.5.5 Sideguard Impact Reinforcement

2.5.5.5.a Provide additional stiffeners and/or cross bracing integrated into the rear of the sideguard on sideguards adjacent to discharge positions where bags are transferred/diverted. Continue stiffeners/cross bracing for a minimum of 24” beyond the most downstream point where bags may impact.

2.5.6 Conveyor Skirts

2.5.6.a Removable skirts shall be bolted to the top of the frame on the operator side of input and manned conveyors to protect personnel operating in close proximity to the conveyor.

2.5.6.b Provide skirts of no more than 10’ lengths to allow easy removal for maintenance.

2.5.6.c Transitions between adjacent skirts shall be smooth to avoid catch points.

2.5.6.d Skirts shall consist of #14-gauge or heavier sheet metal and cover the side framing of the conveyor to protect against snag points or moving parts.

2.5.7 Finger Guard

2.5.7.a At conveyor junctions where a pinch-point is created by two (2) adjacent end pulleys, a finger guard or additional height sideguard shall be provided to minimize the risk of hands or other objects getting caught.

2.5.7.b Head and tail pulleys and relieving idlers shall be short faced and the gap between the ends of the pulley and the side plates made good with a static shroud to the profile of the pulley. The shroud shall be wide enough such that the pulley cannot become exposed under normal operating conditions.

2.5.8 Take-up Section

2.5.8.a All belt conveyors must be fitted with a take-up station for belt tensioning and tracking to compensate for belt stretching.

2.5.8.b This can consist of either a separate tensioning station or integrated into the drive station. In either case, the minimum take-up capacity for conveyors of 8'-0" or greater in length must be no less than 18" or one percent (1%) of total belt length, whichever is the largest.

2.5.8.c It shall be possible to adjust the belt tension from only one side of the conveyor using an integrated mechanism that links the tensioning components on both sides of the conveyor such that movement of the tension mechanism on one side of the conveyor automatically adjusts the tension mechanism on the other side of the conveyor by the same amount such that proper tracking of the belt is maintained.

2.5.8.d Belt tension adjustment shall be achievable without removing guards or other conveyor disassembly.

2.5.8.e Reversing conveyors shall have the facilities for tracking the belt in both directions of travel.

2.5.9 Straight Transport Belt Conveyors

2.5.9.1 General

2.5.9.1.a The slope angle of straight transport conveyors shall follow the requirements of Table 14 in Part 1 § 1.16.10.

2.5.9.2 Mechanical

2.5.9.2.a General transport conveyors shall be capable of handling a minimum of ten (10) stop/start operations per minute continuously under full load.

2.5.9.2.b The conveyor intermediate frame should be formed from mild steel. It can either be formed as a sub-frame into which a slider-bed is fitted and onto which the side-guards are attached, or as a one-piece design where the frame is formed from one piece comprising both side-guard and frame. A sturdy slider bed shall be fitted within the frame.

2.5.9.2.c The frame shall have supports not less than 10' apart. Total deflection should not exceed 1/16" over 10'. The frame should be formed from no less than #11-gauge painted mild steel.

2.5.9.2.d Return rollers must be installed for the support of the return belt.

2.5.9.2.e Whenever possible, the drive station shall be located at the discharge (head) end of the conveyor.

2.5.9.2.f Head end type drives (without use of drive station) shall not be used for any conveyor length.

2.5.9.2.g Conveyors exceeding 25'-0" shall be provided with a drive station with the drive station preferably at the head end.

2.5.9.3 Electrical

2.5.9.3.a Ensure that the design and installation comply fully with the general electrical requirements defined in Part 2 § 2.8.

2.5.9.3.b Provide a jam PEC at the head (discharge) end of all conveyors.

2.5.9.3.c Provide a tail end jam PEC at all incline conveyors greater than or equal to fifteen (15°) degrees to detect rolling bags.

2.5.9.4 Controls

2.5.9.4.a Provide PLC functions as required to provide a fully functioning and working system in compliance with these Specifications. Refer to Part 2 § 2.9.

2.5.10 Ticketing Conveyors

2.5.10.a The general requirements defined for straight transport belt conveyor as defined in Part 2 § 2.5.9 shall apply for ticketing conveyors as well as the following additional specific requirements.

2.5.10.1 Mechanical

2.5.10.1.a The length of take-way conveyors shall not exceed 30'.

2.5.10.1.b The BHS Contractor shall ensure that snag points and traps for ticketing agents operating adjacent to ticketing conveyors are eliminated to avoid damage to clothing and/or personnel who may come

into contract with the conveyor during normal operations.

2.5.10.1.c The BHS Contractor shall ensure that all edges are rounded and ground smooth to eliminate hazards.

2.5.10.1.d Provide an over-height and over-length sensor to prevent over-size bags from getting into the system.

2.5.10.1.e Stainless steel cladding shall be provided as defined in Part 1 § 1.16.15. The stainless-steel cladding shall be easy removable in order to perform inspections, adjustments and/or maintenance including removal and/or replacement of components.

2.5.10.1.f The ticket counter conveyors shall not exceed the noise levels specified in section Part 1 § 1.16.11.

2.5.10.1.g Provide flush access hatches allowing easy access to motor isolator disconnects such that the equipment can be lock-out/tag-out in accordance with OSHA requirements before any maintenance is performed. The access hatch cover shall be attached using flush counter-sunk machine screws.

2.5.10.2 Electrical

2.5.10.2.a Ensure that the design and installation comply with the general electrical requirements defined in Part 2 § 2.8.

2.5.10.2.b Provide a general-purpose duplex power outlet at each ticketing counter for maintenance purposes. This outlet shall not be in plain view of passengers.

2.5.10.3 Controls

2.5.10.3.a Provide PLC functions as defined in these Specifications to provide a fully functioning and working system. Refer to Part 2 § 2.9.

2.5.10.3.b Provide energy conservation functions as defined in Part 2 § 2.9.11.14.

2.5.10.3.c Provide rigid floor mounted stanchion for the operation panels as defined in Part 2 § 2.4.16

2.5.10.3.d One (1) light beacon (visible warning) shall be provided at the top of the stainless-steel sideguard for every 60’ 20 m of take-away conveyor.

2.5.10.3.e Provide audible warning device (horn) as an integrated component of the visible warning (light beacon) device.

2.5.10.3.f The ticket counter shall be provided with two (2) weighing scale displays displaying the readings from the scale. One (1) display for passengers and one (1) for the check-in agent. Each display shall show weight of current bag, total weight, and bag count.

2.5.10.3.g The displays shall simultaneously show both individual bag weight (from 0 to 220 lbs.) and total bag weight (from 0 to 2200 lbs.) in 1 lb. increments. An overload situation shall create a fault message to the check-in agent.

2.5.10.3.h It shall be possible to alternate the weighing unit displayed between metric “kg” and imperial “lbs.” by a switch. It shall be possible to turn on/off and reset to zero the weight display.

2.5.10.3.i Provide the necessary interface such that the scale readings can be communicated to the airlines departure control system (DCS) for their revenue operations.

2.5.10.3.j Adjacent to all ticketing conveyors a control station with the following controls shall be provided on a stanchion above the ticketing conveyor. One (1) control station centrally located shall be provided adjacent to each ticketing take-away conveyor within easy reach of the operator. Location shall be coordinated with the Owner.

Table 31: Tail-End Ticketing Conveyor Control station

Designator	Color	Interface	Status & Position	Function
START	Green	IMPB	Lamp off	Sub-system stopped
			Lamp blinking (1Hz)	Staff ID card approved. Sub-system ready enabled to start
			Lamp on	Sub-system running
			Pressed	Start-up sub-system

Designator	Color	Interface	Status & Position	Function
OPERATIONAL PAUSE	Blue	MCPB	Pressed	Ticketing take-away conveyor stops allowing staff to get bags if they forgot to attach a label. Security doors will not close unless operational stop is active for more than sixty (60) seconds (configurable) and the take-way conveyors shall shut-down.
SHUT DOWN	Red	MCPB	Pressed	Logs out the operator from the specific take-away conveyor controlled by this control station and the green light in the START pushbutton shall extinguish. If no other take-away conveyors are active all take-away conveyors shall stop immediately, and the security doors shall close upon run empty. If other up-stream take-away conveyors are active all operating conveyors shall continue running. If only down-stream take-away conveyors are running this take-away conveyor shall shut-down. Refer to Part 2 § 2.9.11.3
ACCESS READER	-	Staff ID reader	ID approved	Sub-system is energized and allowed to start-up upon activation of 'START' as coordinated with Airport security
			ID rejected	Sub-system is not energized and will not start-up upon activation of 'START'
E-STOP	Red	ILPB	Lamp off	No E-stop condition
			Lamp blinking (1Hz)	E-stop condition released. Reset can be performed.
			Lamp on	E-stop condition. Mushroom head pushbutton is still activated.
			Pressed	Activates the E-stop. Equipment stops.
START-UP ALARM	Black	Buzzer	On	Sounder for audible start-up warning.

2.5.10.3.k At the public, non-secure side of the wall penetration, provide a control station with the following controls flush mounted on the wall adjacent to the wall opening at a height easily accessible by the operator. Location shall be coordinated with the Owner.

Table 32: Public Side Head-End Ticketing Take-Away Access Reader Control Station

Designator	Color	Interface	Status & Position	Function
AUTO / ACCESS OVERRIDE	Black	2LKS	Auto	When the key-switch is in AUTO the ticketing conveyor shall only start after obtained authorization from the Airport Security Access System.
			Access Override	When the key-switch is in ACCESS OVERRIDE the ticketing conveyor can start-up without authorization from the Airport Security Access System.

Designator	Color	Interface	Status & Position	Function
START	Green	IMPB	Lamp off	Sub-system stopped
			Lamp blinking (1Hz)	Staff ID card approved. Sub-system ready enabled to start
			Lamp on	Sub-system running
			Pressed	Start-up sub-system after the start-up audio warning.
OPERATIONAL PAUSE	Blue	MCPB	Pressed	Ticketing take-away conveyor stops allowing staff to get bags if they forgot to attach a label. Security doors will not close unless operational stop is active for more than sixty (60) seconds (configurable) and the take-way conveyors shall shut-down.
SHUT DOWN	Red	MCPB	Pressed	Logs out the operator from the specific take-away conveyor controlled by this control station and the green light in the START pushbutton shall extinguish. If no other take-away conveyors are active all take-away conveyors shall stop immediately, and the security doors shall close upon run empty. If other up-stream take-away conveyors are active all operating conveyors shall continue running. If only down-stream take-away conveyors are running this take-away conveyor shall shut-down. Refer to Part 2 § 2.9.11.3
JAM RESET	Amber	IMPB	Lamp off	No fault condition
			Lamp blinking (1Hz)	Fault condition and sensor is no longer occupied. Reset of fault can be performed.
			Lamp on	Fault condition. Sensor is still occupied.
			Pressed	Resets the fault condition.
OVERSIZE RESET	White	IMPB	Lamp off	No fault condition
			Lamp blinking (1Hz)	Oversize condition no longer present. Reset of fault can be performed.
			Lamp on	Oversize condition detected. Sensor is still occupied.
			Pressed	Resets the fault condition.
ACCESS READER	-	Staff ID reader	ID approved	Sub-system is energized and allowed to start-up upon activation of 'START' as coordinated with Airport security
			ID rejected	Sub-system is not energized and will not start-up upon activation of 'START'
E-STOP	Red	ILPB	Lamp off	No E-stop condition
			Lamp blinking (1Hz)	E-stop condition released. Reset can be performed.
			Lamp on	E-stop condition. Mushroom head pushbutton is still activated.
			Pressed	Activates the E-stop. Equipment stops.

Designator	Color	Interface	Status & Position	Function
HAND / OFF / AUTO	SS	3LKS	Hand	Runs all conveyors continuously in the zone bypassing the PLC
			Off	Isolates all conveyors in the zone (disable)
			Auto	All conveyors in the zone are automatically controlled by the PLC
START-UP ALARM	Black	Buzzer	On	Sounder for audible start-up warning.

2.5.10.3.l Authorized staff shall be allowed to stop the sub-system immediately and close the security/fire door by using the SHUT-DOWN pushbutton.

2.6 DOORS

2.6.1 Security Shutter Doors

2.6.1.1 General

2.6.1.1.a Security shutter doors shall be provided at all penetrations between public and non-public areas. Security shutter doors shall be upgraded to fire rated security shutter doors when such doors are installed at penetrations of fire rated walls or where the building fire code requires.

2.6.1.1.b It shall not be possible for passengers or personnel to manually open any security shutter door with brute force. The BHS Contractor shall provide an electro-mechanical locking bolt solution if the intended security measure cannot be achieved with a clutch/brake motor on the security door.

2.6.1.1.c Security shutter doors shall be electro-mechanically operated from a dual power supply arrangement, fed from separate sources or alternatively a single power supply with UPS battery back-up to ensure that the system always has uninterrupted power supply.

2.6.1.1.d Security shutter doors shall failsafe in the event of total power or PLC failure and be tested and certified.

2.6.1.1.e The BHS Contractor shall ensure that the installers of security shutter doors are certified.

2.6.1.2 Mechanical

2.6.1.2.a Coordinate the installation and framing of the security shutter door with the Owner and Architect.

2.6.1.2.b Provide a manual release device (e.g. hand wheel/chain) adjacent to the security shutter door, to allow the door to be manually operated (opened/closed) in the event of an electrical malfunction or power is not present. A fixed mechanical stop shall be provided to prevent door damage.

2.6.1.2.c The opening of the security door shall be minimum 55” wide and 36” high above TOB.

2.6.1.2.d Install the security shutter door at the non-public side of walls.

2.6.1.2.e Provide draught curtain across the width of the wall opening.

2.6.1.3 Electrical

2.6.1.3.a Ensure that the design and installation comply with the general electrical requirements defined Part 2 § 2.8.

2.6.1.3.b The security door shall operate using a 208 VAC, 3 phase, 60-hertz motor provided by the door manufacturer.

2.6.1.3.c UPS battery backup, if capable, shall be able to operate the security shutter doors for a minimum of 30 minutes.

2.6.1.4 Controls

2.6.1.4.a Provide start-up beacon and horn adjacent to the security shutter door. The start-up delay shall be adjustable.

2.6.1.4.b Provide a control station adjacent to the security shutter door to locally operate the door.

2.6.1.4.c Provide an alarm at SCADA whenever the local control station is in manual operation.

2.6.1.4.d Allow the conveyor line under the door to operate if the door is in manual operation and the Upper limit switch is activated as if the door had opened automatically.

2.6.1.4.e Provide a local fault reset function that must be operated to reset any fault generated by the door to ensure that an operator performs an inspection of the door before resetting the fault and allowing the door to operate.

2.6.1.4.f Provide a remote reset at the MCP and SCADA if the control station becomes damaged.

2.6.1.4.g When the security shutter door separates public and non-public area, the local control panel shall be placed on the non-public side of the door.

2.6.1.4.h In the event that both sides of the security shutter door are in a non public area, the local control panel shall be placed on the most secure side of the door.

2.6.1.4.i If both sides of the security shutter door are of equal security value, the local control panel shall be placed on the downstream side of the door.

2.6.1.4.j The security shutter door shall be fully integrated into the operation of the equipment penetrating the wall (and the fire alarm detection system when the door is fire rated (refer to Part 2 § 2.6.2).

2.6.1.4.k It shall be possible via SCADA to identify the status of each security shutter door.

2.6.1.4.l Provide separate limit switch detector for fully open and fully closed door positions and alarm and monitor such at SCADA. Such limit switches shall be installed on separate brackets external to the door roll housing.

2.6.1.4.m Ensure that limit devices are active whenever the security shutter door is electrically operated in manual mode to allow setting of the detectors and ensure that a User cannot inadvertently damage the door.

2.6.1.4.n Security shutter door motor isolation shall be monitored and alarmed on the SCADA to alert operations personnel that the door cannot close automatically under power.

2.6.1.4.o Provide a local fault reset function to reset any fault generated by the security shutter door to ensure that an operator performs an inspection of the door before resetting the fault and allowing the door to operate.

2.6.1.4.p Provide functionality to check and ensure that the space under the security shutter door is clear before stopping the conveyor and closing the door.

2.6.1.4.q Ensure that limit detection devices are active whenever the door is operated in manual mode to allow setting of the detectors and ensure that a User cannot inadvertently damage the door.

2.6.1.4.r Properly integrate the door into the operation of the equipment penetrating the wall.

2.6.1.4.s Provide a clear space detection photocell within 12” of the security shutter door.

2.6.1.4.t Extended blockage of the space under the security shutter door when the conveyor is running shall be detected as a jam.

2.6.1.4.u The edge of the security shutter door shall have strip sensor to detect when the door come in contact with object as it closes. Upon activation of the strip sensor the door shall reopen and appropriate alarm shall be raised at SCADA.

2.6.1.4.v Provide functionality that allows the security shutter door to close automatically during a power failure.

2.6.1.4.w The security shutter door shall be interlocked such that it cannot be started/operated unless the door is in the fully open position.

2.6.1.4.x If the security shutter door comes off the fully open position the conveyor under the door stops immediately.

2.6.1.4.y The conveyor line under the security shutter door shall operate if the door is in manual operation and the door is fully open.

2.6.1.4.z Where the security shutter door is controlled by an integrated controller supplied by the door manufacturer operation using timers shall not be used and the door shall be capable of interfacing with the CBIS/BHS controls for automatic opening and closing.

2.6.1.4.aa The operation of security shutter doors shall interface with the Automatic Security Authorization

System (e.g. card swipe reader at check-in) as this is an integral part of the airport security clearance preventing unauthorized people from starting and stopping systems. Refer to Part 2 § 2.11.2

2.6.1.4.bb Provide separate limit switch detector for fully open and fully closed door positions and alarm and monitor such at SCADA. Such limit switches shall be installed on separate brackets external to the door roll housing.

2.6.1.4.cc Door motor disconnects/isolators shall be monitored and alarmed on the SCADA whenever the disconnect/isolator is in the OPEN/OFF position, to alert operations personnel that the door cannot close under power.

2.6.1.4.dd If the security shutter door comes off the open limit switch during normal operation, interlock the conveyor/door such that the conveyor under the door stops immediately and upstream conveyors cascade as bags block the head end photocell of each upstream conveyor. Attempt to open the door automatically and restart the conveyor (if the door opens). Maintain failed to open functionality, alarming and reporting if the door fails to open.

2.6.1.4.ee The security shutter door shall automatically close when the equipment has not operated for a User Configurable time. Upon restart of the equipment the security shutter door shall open automatically, if authorization by the Automatic Security Authorization System is not required (to be coordinated with the Owner on a case by case basis).

2.6.1.4.ff Alarm and fault the security shutter door whenever the following conditions occur. Report each condition individually.

2.6.1.4.1 Monitored Door Conditions Shown at SCADA

2.6.1.4.1.a The motor overload is activated.

2.6.1.4.1.b The door open, opening and failed to open.

2.6.1.4.1.c The door closed, closing, and failed to close.

2.6.1.4.1.d The door is in an unexpected condition, e.g. opened when it should be closed. Provide an alarm to report a potential security breach.

2.6.1.4.1.e The door has been open for an extended period (typically five (5) minutes) and the conveyor under the door is not operating (for any reason).

2.6.1.4.1.f Door in manual

2.6.1.4.1.g Bag jam at door

2.6.1.4.1.h Door strip sensor activation (closed on object/obstruction)

2.6.1.5 C/S#9: Security Door Control station

Table 33 C/S#9: Security Door Control station

Designator	Color	Interface	Status & Position	Function
AUTO / MAINT	Black	2LKS or 2LSS	Auto	When the selector-switch is in AUTO the fire/security door operates in automatic
			Maint	When the selector-switch is in MAINT the fire/security door operates in local maintenance mode.
DOOR OPEN	Black	IMPB	Lamp off	Fire/Security door is fully closed
			Lamp blinking (1Hz)	While the fire/security door is opening and until door is in the fully opened position.
			Lamp on	Fire/Security door is fully open.
			Pressed	When pressed the fire/security door will open.
	Black	IMPB	Lamp off	Fire/Security door is fully open

Designator	Color	Interface	Status & Position	Function
DOOR CLOSE			Lamp blinking (1Hz)	While the fire/security door is closing and until door is in the fully closed position.
			Lamp on	Security door is fully closed
			Pressed	When pressed the fire/security door will close.
JAM RESET	Amber	IMPB	Lamp off	No fault condition
			Lamp blinking (1Hz)	Fault condition and sensor is no longer occupied. Reset of fault can be performed.
			Lamp on	Fault condition. Sensor is still occupied.
			Pressed	Resets the fault condition.
START	Green	IMPB	Lamp off	Sub-system stopped
			Lamp blinking (1Hz)	Sub-system starting
			Lamp on	Sub-system running
			Pressed	Start-up sub-system
TECH FAULT RESET	Blue	IMPB	Lamp off	No technical fault condition
			Lamp blinking (1Hz)	Technical fault condition at door and sensor is no longer occupied. Reset of fault can be performed.
			Lamp on	Technical fault condition. Sensor is still occupied.
			Pressed	Resets the fault condition.
OVERSIZE RESET	White	IMPB	Lamp off	No fault condition
			Lamp blinking (1Hz)	Oversize condition no longer present. Reset of fault can be performed.
			Lamp on	Oversize condition detected. Sensor is still occupied.
			Pressed	Resets the fault condition.
E-STOP	Red	ILPB	Lamp off	No E-stop condition
			Lamp blinking (1Hz)	E-stop condition released. Reset can be performed.
			Lamp on	E-stop condition. Mushroom head pushbutton is still activated.
			Pressed	Activates the E-stop. Equipment stops.

2.6.1.b Where it is not practical to locate the control station on the non-public side of the security door and the location is approved by the Owner, the 'AUTO / MAINT' switch shall be of the key-switch type with the key removable in both positions.

2.6.2 Fire Shutter Doors

2.6.2.1 General

2.6.2.1.a All requirements defined for security shutter doors in Part 2 § 2.6.1 shall also apply for fire shutter doors unless below requirements specific for fire shutter doors alter the design/supply.

2.6.2.1.b Fire shutter doors shall be provided with a U.L. labeled fire rating matching the fire partition rating. Doors shall as minimum have a U.L. rating of two (2) hours, Class A or as per local code, whichever is the most stringent.

2.6.2.1.c All cavities in and around the equipment penetrating the fire rated wall shall be properly filled to maximum 6 mm to the equipment and fire rated to the same U.L. rating as the fire shutter door itself. Such provisions, e.g. with foam, shall not damage the equipment.

2.6.2.2 Mechanical

2.6.2.2.a Refer to requirements for security shutter doors under Part 2 § 2.6.1.

2.6.2.3 Electrical

2.6.2.3.a Refer to requirements for security shutter doors under Part 2 § 2.6.1.

2.6.2.4 Controls

2.6.2.4.a The operation of fire shutter doors shall interface with the Fire Alarm System. Refer to Part 2 § 2.11.3 relating to the external interfaces. A fire detection system shall be included to sense an approaching fire, smoke, or heat source on the CBIS/BHS equipment.

2.6.2.4.b Provide the same type of control station (C/S#5) for each fire shutter door as provided for security shutter doors.

2.6.2.4.c On the down-stream side of the fire shutter door provide a temperature rated fusible link to ensure that the door will close automatically even in the event of a power failure. The fusible link shall break at a temperature of 160°F .

2.6.2.4.d Ensure that manual operation to OPEN the fire shutter door via the local control station is NOT possible if a fire detection signal is active.

2.6.2.4.e In the event of a fire alarm, if no bag is detected under the door the equipment passing through the door shall stop and the door shall close. If a bag is detected under the door, run the equipment until it is clear and stop the equipment and close the door.

2.6.2.4.f In the event of a fire alarm, if the space under the door does not come clear within a default time (typically ten (10) seconds) from activation the door shall close on the obstruction and alarms shall be displayed on SCADA that the door has failed to close fully.

2.7 EMERGENCY STOP (E-STOP)

2.7.1 General

2.7.1.a The BHS Contractor shall provide a failsafe emergency stop configuration in compliance with NFPA 79 that allows personnel to immediately stop the equipment in case of personnel injury or equipment damage. Any requirements listed below that conflicts with NFPA 79 shall be ignored.

2.7.1.b On activation of a safety device all equipment with an associated risk shall be brought to a stop.

2.7.1.c The design of the safety system shall be designed to minimize disruption to operations. However, the design shall not conflict with any.

2.7.1.d Emergency stopping devices shall be used to improve protection along baggage system equipment and any other potentially hazardous location.

2.7.1.e Emergency stops must be provided such that personnel working on or operating the equipment are never more than 3000 mm horizontally unobstructed from a stop device.

2.7.1.f Visible red indication lamps shall be provided for each emergency stop device to indicate that the device has been activated.

2.7.1.g Where a conveyor feeds a non-powered storage device (e.g. gravity rollers) or where at a manned position, a powered conveyor feeds another conveyor, safety devices shall be fitted. These devices shall remove the in-running nip danger by stopping the conveyor. Knock out rollers shall not be used.

2.7.1.h Tilt-tray sorters shall have a stopping distance no greater than 2 m. Sorter stopping distances shall be risk assessed in all instances and agreed with Owner. Once the sorter has come to a stop, no rollback is acceptable.

2.7.2 E-Stop Push Button

2.7.2.a Emergency stop devices shall be of a mushroom head type, push to activate, pull to release with an illuminated red lamp.

2.7.2.b The maximum distance between E-stops in public areas shall be 60’.

Table 34: E-stop Control Station

Designator	Color	Interface	Status & Position	Function
E-STOP	Red	ILPB	Lamp off	No E-stop condition
			Lamp blinking (1Hz)	E-stop condition released. Reset can be performed.
			Lamp on	E-stop condition. Mushroom head pushbutton is still activated.
			Pressed	Activates the E-stop. Equipment stops.

2.7.3 Hard-Wired Control

2.7.3.a All Equipment, e.g. conveyors, diverters, doors, and so on that moves shall be provided with hard wired electro-mechanical isolation that removes electrical power from the motor when an Emergency Stop device is activated in accordance with NFPA 79 Category 0 stop requirements.

2.7.3.b The mechanical and electrical design shall ensure that Emergency Stop devices cannot be placed into a condition that is not properly detected or could provide an unsafe condition, where an Emergency stop is not detected/reported or an Emergency stop condition is controlled by software and not electro-mechanical isolation in accordance with NFPA requirements.

2.7.4 E-Stop Zoning

2.7.4.a Conveyors shall be configured into Emergency stop zones that consider safety of personnel and equipment, while also consider continued operation to the extent possible. The BHS Contractor shall submit E-Stop Zoning Layout and E-Stop Location Layout for review and approval.

2.7.4.b Emergency stop zones shall be line of sight.

2.7.4.c Hold Baggage Screening lines shall have separate emergency stop zones such that activation of an emergency stop on a screening line shall not affect the operation of other screening lines.

2.7.4.d Two (2) parallel lines of equipment, i.e. separate sub-systems, shall be configured in separate emergency stop zones to minimize disruption to operations.

2.7.4.e Two (2) stacked lines of equipment, i.e. separate double-stacked sub-systems, shall be configured in separate emergency stop zones to minimize disruption to operations.

2.7.5 Inter-Locking

2.7.5.a Emergency stop zones shall overlap at wall or slab/floor penetrations.

2.7.5.b Emergency stop zones shall overlap as necessary at the junction of conveyor lines.

2.7.5.c Two (2) adjacent emergency zones shall both be activated when E-stops in the immediate vicinity of the zoning border is activated.

2.7.6 Response Times

2.7.6.a Activation of E-stop device shall stop the equipment immediately under controlled and powered conditions. Once equipment has stopped the power supply shall be disconnected.

2.7.6.b Activation of an emergency stop device shall enable the ‘Start’ push button on the control station in conformance with ASME requirements. The Emergency stop circuit shall only be able to be reset using the ‘start’ push button from the enabled control station, after the emergency stop device has been released. MCP Emergency Stop resets push buttons shall be programmed as a central reset in the event of a fault that disables the latched Emergency stop from being reset.

2.7.7 Status Monitoring

2.7.7.a Emergency stop devices that have been activated and released, but not reset shall continue to flash.

2.7.7.b The SCADA shall show the individual status of each emergency stop device such that control room operators can identify the current status, e.g. not activated (no light), activated (steady light), released, but not reset (blinking/flashing)

2.7.8 Minimum Locations of E-stops

2.7.8.a An Emergency stop device shall be positioned in the immediate vicinity of every diverter. Where diverters are located in close proximity to each other, a centrally located device shall be sufficient provided emergency stop zoning requirements defined above are maintained.

2.7.8.b Manned areas

2.7.8.c Input stations

2.7.8.d Power turns

2.7.8.e EDS

2.7.8.f CBRA

2.7.8.g All slab openings and wall penetrations

2.7.8.h Personnel cross-overs (E-stop shall be accessible from both sides of the equipment)

2.7.8.i As required by safety standards

2.8 ELECTRICAL & POWER REQUIREMENTS

2.8.1 General

2.8.1.a The BHS Contractor shall comply with the requirements of Division ??, Section ?? for Electrical requirements. In addition to these requirements the following requirements shall apply.

2.8.1.b The BHS Contractor shall provide components, parts, and equipment to match existing installation(s) and spare-parts inventory. In the event that parts and equipment have been superseded or replaced with newer models, the BHS Contractor shall detail this replacement/substitution and make sure that such replacements are compatible with all existing controls and systems. In the event that any existing cables, parts and equipment on-site need to be replaced in order for the BHS Contractor to fulfil the requirements of this Contract the cost of such replacement shall be covered by the BHS Contractor.

2.8.1.c All equipment shall meet current industrial standards and must belong to tried and tested product families to ensure continuity and shall be widely available.

2.8.1.d All equipment shall be suitable for use under harsh environmental conditions (e.g. temperature, soiling, electrically contaminated environs, vibrations/shocks, humidity, altitude climate).

2.8.1.e All equipment shall be equal to or exceed the minimum requirements of NEMA, IEEE, Underwriters Laboratories Inc., and Electrical Standards.

2.8.1.f All equipment shall be supplied and installed in accordance with the manufacturer's recommendations.

2.8.1.g Electrical connectors and terminals shall mate and match, including sizes and ratings, with equipment terminals that are recommended by equipment manufacturer for intended applications.

2.8.1.h Provide electrical insulating tape, heat-shrinkable insulating tubing and boots, stress cones, splice kits, termination kits, wire nuts and cable ties as recommended for use by accessories manufacturers for type of services as required.

2.8.1.i Comply with the requirements of the reference standards noted herein, except where more stringent requirements are listed herein or otherwise required by the Contract Documents.

2.8.1.1 Prohibited Materials

2.8.1.1.a Intermediate conduits

2.8.1.1.b Aluminum conduit and Aluminum, Zinc Die Cast boxes and fittings

2.8.1.1.c Set screw type fittings 2" and smaller.

2.8.1.1.d Wire channel and associated products.

2.8.1.1.e Power poles.

2.8.1.1.f Non metallic flexible conduit.

2.8.1.1.g Armored cable of any type.

2.8.1.1.h Modular wiring systems.

2.8.1.2 Other

2.8.1.2.a All other parts and components shall be supplied as per manufacturers standard with a focus on matching existing components on site and already existing in the Owner's spare parts inventory.

2.8.1.j All electrical/electronic circuits, including audio, video, and fire alarm systems, shall be in an approved raceway system. No "wild circuits" will be accepted.

2.8.1.k The BHS Contractor shall not install rigid metal conduit, electrical metallic tubing, flexible steel conduit, liquid-tight flexible steel conduit, non-metallic rigid conduit or innerduct in any concrete wall or slab structures.

2.8.2 Power Factor Correction

2.8.2.a The BHS Contractor shall ensure that the overall power factor for the CBIS/BHS is 0.95 or higher. The power factor shall be achieved under all operational conditions, e.g. reduced load, partial load and full load on a sub-system by sub-system basis as well as the whole system.

2.8.2.b When asynchronous motors are used the BHS Contractor shall provide reactive power compensation in the power panels unless otherwise agreed with Owner.

2.8.2.c When synchronous motors are used reactive power compensation is not required. Synchronous motor shall have a power factor of minimum 0.99.

2.8.3 Voltage Drop

2.8.3.a The BHS Contractor shall ensure that the system performance is not affected by voltage drops. The size of conductors shall be such that the maximum voltage drop is less than three per cent (3%) for the outlet of power, heating, and lighting loads. The maximum permissible voltage drop is five per cent (5%) for the farthest outlet for both feeders and branch circuits.

2.8.4 Short Circuit Current

2.8.4.a The circuit breakers shall protect cables against short circuit. The value of the short cut current depends on the electrical resistance of the cable. For activation of the circuit breaker a minimal short cut current is necessary. It must be guaranteed, that the circuit breaker is able to protect the cable.

2.8.5 Electrical Components

2.8.5.1 Power Cables

2.8.5.1.a Power cables and wires shall be industrial grade, oil resistant, low smoke and fume, non-toxic halogen free cables isolate rated for 600 VAC.

2.8.5.1.b All conductors shall be copper.

2.8.5.1.c Thermoplastic-Insulated Wire: THW, THHN, THWN rated 600 volt NEMA WC 5.

2.8.5.1.d Rubber-Insulated Wire: RH, RHW, RHH, XHHW rated 600 volt, NEMA WC 3.

2.8.5.1.e Feeders and Branch Circuits Larger than No. 12 AWG: Copper, stranded conductor, 600-volt insulation, THHN/THWN, or XHHW.

2.8.5.1.f Feeders and Branch Circuits No. 12 AWG and Smaller: Copper conductor, 600-volt insulation, THHN/THWN, or XHHW, solid conductor; except for connection to vibrating equipment then stranded shall be used.

2.8.5.1.g Control Circuits: Copper, stranded conductor 600-volt insulation, THHN/THWN, or XHHW.

2.8.5.1.h All building wire and cable shall be installed in an approved raceway.

2.8.5.1.i For installation with terminal blocks solid wire shall be used. If multi-core wire is used such shall be provided with cramp on connector plugs.

2.8.5.1.1 Cable Sizes

2.8.5.1.1.a The following cable sizes shall be used for power distribution.

Table 35 Power Cable/Wiring Sizes

Type of Cable	Cross Area	AWG
Power 600 VAC	12-15 mm^2	#6
Power 600 VAC	8-9 mm^2	#8
Power 600 VAC	5-6 mm^2	#10
Power bus line 380 VAC (from FDP and outgoing)	3-4 mm^2	#12
Power 380 VAC (3 phase single line)	2.5-3 mm^2	#13
Power 220 VAC (1 phase single line)	1.5 mm^2	#15
Power 120 VAC (1 phase single line)	1.5 mm^2	#15

2.8.5.2 Spare Conductors

2.8.5.2.a Spare conductors shall be run from the MCP to the end point based on the following table;

Table 36 Spare Conductors

Designator	Quantity	Comment
Power	None	
Control stations (OP)	Minimum 1	Up to three (3) buttons/lamps
Control stations (OP)	Minimum 2	More than three (3) buttons/lamps
Warning devices	Minimum 1	
Photocell terminal boxes	Minimum 1	
Proximity sensors	None	

2.8.5.2.b Spare conductors shall be labeled at both ends based on the end point location.

2.8.5.2.c Spare conductors shall be terminated to individual terminals in the MCP using terminals at the end of live terminal rails.

2.8.5.2.d Spare conductors shall be grouped based on function.

2.8.6 Electrical (Power) Components

2.8.6.1 Junction Boxes

2.8.6.1.a Junction boxes for control wires shall be 12” x 12” x 8” in size and provided with terminal boards.

2.8.6.2 Wire-ways/Cable Trays

2.8.6.2.a Wire-ways and cable trays shall be galvanized trays.

2.8.6.2.b Wire-ways and cable trays shall be continuously grounded between sections.

2.8.6.2.c Separation of power and control cables within the wire-ways and cable trays shall be done with a metal divider.

2.8.6.3 Conduit

2.8.6.3.a It is acceptable to run multiple cables/wires in the same conduit provided such installation can be performed without damaging the cables.

2.8.6.3.b Under no circumstances shall low level control cables or LAN communication cables be installed in the same conduit as power cables.

2.8.6.3.c Low level control cables and LAN communication cables shall be provided with separate conduits.

2.8.6.3.1 Rigid Metal Conduit & Fittings (RMC)

2.8.6.3.1.a Provide rigid steel conduit compliant with ANSI C80.1.

2.8.6.3.1.b Provide rigid steel conduit with internally galvanized surface and externally coated with PVC of a thickness of 40 mil according to NEMA RN 1.

2.8.6.3.1.c Provide fittings and conduit bodies of PVC coated, threaded type, steel, or malleable iron compliant with ANSI/NEMA FB 1.

2.8.6.3.1.d Provide appropriately sized bushings and jumpers on all conduit and fittings that enter junction boxes, panels, or operator stations.

2.8.6.3.2 Electrical Metallic Tubing (EMT) and Fittings

2.8.6.3.2.a Provide galvanized electrical metallic tubing compliant with ANSI C80.3.

2.8.6.3.2.b Provide ANSI/NEMA FB 1 compliant steel or malleable iron fittings, conduit bodies, couplings, and connectors. Use steel compression type up through 2" in size.

2.8.6.3.3 Flexible Metal Conduit (FMC)

2.8.6.3.3.a Provide flexible metal conduit compliant with FS WW-C-566. The material shall be steel.

2.8.6.3.3.b Provide fittings and conduit bodies compliant with ANSI/NEMA FB 1. The material shall be steel or malleable iron.

2.8.6.3.3.c Provide flexible metal conduit covering cabling feeding equipment subjected to vibrations and or adjustment.

2.8.6.3.4 Liquid-Tight Flexible Conduit & Fittings (Flexible Plastic Conduit)

2.8.6.3.4.a Provide liquid-tight flexible steel conduit with PVC jacket.

2.8.6.3.4.b Provide ANSI/NEMA FB 1 compliant steel or malleable iron fittings and conduit bodies.

2.8.6.3.4.c Use liquid-tight flexible conduit in damp or wet locations. Length shall be 3' maximum.

2.8.6.3.5 Non-Metallic Rigid Conduit & Fittings

2.8.6.3.5.a Provide NEMA TC 2 compliant non-metallic rigid conduit of schedule 40 PVC material.

2.8.6.3.5.b Provide NEMA TC 3 compliant fittings and conduit bodies.

2.8.6.3.6 Conduit Supports

2.8.6.3.6.a All conduit clamps, straps, and supports shall be made of steel or malleable iron.

2.8.6.4 Innerduct

2.8.6.4.a Provide innerduct, meeting or exceeding the following requirements, to partition conduit.

2.8.6.4.1 Material Properties

2.8.6.4.1.a Melting point: 260° F, minimum.

2.8.6.4.1.b Tensile yield strength: 3600 psi/sq. in., minimum

2.8.6.4.1.c Brittleness temperature, maximum: -140° F.

2.8.6.4.1.d Heat distortion temperature: 170° F minimum.

2.8.6.5 Motor Starter

2.8.6.5.a Motor starters shall be suitable for forty (40) operating cycles per hour minimum, NEMA rated, 3-phase, 400 VAC, 24 VDC starter coil voltage, magnetic across-the-line contactors, each with a holding contact and auxiliary contacts as required.

2.8.6.5.b Motor starters shall each have three (3) manual reset, thermal overload relays.

2.8.6.5.c Reversing motor starters shall have electrical and mechanical interlocks.

2.8.6.5.d Starters shall incorporate thermal overload protection.

2.8.6.5.e Overload shall be set at one hundred percent (100%).

2.8.6.5.f Direct-on-line starting shall not be used for motors of 7 HP or greater.

2.8.6.5.g The minimum motor starter size shall be NEMA size "0".

2.8.6.5.h All motor starters shall be mounted in the MCP with their associated controls unless distributed I/O is used.

2.8.6.6 Soft Starters

2.8.6.6.a Soft starters shall allow for a controlled start and stop of equipment based on gradually increasing/decreasing voltage to the motor under start/stop conditions.

2.8.6.6.b The thyristor controller shall be rated to withstand five (5) times the motor running current for five seconds (5 sec) and shall have a minimum peak reverse voltage of 1300 Volts.

2.8.6.6.c Soft starters shall be designed for continuous operation under 'live shutdown' conditions (i.e., full voltage on the input side and non-conducting thyristors) without sustaining thermal damage.

2.8.6.6.d The soft starter shall have the following configurable parameters;

2.8.6.6.1 Configurable Parameters

2.8.6.6.1.a Start-up time (0.5 to 60 seconds)

2.8.6.6.1.b Start-up voltage

2.8.6.6.1.c Max current

2.8.6.6.1.d Stop voltage

2.8.6.6.1.e Shut-down time

2.8.6.6.e Replacement soft starters shall automatically have the motor parameters downloaded from the PLC when connected to the power. Download and upload of motor parameters shall also be possible manually via a programming PC.

2.8.6.6.f The types and models of soft starters used shall be standardized.

2.8.6.7 Variable Frequency Drives (VFD)

2.8.6.7.a The types and models of VFDs used shall be standardized. All VFDs shall be provided with networking capabilities (e.g. ProfiBus/ProfiNet).

2.8.6.7.b When distributed I/O design is used all VFD motor starters shall be mounted directly on the motor or immediately adjacent to the drive, while the VFD shall be mounted in the MCP when a hardwired design is used.

2.8.6.7.c VFDs shall be supplied as part of the motor starter unit. The rectifier inverter unit shall be of the voltage source type with frequency adjustment and voltage control by pulse width modulation. It shall be possible to adjust the controls on the VFD to give 400 Volts at the full speed output of fifty Herts (50 Hz).

2.8.6.7.d VFD’s shall have dynamic braking capabilities.

2.8.6.7.1 Configurable Parameters

2.8.6.7.1.a Start-up time (0.5-60 seconds)

2.8.6.7.1.b Start-up voltage

2.8.6.7.1.c Max current

2.8.6.7.1.d Stop voltage

2.8.6.7.1.e Shut-down time

2.8.6.7.1.f Frequency such that speed can be controlled

2.8.6.7.e Standard OEM methods for performing VFD speed adjustments is permitted. Acceptable methodologies include dip switches, rotary dials, hand-held keypad, and/or PLC setpoints.

2.8.6.7.f VFD settings are to be hard coded into the PLC and downloaded to the VFD periodically as follows.

2.8.6.7.2 Download VFD Settings from PLC to VFD

2.8.6.7.2.a Daily

2.8.6.7.2.b After fault

2.8.6.7.2.c Operator’s request (e.g., after equipment change out)

2.8.6.8 Panel Main Power Shut-Off

2.8.6.8.a The main power shutoff for panels shall be a heavy-duty, 208 V, 3 phase, fused switch type. It shall be sized for one-hundred thirty percent (130%) code motor load.

2.8.6.8.b The shutoff shall be installed inside housing with operating handle arranged for connect or disconnect with panel doors in closed position.

2.8.6.9 Fuses

2.8.6.9.a Fuses shall be rated at 600A RK1 fuses.

2.8.6.10 Circuit Breaker

2.8.6.10.a Circuit breakers shall be magnetic only motor circuit breakers, 208 V, 3 phase, 15,000 AIC

minimum, and sized as required for the intended load.

2.8.6.11 Duplex Power Outlets

2.8.6.11.a All duplex power outlets (receptacles) shall be NEMA 5-20R type.

2.8.6.11.b General purpose outlets mounted along equipment shall be mounted in 4” x 4” x 2-3/4” boxes with sheet metal plate.

2.8.6.12 Quad Power Outlets

2.8.6.12.a All quad power outlets (receptacles) shall be NEMA 5-20R type.

2.8.6.12.b General purpose outlets mounted along equipment shall be mounted in 8” x 4” x 2-3/4” boxes with sheet metal plate.

2.8.7 Motor Control Panels (MCP)

2.8.7.a Open type starters and circuit breakers shall be installed in the interior for each motor.

2.8.7.b Each starter and each control device shall be provided with a machine typed nameplate for maintenance purposes. Hand-written nameplates are not acceptable.

2.8.7.c A main fused disconnect switch or circuit breaker shall be provided and installed inside the MCP interlocked with the doors such that doors can only be opened with the disconnect in the OFF position. There shall be an inter-lock override feature that allows trained maintenance personnel to open the door with the disconnect in the “ON” position for maintenance and/or trouble shooting purposes.

2.8.7.d Exposed voltages greater than and including 120 VAC shall be covered/shrouded with a clear plastic material (acrylic or similar), such that personnel are protected from inadvertent contact. Such covers shall be easily removable for maintenance purposes (replacement, repair, cleaning, etc).

2.8.7.e Provide warning labels inside and outside of the MCP to alert personnel of potential hazards.

2.8.7.f All hot power wires within an MCP that are not isolated when the main disconnect is in the OFF position shall be ‘yellow’.

2.8.7.g Resettable devices (fuses, circuit breakers, etc) shall NOT be located in the lower 12” of the MCP.

2.8.7.h Control fuses shall be monitored in such a manner that O&M personnel can easily identify a blown fuse either by;

2.8.7.1 Fuse Monitoring

2.8.7.1.a PLC monitoring and alarming on the SCADA system.

2.8.7.1.b OR installation of equipment integral into the fuse carrier such that a voltage differential across the fuse is detected and a light is illuminated whenever the fuse is blown/removed.

2.8.7.i Controls design shall ensure that load is connected during normal operations such that a blown fuse is immediately evident upon inspection (e.g., powering relays on a circuit that are only active during maintenance operations so that no voltage differential exists across a blown fuse during normal operations and fails to identify a blown fuse would be regarded as a defective design).

2.8.7.2 Each MCP shall be provided with the following labels as a minimum.

2.8.7.2.a Designation.

2.8.7.2.b Power requirements, voltage, and capacity.

2.8.7.2.c Power feed location (power source).

2.8.7.2.d Equipment and electrical safety warnings.

2.8.7.j Where any power within the MCP is not isolated by the MCP main disconnect, provide a label clearly identifying the color of the wires, the voltage and indication that the power is not isolated when the main disconnect is turned off.

2.8.7.k Each MCP shall be provided with the following controls and indicators as defined below. The controls shall be logically arranged on the MCP.

Table 37 C/S#11: CDP (MCP) Operator Panel

Designator	Color	Interface	Status & Position	Function
START	Green	IMPB	Lamp off	Sub-systems connected to CDP is stopped
			Lamp blinking (1Hz)	Sub-systems connected to CDP is starting
			Lamp on	Sub-systems connected to CDP is running
			Pressed	Start-up sub-systems connected to CDP. Resets any fault conditions and restarts equipment
STOP	Red	IMPB	Lamp off	Sub-systems connected to CDP is running
			Lamp blinking (1Hz)	Sub-systems connected to CDP is stopping
			Lamp on	Sub-systems connected to CDP is stopped
			Pressed	Stop sub-systems connected to CDP
E-STOP	Red	ILPB	Lamp off	No E-stop condition
			Lamp blinking (1Hz)	E-stop condition released. Reset can be performed.
			Lamp on	E-stop condition. Mushroom head pushbutton is still activated.
			Pressed	Activates the E-stop. Equipment stops.
E-STOP RESET	Red	IMPB	Lamp off	No E-Stop condition. Panel on.
			Lamp blinking (1Hz)	E-Stop condition released. Reset can be performed.
			Lamp on	E-Stop activated.
			Pressed	Resets E-Stop condition. Panel ready for restart.
LAMP TEST	Black	SMPB	Pressed	All lamps on the panel and subsequent panels lights up. All lamps, beacons and pilot lights connected and fed by the CDP panel lights up.
ALARM SILENCE	Yellow	SMPB	Pressed	Silences the audio alarm. Audio alarm starts again if another fault occurs.
FAULT RESET	Black	SMPB	Pressed	Resets the fault condition. System ready to start.
PHASE L1	White	ILLT	Lamp off	Phase is off (power outage)
			Lamp on	208 VAC phase is available
PHASE L2	White	ILLT	Lamp off	Phase is off (power outage)
			Lamp on	208 VAC phase is available
PHASE L3	White	ILLT	Lamp off	Phase is off (power outage)
			Lamp on	208 VAC phase is available
JAM	Amber	ILLT	Lamp off	No fault condition
			Lamp blinking (1Hz)	Fault condition and sensor is no longer occupied. Reset of fault can be performed.
			Lamp on	Fault condition. Sensor is still occupied.
TECH FAULT	Blue	ILLT	Lamp off	No fault condition

Designator	Color	Interface	Status & Position	Function
			Lamp blinking (1Hz)	Fault condition and sensor is no longer occupied. Reset of fault can be performed.
			Lamp on	Fault condition. Sensor is still occupied.
SECURITY ACCESS CONTROL FAULT	Magenta	ILLT	Lamp off	No fault condition
			Lamp blinking (1Hz)	Fault condition and sensor is no longer occupied. Reset of fault can be performed.
			Lamp on	Fault condition. Sensor is still occupied.
ENERGY SAVE	White	ILLT	Lamp off	System is running
			Lamp blinking (1Hz)	System is initiating energy saving mode.
			Lamp on	System is in energy save mode
ISOLATOR	Black	2LIS	ON	Panel is ON
			OFF	Panel is OFF
HMI SCREEN	-	Touch screen	Status	The local visualization screen shall show the status of the equipment controlled by the PLC using same screen as SCADA.
POWER METER	-	Digital display	Data	Digital display with power data such as voltage, current, power factor, and power consumption

2.8.7.l Additionally, to the front mounted controls and indicators each MCP shall be provided with a layered status light/beacon mounted above the MCP as defined below. The order of the layered colors shall be consistent between all MCP.

Table 38 C/S#11B: CDP (MCP) Layered Status Light/Beacon

Designator	Color	Interface	Status & Position	Function
START	Green	Light	Lamp off	System stopped.
			Lamp on	System on and healthy.
E-STOP	Red	Light	Lamp off	No E-stop condition.
			Lamp on	E-stop condition.
JAM	Amber	Light	Lamp off	No jam condition.
			Lamp on	Jam condition.
TECH FAULT	Blue	Light	Lamp off	No technical faults.
			Lamp on	Technical fault condition.

2.8.7.m Internally within the MCP provide a duplex 120 VAC general purpose power outlet.

2.8.7.n Internally within the MCP provide lighting that shall be activated whenever the MCP door is opened.

2.8.7.o The duplex 120 VAC power outlet and the internal panel lighting shall be fused separately from any external general power outlets so that a power circuit overload does not disconnect power to the lighting and general-purpose circuit.

2.8.7.p Within the door of each MCP, in an appropriate binder, provide 11x17” size laminated electrical schematics for the particular MCP along with a laminated list of the equipment controlled by the MCP.

2.8.7.2.1 MCP Binder Information

2.8.7.2.1.a Motor sizes (HP)

2.8.7.2.1.b Drive type (queue, power turn, merge, door, etc)

2.8.7.2.1.c Device function (queuing, indexing, tracking, etc)

2.8.7.2.1.d Fuse protection type and size

2.8.7.2.1.e Starter type (DOL, VFD, soft start)

2.8.7.2.1.f Electrical schematics

2.9 LOW LEVEL CONTROL (LLC) REQUIREMENTS

2.9.1 General

2.9.1.a LLC power shall be 24 VDC.

2.9.2 Control Cables

2.9.2.a Control cables shall be industrial grade, oil resistant, low smoke and fume, non-toxic halogen free cables isolate rated for 300 VDC.

2.9.2.b Control Cable for Class 1 Remote Control and Signal Circuits: Copper conductor, 600 volt insulation, rated 60 °C, individual conductors twisted together, shielded, and covered with a PVC jacket.

2.9.2.c Control Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300 volt insulation, rated 60 °C, individual conductors twisted together, shielded, and covered with a PVC jacket; UL listed.

2.9.2.d Plenum Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300 volt insulation, rated 60 °C, individual conductors twisted together, shielded, and covered with a non-metallic jacket; UL listed for use in air handling ducts, hollow spaces used as ducts, and plenums.

2.9.2.e All power, control, data, communication and signal wire or cable shall be installed in an approved raceway.

2.9.2.f Control cable for field devices such as PEC, shaft encoders, proximity switches and the like shall be installed with adequate cable length such that maintenance staff can disconnect the plug and cable from the field device when replacement or adjustment is required. However, the excess cable length shall not exceed 1'.

2.9.2.g Excess cable shall be coiled and securely tied to the equipment using plastic cable strips or cable ties.

2.9.2.1 Cable Sizes

2.9.2.1.a The following cable sizes shall be used for equipment control signals.

Table 39 Control Cable/wiring Sizes

Type of Cable	Cross Area
Control 120 VDC	1.25 mm^2
Control 24 VDC	0.5 mm^2
Electronic Circuits	0.25 mm^2

2.9.2.2 Spare Communication Cables

2.9.2.2.a Spare/redundant communication cables shall be run in parallel to operational cables based on the following table;

Table 40 Spare Communication Cables

Designator	Quantity	Comment
Remote workstations	Minimum 1	Single workstations

Designator	Quantity	Comment
Remote workstations	Minimum 1	For every three (3) connections where connections are grouped (source and destination).
EDS screening machine	Minimum 1	For each type of communications
CBRA workstations	Minimum 1	For each group of workstations

2.9.2.2.b Spare cables shall be labeled at both ends based on the end point location.

2.9.3 Control Components

2.9.3.a The BHS Contractor shall use only pre-approved control devices as per Part 2 § 2.3.

2.9.3.b The BHS Contractor shall use the same rating for all control devices per local code.

2.9.3.c The BHS Contractor shall minimize the number of control device types used and all types shall be of the same make/supplier.

2.9.3.d The BHS Contractor shall ensure that functionality and color of control devices match existing conditions, where applicable.

2.9.3.1 Proximity Switches

2.9.3.1.a Proximity switches shall be sealed precision plug-in industrial grade switches rated for minimum ten amps (10A) continuous load.

2.9.3.2 Limit Switches

2.9.3.2.a Limit switches shall be sealed precision plug-in industrial grade switches rated for minimum ten amps (10A) continuous load.

2.9.3.3 Shaft Encoders

2.9.3.3.a Shaft encoders shall be sealed precision plug-in industrial grade encoders rated for continuous use.

2.9.3.3.b Shaft encoders shall be provided for all tracked conveyors. Shaft encoders shall be installed on the shaft of the non-driven head or tail end pulley. The pulse rate of the encoder shall support the required bag tracking accuracy.

2.9.3.3.c Appropriate protective covers shall be provided over all shaft encoders. Such covers shall be painted safety yellow.

2.9.3.4 Photocells (PEC)

2.9.3.4.a All photocells shall be of the polarized retro-reflective type such that a failed/false trigger from materials common to airport baggage does not result in improper and/or unsafe operation of the system.

2.9.3.4.b Photocells shall be of the quick disconnect plug-in type and mounted in a manner such that replacement can be made without rewiring the device and replacement can be completed in less than five (5) minutes.

2.9.3.4.c Photocell brackets shall be designed in such a manner that the photocell can be manipulated in all axes (x, y & z) to ensure proper alignment with the reflector.

2.9.3.4.d Photocells shall be securely bolted to the equipment on the accessible side of the equipment. The use of magnets or similar non-permanent installation method is not permitted.

2.9.3.4.e Vibration transmitted to photocells shall be minimized.

2.9.3.4.f Reflector mirrors shall be minimum 2” in diameter and be permanently installed on the non-accessible side of the equipment. Reflector mounting bolts/screws shall be at the perimeter of the reflector to avoid obstructing the reflective function of the reflector.

2.9.3.4.g Photocells shall be provided at a height above TOB such that the smallest size bag can be detected for proper conveyor operation, fault detection and tracking of baggage. The optimum height of photocells shall be 2” above TOB.

2.9.3.4.h The photocell and reflector shall be installed such that there are no more than two (2) penetrations in sideguards, one (1) for the photocell and one (1) for the reflector. Each penetration shall be 1-1/2” in diameter.

2.9.3.4.i Photocells shall have a status LED that shows maintenance personnel in the field the status of the

photocell, e.g. powered, aligned, unbroken and broken signal. The LED shall be visible when personnel are standing upright next to the conveyor.

2.9.3.4.j The signal strength of the photocell shall be sufficient and appropriate for the application and installation.

2.9.3.4.k The status of all photocells such as but not limited to blocked/unblocked/out of alignment shall be independently displayed at SCADA. The status shall be shown in near real time.

2.9.3.4.l Tracking photocells shall be provided as necessary to properly track bags and reliable tracking shall be maintained at all times.

2.9.3.5 Timers

2.9.3.5.a All timing relays shall be solid state, electronic type timer, 24 VDC with a contact rating of 600 VAC, 6 A.

2.9.3.5.b Relays shall have variable time range with options of remote switch, instant and timed contacts, and time-on or time-off selection.

2.9.3.6 Relays

2.9.3.6.a All control relays shall have a 24 VDC coil rating and a minimum of 8 NO/NC contacts rated at 600 VAC, 10 A.

2.9.3.6.b

2.9.3.7 Light Beacon

2.9.3.7.a Rotating light beacons shall be used in combination with Audible Horns and Buzzers at PDP/CDP/FDP/MCPs, baggage inputs and equipment ROWs to provide visual indication of equipment operation, hazard, or malfunction.

2.9.3.7.b Light beacons shall as a minimum, but not limited to, be located as required to ensure;

2.9.3.7.1 Locations

2.9.3.7.1.a One (1) beacon at every baggage input / output and operational access area.

2.9.3.7.c Light beacons shall use LEDs, be of minimum diameter 2”, oil resistant and mounted on 1” tubing. They shall be visible from wherever there is line-of-sight.

2.9.3.7.d Light beacons shall consist of durable and easily replaceable light source and rotating reflector.

2.9.3.7.e Light beacon color is dependent upon location and function as follows;

Table 41 Color Coding for Light Beacons

Function	Color
Start-up	Amber
E-Stop	Red
Running	Green
Fault	Amber

2.9.3.8 Layered Stacked Lights

2.9.3.8.a Stacked lights with an integrated audible alert can be used in lieu of light beacons.

2.9.3.8.b Stacked lights with an integrated audible alert shall as a minimum, but not limited to, be located as required to ensure;

2.9.3.8.1 Locations

2.9.3.8.1.a One (1) stacked light with integrated audible alert at every baggage input / output and operational access area.

2.9.3.8.1.b One (1) visible stacked light with integrated audible alert from any location along conveyor ROWs and maintenance platform.

2.9.3.8.1.c One (1) visible stacked light located at each security decision point to visually depict the current security status of each bag as it passes the security decision point.

2.9.3.8.2 Security Status

2.9.3.8.2.a Security status is depicted visually by illuminating the following colored stacked light;

Table 42 Color Coding for Security Stacked Light

Function	Color
Clear	Green
Alarm	Red
Pending	White
Unknown / Fault	Amber

2.9.3.8.c Stacked lights shall consist of an LED light source with a color coded globe.

2.9.3.8.d Stacked light color shall be consistent with light beacon color and is dependent upon location and function.

2.9.3.8.e All stacked lights shall be mounted vertically using 1" pipe. They shall be visible from wherever there is line-of-sight.

2.9.3.9 Audible Horns (Sounders)

2.9.3.9.a Audible horns/sounders shall be 24 VDC type, which has a sound pressure level of 103 dB(A) at 10' from the horn.

2.9.3.9.b Horns shall be provided with an adjustable sound level.

2.9.3.9.c The horn may be an integrated part of a light beacon or a separate unit.

2.9.3.9.d Audible horns shall be oil resistant and of an industrial type.

2.9.3.10 Audible Buzzer (Sounders)

2.9.3.10.a Audible buzzers shall be 24 VDC and provide a sound pressure that allows personnel to hear it 10' meters away from the buzzer during normal operation.

2.9.3.10.b Buzzers shall be provided with an adjustable sound level and be a buzzer or chime type.

2.9.3.10.c Buzzers shall be an integrated part of control stations and operator panels.

2.9.3.10.d Buzzers shall be oil resistant and of an industrial type.

2.9.3.11 Indicator Lamps (Pilot Lights)

2.9.3.11.a Indicator lamps shall be installed in the front cover of the power panels and control stations to visually depict equipment status and fault conditions in accordance with the color coding defined in Part 2 § **Error! Reference source not found.**.

2.9.3.11.b Indicator lamps shall be push to test or integrated with a common lamp test pushbutton.

2.9.3.12 Operational Push Buttons

2.9.3.12.a Pushbuttons shall be flush mounted.

2.9.3.12.b Pushbuttons shall be oil resistant, momentary contact type.

2.9.3.12.c Illuminated push buttons shall be utilized in public areas. Non-illuminated push buttons can be utilized in non-public areas.

2.9.3.12.d Push button color is determined by the associated function in accordance with the color coding defined in Part 2 § **Error! Reference source not found.**.

2.9.3.13 Safety System / E-stop Push Buttons

2.9.3.13.a All safety pushbuttons used for E-stops shall be red illuminated, maintained contact, push-to-stop mushroom-head pushbutton type. The E-stop pushbutton shall remain illuminated until the E-Stop condition is reset.

2.9.3.13.b E-stop push buttons shall be wired in each zone in series with the power source controlling the conveyors in the subsystem.

2.9.3.13.c E-stop conditions shall be depicted at the SCADA and associated MCP.

2.9.3.13.1 Location

2.9.3.13.1.a Locate E-stop pushbuttons as required to ensure ready and easy access to all personnel in operational areas.

2.9.3.13.1.b At all control stations and along equipment and platform no more than 15m apart in maintenance areas.

2.9.3.13.1.c The front panel of each MCP.

2.9.3.13.1.d Immediately upstream and downstream of each screening device.

2.9.3.13.d E-stops adjacent to screening devices shall be interlocked in accordance with the screening device manufacturer's guidelines.

2.9.3.14 Key-Switches

2.9.3.14.a Key switches shall be flush mounted, oil resistant.

2.9.3.14.b Key-switch components, application and functionality shall be coordinated for each application / instance and shall be approved by Owner. Key-switch considerations include, but are not limited to;

2.9.3.14.1 Key-Switch Considerations

2.9.3.14.1.a Access Control - Variable key / core combinations

2.9.3.14.1.b Maintained / Momentary Contact - Function dependent

2.9.3.14.1.c Key Position / Retention - Function dependent

2.9.3.15 Motor Safety Disconnect (Isolator)

2.9.3.15.a Motor safety disconnect switches shall be 3-pole, heavy-duty, non-fusible with a quick-make and break mechanism.

2.9.3.15.b Motor safety disconnects shall include an integrated means of padlocking the disconnect switch in the OFF position.

2.9.3.15.c Splicing of power cabling between the motor safety disconnect and the associated MCP/PDP/CDP/FDP/MDB is not acceptable.

2.9.3.15.d Provide a normally-open auxiliary contact for connection to a PLC input to provide the following functions;

2.9.3.15.1 Controls

2.9.3.15.1.a All motor safety disconnect switches shall open the control circuitry of the device whenever the disconnect switch is turned OFF.

2.9.3.15.1.b Reactivation / re-start of the appropriate device shall be required after turning the motor safety disconnect to the ON position.

2.9.3.15.1.c The status of the motor safety disconnect shall be monitored by the SCADA.

2.9.3.15.1.d Provide an additional auxiliary contact as required to provide control voltage to the associated drive component.

2.9.3.16 Connections

2.9.3.16.a All electrical connections shall be secure and resilient to vibration.

2.9.3.16.b Strain relief support shall be provided for any electrical connection, which is subject to damage or physical force.

2.9.3.16.1 Power

2.9.3.16.1.a Power cables terminations shall be secured via screws or clamps to rated terminal strips within a rated electrical enclosure.

2.9.3.16.1.b Power cables shall be continuous homeruns from the filed device to the associated MCP/PDP/CDP/FDP/MDB.

2.9.3.16.2 Controls

2.9.3.16.2.a Control media shall be terminated with a secure, reusable connector and shall be resistant to EMF and RFI interference.

2.9.3.16.3 Plug and Play Connectors (Quick Disconnects)

2.9.3.16.3.a A functional mock-up of the proposed plug and play configuration shall be provided for Owner's testing and approval prior to implementation.

2.9.4 Control Communication (Bus Network)

2.9.4.1 General

2.9.4.1.a Provide an industrial proven low level control communication bus network. The same bus network make and model shall be used throughout the CBIS/BHS installation provided under this Contract.

2.9.4.2 Integration with Existing Bus Network

2.9.4.2.a Where possible the same bus network shall be used in the extensions and new installations as used in the existing installation to allow for a seamless electronic interface allowing bag tracking data transmission between new and existing equipment.

2.9.4.2.b Should it be necessary to use a different bus network, the BHS Contractor shall ensure that bags can be automatically routed from new to existing equipment and vice versa without manual intervention. Routing of bags shall be based on known security status at the time of interchange between new and existing equipment or vice versa.

2.9.5 Field Warning Devices (Stacked Lights, Light Beacons & Audible Horns)

2.9.5.a Audible and visual warning devices shall be located at intervals along the conveyor such that they alert personnel in the area of the status of the equipment, e.g. faults, equipment startup conditions, jam conditions, equipment full conditions, E-stop conditions and so on as coordinated with the Owner.

2.9.5.b An audible and visual warning device shall be positioned in the immediate vicinity of potential jam points. Where multiple potential jam points are located within close proximity of one another, one warning device centrally located shall be sufficient.

2.9.5.c Warning devices shall operate independently of each other based on the status of the sub-system or equipment, which they represent.

2.9.5.d An audible and visual warning device shall operate in the immediate area of a conveyor fault.

2.9.5.e Light beacons shall continue to operate until the fault condition has been cleared.

2.9.5.f The audible device shall operate for 10 seconds in every 30 seconds or until an operator activates an alarm silence pushbutton in the immediate area in which case the audible alarm shall be silenced. A new fault in the area shall reactivate the audible alarm.

2.9.5.g A visual warning device shall operate continuously whenever an emergency stop device in the area is activated.

2.9.6 General Control Requirements

2.9.6.a A complete CBIS/BHS control system shall be supplied as part of the Works required under this Contract.

2.9.6.b All controls shall be of the fail-safe type, such that when power is removed from the sub-system ALL control states revert to a known 'safe' condition. E.g., restoration of power does not restart equipment automatically.

2.9.6.c The up- and download properties of the decentralized software shall be standard.

2.9.6.d The BHS Contractor shall ensure that all PLC hardware/software is compatible with interfacing equipment including High Level Controls and HBS machine control systems.

2.9.6.e All PLC interfaces to controls and field devices shall be achieved by a control network in accordance with the latest industry standards and codes of practice.

2.9.6.f The PLC shall accept all exterior inputs and outputs. It is not permitted to wire signals from input devices (e.g., photocell) directly to output devices/actors (e.g., output relay). The logic controller shall act as the device to provide indications to the local and central monitoring system (SCADA).

2.9.6.g The PLC architecture shall be based on a uniform and consistent design.

2.9.6.h The PLCs shall be programmed by means of standardized software-modules. Identical functions (e.g., conventional belt conveyor) have to be controlled by identical software-modules. Software modules with the same function must be interchangeable.

2.9.6.i PLCs controlling functional areas with identical functional configuration (e.g., Make-up carousel with feed line) shall have the same I/O-signal configuration.

2.9.6.j All software-modules have to be equipped with a short online description.

2.9.6.k Every I/O-signal must have a symbolic name, which is corresponding to the respective ID number of the electrical/mechanical component in the system as well as in the hardware-documentation.

2.9.7 PLC Hardware

2.9.7.a Each PLC shall consist of a CPU, power supply unit, communication module, interface module and I/O module.

2.9.7.b The PLC modules shall plug and lock into the PLC chassis.

2.9.7.c Each PLC and I/O module shall be a self-contained unit housed within an enclosure.

2.9.7.d All PLCs shall be of the same manufacturer, model, and capacity across the entire design, such that PLCs are fully interchangeable in all sub-systems. The exception being where extended memory is removable. Deviation from this requirement shall only be accepted, if approved in writing by the Owner.

2.9.7.e All PLCs shall be provided with a non-volatile backed up memory (Flash RAM, EEPROM, etc), that can be configured to download the backed-up program into the PLC active RAM under certain fault conditions.

2.9.7.f Non-volatile memory must be removable, such that the PLC processor can be replaced, the backed up non-volatile memory module inserted into the replacement processor and the PLC program/configuration downloaded into the replacement PLC active RAM when powered up. The sub-system shall restart without any additional operator action or intervention.

2.9.7.g It is preferred to have the PLC installed in the MCP.

2.9.7.h Where PLCs are installed remotely to the MCP (e.g., at the Control room) and fed from a power source supply separate to the conveyors, each PLC or subsets of PLCs shall be provided with an Uninterruptible Power Supply (UPS), where the failure of a power feed to the PLC (including UPS) keeps a minimum of fifty percent (50%) of sub-systems operating, such that baggage can continue to be transported from ticketing through critical sub-systems (Screening, etc) to the makeup area.

2.9.7.1 Central Processing Unit (CPU)

2.9.7.1.a The PLC Central Processing Unit (CPU) shall be a self-contained unit and shall provide control program execution, I/O scanning, and remote or local programming support.

2.9.7.1.b The CPU shall perform internal diagnostic checks and give visual indication to the user by illuminating a “green” indicator when no fault is detected and a “red” indicator when a fault is detected, as specified.

2.9.7.1.1 CPU Performance Features

2.9.7.1.1.a Ladder logic, Sequential Function Chart (SFC), and Structured-Text programming support compliant with the IEC 61131-3 and IEC 61499 Standards.

2.9.7.1.1.b Dedicated port for programming.

2.9.7.1.1.c Advanced instruction set, including file handling, sequencer, diagnostic, shift register, immediate I/O, and program control instructions;

2.9.7.1.1.d Multiple main control programs for segregation of control tasks;

2.9.7.1.1.e Processor input interrupts and global status flags.

2.9.7.1.1.f Programmable fault response for reacting to a fault before the system goes down.

2.9.7.1.1.g Timed-interrupt routine for examining specific information at specific time intervals.

2.9.7.2 Firmware

2.9.7.2.a The BHS Contractor supplier shall ensure that the firmware deployed is compatible with the

BHS firmware.

2.9.7.2.b Site-dependent firmware shall be installed and tested prior to site commissioning.

2.9.7.3 Processor Fault

2.9.7.3.a The PLC shall provide a visual indication of a PLC processor fault. By default, a PLC processor fault shall cause analogue control signals to fail in the last state and digital control signals to fail in the low state.

2.9.7.3.b The PLC shall have the capability for the discrete output signals to fail and restore to its last known state.

2.9.7.3.c The PLC shall have the capability to change the analogue and digital control signal states in response to a failure. If the fault is caused by a memory problem, it shall be possible to clear the fault using a procedure to boot the PLC from the Electrically Erasable Programmable Read-Only Memory (EEPROM) or FLASHPROM memory. The devices associated with the control signals shall remain in the last state, with the exception of signals that require a continuous output voltage.

2.9.7.4 Multiple, Independent, Asynchronous Scans

2.9.7.4.a The PLC processor shall use designated scans for processing I/O information, program logic, and background-processing of other processor functions. The I/O devices located in the same backplane (local I/O) as the CPU shall produce at the rate of the configured Requested Packet Interval (RPI), and for inputs enabled for Change of State (COS), at the time any point changes state. Scan rates for devices located in backplanes other than that in which the processor is located shall be user selectable and shall range from 2 to 50 milliseconds.

2.9.7.5 Spare Memory

2.9.7.5.a Upon acceptance of the system by Owner each PLC shall have a minimum of twenty five percent (25%) spare memory. This spare memory is required for future modifications and enhancements to improve system processes.

2.9.7.i The following indicators and status information shall be shown on the chassis or modules within the PLC chassis;

2.9.7.6 LLC Indicators

2.9.7.6.a PROGRAM or RUN mode of the CPU,

2.9.7.6.b The RUN/FAULT status of the CPU,

2.9.7.6.c ENABLED/DISABLED state of outputs,

2.9.7.6.d State of the I/O adapters,

2.9.7.6.e State of the communication adapters,

2.9.7.6.f Data I/O forces PRESENT/ACTIVE,

2.9.7.6.g Remote device communicating via the inter-processor communications link,

2.9.7.6.h Status of the Ethernet transceiver port,

2.9.7.6.i Data transfer activity over the Ethernet,

2.9.7.6.j EIA 232 activity.

2.9.8 PLC Communications

2.9.8.a The PLC system shall have the ability to support several communication options for processor-to-processor and processor-to-SCADA communications, with a maximum of one (1) card per communication network. The use of Dynamic Host Configuration Protocol (DHCP) client capability is not acceptable. If the Ethernet is to connect the HBS and BHS, the BHS is responsible for assigning the IP address to each HBS to avoid IP conflicts.

2.9.8.b The PLC system shall support multiple BHS interface protocols, such as:

2.9.8.1 Communication Protocol Types

2.9.8.1.a ControlNet,

2.9.8.1.b Ethernet/IP Modbus: Master/Slave.

2.9.8.1.c Modbus Transmission Control Protocol (TCP)/IP.

2.9.8.1.d PROFIBUS® IEC 61158/IEC 61784 (to equipment zones)

2.9.8.1.e AS-I® IEC 61158 (for local equipment actuator sensor interfacing)

2.9.8.2 Network Topologies

2.9.8.2.a The PLC system networks shall support star, bus, ring, or any combination thereof.

2.9.8.c All PLC system network communications with HBS machines, the BHS IT infrastructure or for inter-PLC communications shall contain the following performance features as a minimum:

2.9.8.3 Minimum LLC Network Performance Features

2.9.8.3.a Message-error checking (counters should be based on the confirmation of message success and failure status bits).

2.9.8.3.b Retries of unacknowledged messages.

2.9.8.3.c Interface with more than one (1) network.

2.9.8.3.d Ability to perform PLC processor memory uploads and downloads.

2.9.8.3.e Bi-directional communication between PLCs and communication networks.

2.9.8.3.f Ability to communicate with other models of PLC manufactured by the same supplier.

2.9.8.3.g Ability to communicate with other models of PLC manufactured by other suppliers.

2.9.8.3.h Ability to monitor the status of the processor remotely via the network.

2.9.8.3.i Security compliant so as not to expose the PLC or other integrated control systems to viruses.

2.9.8.d The PLC processor shall send and receive data on a network using the TCP/IP protocol.

2.9.8.e The PLC system shall provide industry-standard Ethernet communication capabilities embedded either in the PLC processor or through an Ethernet communication module.

2.9.8.4 General Ethernet Capabilities

2.9.8.4.a The Ethernet interface shall support the following:

2.9.8.4.b Standard IP communications,

2.9.8.4.c CSMA/CD access method,

2.9.8.4.d Subnet masking to comply with networks that use subnetting,

2.9.8.4.e DHCP client (selectable, turned on or off),

2.9.8.4.f Bridging to other types of networks (e.g., ControlNet and Profibus),

2.9.8.4.g Support both scheduled and unscheduled messaging simultaneously on the same Ethernet cable.

2.9.8.5 Ethernet Diagnostic Status

2.9.8.5.a The programmable controller shall locally maintain an Ethernet diagnostic status file that contains relative counters to record the number of retries.

2.9.8.6 PLC Processor-to-SCADA Communications

2.9.8.6.a The PLC processor shall transfer data to and from SCADA application software via Ethernet TCP/IP, User Datagram Protocol (UDP), IP multicast, or Object Linking and Embedding (OLE) for Object Linking and Embedding Process Control (OPC).

2.9.8.7 OLE for OPC

2.9.8.7.a Data communications using the OPC shall be accomplished using an external OPC server software application, while using the PLC processor itself as an OPC server or having a module within the PLC rack that contains an OPC server.

2.9.9 PLC Diagnostics

2.9.9.a The PLC system shall have resource and diagnostic control at all system levels. The PLC system shall provide diagnostic capabilities to allow troubleshooting down to the lowest replaceable unit.

2.9.9.b Diagnostics shall be of the power-up and online type.

2.9.9.c The PLC shall support a device that will display diagnostic results, status of selectable addresses, and the suspected modules that could cause the failure. The elimination of suspected failed modules shall be a maximum of three (3) of the most likely modules that could cause that particular failure.

2.9.10 PLC Software

2.9.10.a The user programs and data shall be contained in non-volatile memory.

2.9.10.b PLC software shall be developed using ladder logic. Specialized routines using software other than ladder logic shall only be accepted by the Owner if the BHS Contractor can demonstrate to the Owner that such routines cannot be provided by ladder logic and tools are provided to the Owner to allow the software to be modified.

2.9.10.c The BHS Contractor shall maintain a central PLC software library allowing roll-out of software version from a central point.

2.9.10.d Each rung of PLC logic shall be provided with an identifier and a detailed description of the logic.

2.9.10.e Tag naming conventions shall be User friendly, module / sub-system / subcomponent specific and in some way represent the function provided by the logic item.

2.9.10.f Each PLC software module shall have a detailed description detailing what function the module performs.

2.9.10.g Default parameters that are hard coded shall be grouped together for ease of identification and the default value at the time of handover shall be detailed in the software documentation descriptions.

2.9.10.h Fixed parameters shall be hard coded into the software. Setting of data registers at the time of commissioning is not acceptable.

2.9.10.i Upon acceptance of the system by the Owner, the PLC software and all source code shall become the property of the Owner.

2.9.10.j PLC scan time shall not exceed fifty milliseconds (50 ms) when system is running at full capacity. The BHS Contractor shall demonstrate this during commissioning phase.

2.9.11 PLC Functions

2.9.11.1.a The BHS Contractor shall provide a complete CBIS/BHS control system as part of the Scope of Works required under this Contract including, but not limited to the following functionalities;

2.9.11.2 Start-up

2.9.11.2.a All baggage handling equipment that can start automatically shall be fitted with audible and visual warnings of start-up.

2.9.11.2.b In public areas where there is a possible danger when starting a piece of equipment, the person controlling the start operation shall be able to see (either directly or with the aid of CCTV monitoring) all parts of the equipment where such a danger may occur.

2.9.11.2.c Input areas shall be provided with start-up functions following personnel activation of a readily accessible operator control station.

2.9.11.2.d Down-stream equipment lines/sub-systems shall be provided with automated start-up functions such that equipment is operating and running at full speed prior to a bag leaving the up-stream conveyor. The BHS Contractor shall ensure that bags are not discharging onto a stopped conveyor, shall avoid any cascade/dieback and any impact to the bag tracking, throughput and spacing.

2.9.11.2.e Conveyors shall start in a reverse cascade manner such that the starting of adjacent conveyors are delayed by a small time period to minimize inrush current on the electrical distribution equipment caused by the simultaneous starting of multiple conveyors.

2.9.11.2.f Conveyor start-up functionality shall maintain/restore baggage separation.

2.9.11.2.g Equipment stat-up status shall during the start-up process be shown at SCADA with a unique color coding.

2.9.11.2.h The 'START' push-button shall provide a 'START' function after an outage or controlled stoppage.

2.9.11.2.i The 'START' push-button shall provide an alarm silence feature for audible warning devices in the immediate vicinity of a fault condition. A new fault detected after an alarm silence has been initiated shall reactivate the audible alarm.

2.9.11.2.j The 'START' push-button shall provide a 'RESET' function for jam detection photocells that do not have a dedicated jam reset control station. If a dedicated jam reset control station is not located within 10' of the jam detection device (photocell), reset positions shall be provided at the first upstream and first downstream control station from the jam photocell.

2.9.11.3 Shut Down

2.9.11.3.a Equipment provided with control stations with "STOP" functionality shall allow personnel the ability to stop equipment at will. When activated the equipment shall run empty and come to a stop. Security/fire shutter doors shall close.

2.9.11.3.b Photocells shall perform auto-stop functions such that when no baggage is being processed, the conveyor sub-systems shall perform a purge (last bag shut down), shut down and become inactive.

2.9.11.3.c Equipment shut-down status (i.e. inactive, disabled, idle) shall be actively displayed via the SCADA with a unique color coding.

2.9.11.4 Jam

2.9.11.4.a All photocells shall be configured with jam detection functionality to stop all adjacent conveyors whenever the conveyor is running, and the photocell is blocked for a configurable time (typically six (6) seconds).

2.9.11.4.b Jam detection shall only be active when the respective conveyor is running. If a conveyor stops running as a result of cascade stop or other operational reason, no false jam alarm shall be generated.

2.9.11.4.c The conveyor shall be latched stopped such that is does not automatically restart when the bag jam is cleared and the jam photocell is no longer blocked. The conveyor shall require activation of a jam reset before a restart is allowed.

2.9.11.4.d Equipment jam status shall be shown at SCADA with a unique color coding.

2.9.11.5 Cascade Stop

2.9.11.5.a All conveyors shall have functionality to stop and queue baggage whenever the head end photocell becomes blocked, and the downstream conveyor is not operating. The conveyor shall restart automatically after the downstream conveyor has restarted and after a short delay has expired in order to restore baggage separation that may have been compromised when the conveyor cascade stopped.

2.9.11.5.b Cascade stops on inclines/declines shall not cause rolling bags on belt conveyors.

2.9.11.5.c Head end photocells shall be positioned at a location such that the conveyor comes to a complete stop before the bag is transferred onto a stopped conveyor or is in transition between two (2) conveyors.

2.9.11.5.d Conveyors at the end of a line shall have functionality to stop the conveyor whenever the head end photocell becomes blocked causing upstream conveyors to cascade/dieback.

2.9.11.5.e Equipment cascade stop status shall be shown at SCADA with a unique color coding.

2.9.11.6 Run Time

2.9.11.6.a All equipment shall report actual run time to the SCADA for planning and management of preventive maintenance activities.

2.9.11.6.b The equipment run status shall be accessible via the SCADA.

2.9.11.7 Timer Retention

2.9.11.7.a All timers shall stop and not time out whenever the system/equipment/conveyor stops so that no baggage can generate false alarms or become stranded within the system.

2.9.11.8 Indexing

2.9.11.8.a Laterals and run-out conveyors shall be provided with indexing functionality such that the conveyor runs momentarily to accept the approaching bag and create adequate tail to head bag spacing to the next bag.

2.9.11.8.b Indexing functionality shall be accomplished using a PEC at the tail end of the conveyor in combination with a shaft encoder to determine the belt distance travelled.

2.9.11.8.c Indexing conveyors shall be provided with indexing override functionality that allows the User to control the run time of the equipment. This shall take the form of a run lanyard, a foot PEC or a foot pedal as determined by Owner. The equipment shall run momentarily while the run lanyard is pulled, foot PEC is broken, or the foot pedal is activated.

2.9.11.8.d It shall not be possible to run the equipment beyond the head end full PEC and the equipment shall stop once such PEC is blocked by a bag.

2.9.11.8.e Laterals and run-out conveyors shall raise an alarm at SCADA when the head end full PEC is blocked for longer than six (6) sections (configurable).

2.9.11.9 Last Bag

2.9.11.9.a Upon activation of a Shut-Down the controls shall ensure that equipment does not stop before all bags have been processed by the system, i.e. the controls shall ensure that bags are not stranded and left anywhere in the system due to system shut-downs.

2.9.11.10 Lamp Test

2.9.11.10.a Provide functionality that allows personnel to inspect the operation of all indicator devices in power panels, control panels and control stations.

2.9.11.10.b All lamps within a sub-system (i.e. controlled by the MCP) shall illuminate when the “LAMP TEST” pushbutton is activated. The lamps shall continue to illuminate for a User Configurable time or until the same “LAMP TEST” pushbutton is pressed again.

2.9.11.10.c It shall be possible to test the bulb of individual indicator lamps/lights by pushing the pushbutton and the lamp/light shall illuminate for the time the pushbutton is pressed.

2.9.11.11 PEC Remap Function

2.9.11.11.a Functions to remap physical photocells to a virtual photocell for head end operation shall be submitted to the Owner for approval and shall only be considered by the Owner, if the BHS Contractor can demonstrate that a physical photocell cannot be installed or adequately maintained.

2.9.11.12 Operational Pause / Instant Stop

2.9.11.12.a Using the Operational Pause / Instant Stop functionality, it shall be possible for Users to instigate an immediate line stop.

2.9.11.12.b To resume operation after an Operational Pause / Instant Stop the User shall perform a START.

2.9.11.13 Oversize Detection

2.9.11.13.a Oversize detection shall only be active when the respective conveyor is running. If a conveyor stops running as a result of cascade stop or other operational reason, no false oversize alarm shall be generated.

2.9.11.13.b The conveyor shall be latched stopped such that is does not automatically restart when the oversize item is removed/reorientated, and the oversize photocell is no longer blocked. The conveyor shall require activation of an oversize reset before a restart is allowed.

2.9.11.13.c Provide over-length and over-height detection immediately downstream of each bag input.

2.9.11.13.d Provide over-height baggage detection immediately upstream of a wall penetration fitted with a security/fire door.

2.9.11.13.e The detection limits shall be configurable in maximum increments of 1” to accommodate the following range;

2.9.11.13.1 Minimum Detection Configuration Range

2.9.11.13.1.a 30” to 54” in length

2.9.11.13.1.b 16” to 34” in height

2.9.11.13.f Length detection shall be performed with a minimum of two (2) PECs. The use of one (1) PEC and timer is not allowed.

2.9.11.13.g The controls shall provide the following functionality when oversize baggage is detected;

2.9.11.13.2 Oversize Detection Events

2.9.11.13.2.a The particular conveyor with the oversize detection shall stop immediately.

2.9.11.13.2.b Upstream conveyors (if applicable) shall cascade stop (die-back) in order to queue bags.

2.9.11.13.2.c The oversize detection control device in the relevant control station shall illuminate to indicate the fault condition, the equipment status shall be shown at SCADA and an alarm shall be generated on the SCADA.

2.9.11.13.h The LLC shall provide the following functionality in order to reset an oversize condition;

2.9.11.13.3 Oversize Reset Events

2.9.11.13.3.a A User shall remove the bag from the conveyor and/or reposition the bag such that it is no longer oversize.

2.9.11.13.3.b The operator shall press the “OVERSIZE RESET” pushbutton on the adjacent control station and the local indicator shall extinguish and the alarm condition shall be reset.

2.9.11.13.3.c The local warning alarm shall be extinguished (if not already silenced).

2.9.11.13.3.d The operator shall press the “START” pushbutton and the stopped conveyors shall restart.

2.9.11.14 Energy Conservation - Intelligent Power Saving (IPS)

2.9.11.14.a Public area conveyors shall not have an Intelligent Power Saving function (e.g. Claim carousels, Ticketing take-away belts), but be provided with the Sub-System Energy Conversation mode defined in Part 2 § 2.9.11.15.

2.9.11.14.b Non-public conveyor shall each be provided with intelligent power saving (IPS) software such that a conveyor stops when no bags are being transported on the conveyor and a configurable number of upstream conveyors. For long conveyors immediately downstream of short conveyors (queue belts, power turns, and so on) shall look further upstream than the long conveyor to minimize unnecessary stopping and starting operations.

2.9.11.14.c Wherever possible, IPS shall consider bags on upstream conveyors using tracking information, to avoid the downstream conveyor stopping and then immediately starting due to arriving baggage so as to avoid unnecessary stop/starts while ensuring energy is not wasted.

2.9.11.14.d Wherever the BHS Contractor performs software modifications on an existing conveyor line the IPS functions for all conveyors on that conveyor line shall be modified to be fully compliant with the IPS functionality described in these Specifications.

2.9.11.14.e Each IPS shutdown timer shall be independently User Configurable.

2.9.11.14.f IPS timers shall be configured to ensure that a conveyor cannot perform more than a maximum number of stop/starts per minute dependent on the conveyor type (e.g., conveyors not designed for high cycling functions shall be limited no more than six (6) stop/start operations per minute).

2.9.11.14.g When an upstream bag approaches a stopped conveyor, the stopped conveyor shall restart such that the stopped conveyor is at full operating speed prior to the bag transferring onto the previously stopped conveyor, without stopping the upstream conveyor (dieback).

2.9.11.14.h When conveyors are operating in IPS mode, visual warning devices along the line shall operate periodically to alert personnel in the area that the conveyor is operating, and correct equipment status shall be shown at SCADA with a unique color code for IPS mode.

2.9.11.14.i Energy conservation shall be deemed to have been interrupted whenever an emergency stop device has been activated in the sub-system and restart of the equipment shall follow procedures for emergency stops.

2.9.11.14.j Provide a 3-position ON/OFF/SCADA key switch for each CDP/MCP centrally located to the PLC. The key shall be removable in all positions.

Table 43: IPS Key Switch

Position	Function
ON	All sub-systems within the PLC shall operate in IPS mode
OFF	All sub-systems within the PLC shall operate without IPS mode
SCADA	The use of IPS for all sub-systems within the PLC shall be User controlled via SCADA

2.9.11.14.k IPS functions shall be switchable ON/OFF by sub-system, via an interface in the SCADA system. This function is only possible, if the IPS key switch located adjacent to the PLC is in the “SCADA” position.

2.9.11.15 Energy Conservation - Sub-System Energy Conservation

2.9.11.15.a Sub-systems shall be provided with energy conservation functions.

2.9.11.15.b Individual sub-systems shall shut down after a User Configurable (1-30 minutes) time period (typically as specified below unless otherwise noted), whenever the sub-system is not processing baggage.

2.9.11.15.c The default shut down time period for zones with Access Readers shall typically be five (5) minutes.

Table 44: Sub-System Energy Conservation

Sub-System	Time-Out Duration
Ticketing / check-in	10 min

2.9.11.15.d Once conveyors have stopped and are shut-down due to sub-system energy conservation, associated security/fire doors shall close automatically.

2.9.11.15.e Techniques shall be employed to ensure that bags are not stranded on conveyor lines.

2.9.11.15.1 Take-Away Ticketing

2.9.11.15.1.a Ticketing conveyors in the public area shall have multiple zones such that upstream conveyors not being used by a ticketing agent do not continue to operate. Typically, a single zone shall be created for each conveyor that ticketing agents load baggage onto.

2.9.11.15.1.b When all timers in a ticketing sub-system have expired or all Access Readers are inactive, the ticketing sub-system shall shutdown and the security door(s) shall close.

2.9.11.15.1.c Shutdown timers associated with each zone shall reset whenever a photocell on the conveyor is blocked by baggage. Only photocells within a zone shall reset zone timers.

2.9.11.15.1.d An active upstream zone shall keep all downstream conveyors operating.

2.9.11.15.1.e When a timer in a zone has expired and the upstream zone is shutdown, the zone shall also shut-down and the security/fire door as appropriate shall close.

2.9.11.15.1.f When a zone times out, the start button shall extinguish and require personnel to obtain authorization by the Airport Security Authorization System (e.g. Access Reader) before allowing an operator to start the zone and open the security/fire door.

2.10 SYSTEM MONITORING

2.10.1 Local Visualization (Status Maps in CDP/MCP)

2.10.1.a To assist personnel with the in-field control and monitoring of the system provide local visualization of equipment status at each CDP/MCP.

2.10.1.b All components that make up the CBIS/BHS shall be monitored and their status reported graphically and alarmed in real time as detailed in this Specification.

2.10.1.c The update of screen elements shall be dynamic and be event based. All events shall be recorded.

2.10.1.d The detail design of the Status maps shall be coordinated with and accepted by the Owner during the Detail Design. Below are the minimum requirements.

2.10.1.1 Hardware for Local Visualization (Status Maps in CDP/MCP)

2.10.1.1.a The hardware for the Status maps mounted in the CDP/MCP panel shall be fan-less, industrially rated 16-bit color LCD/TFT screen.

2.10.1.1.b Status maps shall be minimum 12” size and have native resolution of 1024 x 768 or better.

2.10.1.1.c Status maps shall be touch sensitive and all related components shall be rated for NEMA 3.

2.10.1.1.d Environmentally packaged suitable for an industrial application exposed to blowing dust and dirt expected in an indoor CBIS/BHS, possible exposure to water.

2.10.1.1.e External USB ports for attachment of USB keyboard and/or mouse for configuration. Such external USB ports shall be disabled by the BHS Contractor to avoid the possibility of introducing of viruses into the CBIS/BHS.

2.10.1.1.f Provide 102-keys hardware keyboard at each CDP/MCP panel. Mounted on pull-out rail. Allow storage in panel.

2.10.1.e The system shall be responsive to User input and configuration.

2.10.1.f Each visualization screen shall maximize the use of the physical monitor size. Unused monitor space shall be avoided.

2.10.1.g All visualization screens shall be easy to use and have a cohesive and consistent appearance with consistent color coding and equipment symbols.

2.10.1.h It shall be possible for the User to minimize (turn on/off) the alarm window independently of User viewing visualization screens or dialogues.

2.10.1.i The visualization shall allow display of equipment status and alarm messages. The number of latest alarm messages shown in the alarm banner shall be configurable (3 default). It shall be possible to turn on/off the display of the alarm message banner and it shall be possible to maximize the alarm banner to use the full monitor. The operator shall be able to scroll through the last 24 hours of alarm messages (unless the PLC has been rebooted).

2.10.1.j The User shall be able to acknowledge alarms and create comments to alarms via the touch screen. It shall be possible to filter alarms.

2.10.1.k Each status map shall only display the equipment controlled by the particular PLC, i.e. it is not necessary to allow navigation to adjacent PLC zones.

2.10.1.l Provide a soft keyboard functionality to assist the User with login, enter alarm comments, and apply filtering constraints.

2.10.1.m Each screen shall allow Users to pull up the color-coding help legend and equipment symbol help legend screens on demand.

2.10.1.n It shall be possible for the User to access BHS Parameter settings.

2.10.1.2 Equipment Identification (ID)

2.10.1.2.a Each screen shall include static equipment identification of the equipment shown following the agreed equipment naming convention.

2.10.1.2.b Equipment names and serial numbers for screening machines shall be visible to the User.

2.10.1.2.c It shall be possible to turn on/off the display of the equipment ID.

2.10.1.o Perform an automatic logout of the User, if the status map has been inactive for a configurable time (default 10 minutes). Upon automatic logout the status map shall revert to showing the Overview screen and alarm message banner.

2.10.1.p The touch screen shall go into energy saving mode after 20 minutes of inactivity. Upon activation of the touch screen, it shall become operational and show equipment status again.

2.10.1.q User login is required to acknowledge alarms or provide any form of User inputs.

2.10.1.3 HMI Text

2.10.1.3.a All text shall be left aligned except titles/headings for number columns, which shall be right aligned.

2.10.1.3.b All number fields and columns shall be right aligned and have a fixed number of decimals.

2.10.1.3.c Line width shall be limited to 50-60 characters of text.

2.10.1.3.d Line height should be 130-150%.

2.10.1.3.e The use of Serif type fonts is not allowed. Accepted fonts include: Arial, Verdana, SansSerif or Calibri.

2.10.1.3.f Font sizes shall be uniform. Size 12-13pt for basic content/information, size 8-9pt for secondary and supporting information and size 14-15pt for enhanced content and Pop-up windows/messages.

2.10.1.3.g Text shall be sentence capitalized only.

2.10.1.3.h Use of color contrast between text font and background color shall be such that the contrast is high.

2.10.1.3.i The use of text emphasis shall be avoided. Underlining text is not allowed, while the use of Bold text is recommended for key information within a screen.

2.10.1.3.j Place important information in the top-left area of the screen. Consider normal English reading from left-to-right.

2.10.1.3.k Ensure each screen has an appropriate amount of unused 'white space'/'negative space' around the content to aid the User in reading the information.

2.10.1.4 Size of Soft Buttons

2.10.1.4.a The minimum active size of softkeys and buttons shall be maximized considering the best use of the screen size and be no smaller than 1" x ½".

2.10.1.5 Logos

2.10.1.5.a The space used for company logos shall be minimized.

2.10.1.r All devices that detect the position of a component (proximity, limit switch, etc.) shall be provided with logic that detects for an abnormal position, which shall be reported to the Status map. Examples include, but are not limited to, the following;

2.10.1.6 Minimum Position Detection

2.10.1.6.a A door closed limit switch detecting the door open position when it should be closed, indicating either a security breach or a limit switch fault.

2.10.1.6.b A proximity switch detecting the movement of a diverter when it should be retracted/extended, indicating a proximity adjustment/fault.

2.10.1.s The SCADA application shall provide the following functionality;

2.10.1.7 The Status Banner

2.10.1.7.a At the top of each screen provide a Status Banner, where icons are used to show the User the general status of the PLC. These shall include: network connection, master clock connection, highest priority of plant status.

2.10.1.7.b The Status Banner shall show the current date (YYYY/mm/dd), and time (HH:mm:ss).

2.10.1.7.c The Status Banner shall show the Sub-system name and PLC number along with theing

2.10.1.8 Functional Navigation Banner

2.10.1.8.a At the top and bottom of each screen a series of functional icons/buttons/tabs shall be provided allowing the User access to overall and typical operations and navigate the SCADA.

2.10.1.8.b It shall be possible for the User to switch between visualization and dialogues by selecting the appropriate icon/button/tab. And each icon/button/tab shall indicate what is active.

2.10.1.8.c The visualization icon/button/tab shall be colored based on the color code for the highest priority equipment status under that tab such that operators can easily identify when additional attention is needed.

2.10.1.9 Equipment Status Architecture

2.10.1.9.a The visualization system shall be based on a tiered multi-layered architecture with the following minimum layers;

2.10.1.9.1 Tier 1

2.10.1.9.1.a Overview Status Screen of PLC controlled equipment.

2.10.1.9.2 Tier 2

2.10.1.9.2.a External Interfaces Status Screen

2.10.1.9.2.b Application Software Status Screen

2.10.1.9.2.c PLC Status Screen

2.10.1.9.2.d Power Demand Status Screen

2.10.1.9.2.e Diagnostics Screen

2.10.1.9.2.f Statistics Screen

2.10.1.9.2.g On-line Alarm Banner & Extended Alarm Window

2.10.1.9.3 Tier 3

2.10.1.9.3.a Component Screens

2.10.1.9.4 Supporting Tiers

2.10.1.9.4.a Help Screen

2.10.1.9.4.b User Login

2.10.1.10 Tier 1: Overview Status Screen

2.10.1.10.a The overview screen shall be the top tiered screen and be shown by default after Users have successfully logged into the system.

2.10.1.10.b It shall be possible for the User to navigate to a specific Tier 2 screen by clicking on the specific tab in the overview screen. It shall be possible to return to the Tier 1 overview screen from every screen.

2.10.1.10.c The graphical presentation of the overview screen shall be a general representation of the actual mechanical design. I.e. a queue conveyor shall be shown as a short conveyor, while long transport conveyors shall be shown as a long conveyor such that Users can identify the equipment in the field. Their relative location shall correlate with the actual field installation. The design of the visualization screens shall be based on the mechanical CAD drawings.

2.10.1.10.d For large PLC controlled areas, it may be necessary to split the overview view two separate screen. Such situations shall be approved by the Owner during the Detail Design.

2.10.1.10.e The Overview screen shall contain and show the status of all monitored equipment.

2.10.1.10.1 Minimum Equipment Status Shown

2.10.1.10.1.a Interface connections, CPU in use (master/slave), scan time

2.10.1.10.1.b Show location, ID and status of panels (MCP, PDP, CDP, FDP)

2.10.1.10.1.c Show location, ID and status of each E-stop device.

2.10.1.10.1.d Show location, ID and status of all conveyors.

2.10.1.10.1.e Show location, ID and status of all carousels.

2.10.1.10.1.f Show location, ID and status of security/fire doors.

2.10.1.10.1.g Show location, ID and status of screening machines.

2.10.1.10.1.h Show location, ID and status of interlocked access doors and gates.

2.10.1.10.f It shall be possible for the User to navigate to a Tier 3 component screen by clicking on the individual equipment components, e.g., conveyor segment, carousel, doors, security machines and so on.

2.10.1.10.g It shall be possible for the User to toggle on/off location and status display of control stations.

2.10.1.10.h It shall be possible for the User to toggle on/off location and status display of shaft encoders (pulses), PEC (block/unblock/alignment signals), limit switches and proximity switches.

2.10.1.11 Tier 2: External Interface Status Screen

2.10.1.11.a The external interface screen shall illustrate the status of all external interfaces with the CBIS/BHS.

2.10.1.12 Tier 2: Application Software Overview

2.10.1.12.a Display the status of all software application tasks/threads.

2.10.1.13 Tier 2: PLC Status Screen

2.10.1.13.a Illustrate the complete PLC architecture including CPU, communication modules, power supply, local, remote, and distributed I/O.

2.10.1.13.b Display PLC heart-beat (health messages) status.

2.10.1.13.c Display the current and maximum PLC scan-times seen in last 24 hours.

2.10.1.13.d For Hot-back-up redundant PLC it shall be possible to identify the status of both pairs of the redundant configuration, i.e. show which side is operational and which is in standby.

2.10.1.13.e The system shall provide both a visual indicator and an alarm message when master equipment fails and the system must switch-over and run on redundant equipment (hot or warm back-up).

2.10.1.14 Tier 2: Power Demand Overview

2.10.1.14.a This screen shall show the power demand of each panel monitored and identify the used power source (source A/B/emergency etc).

2.10.1.14.b The screen shall show the daily, weekly and monthly power consumption for the equipment connected to the PLC.

2.10.1.14.c The status of power panel fuses.

2.10.1.15 Tier 2: Diagnostics Screen

2.10.1.15.a The Diagnostic screen shall allow the User to drill down and investigate the status of every PROFINET component on the network, as well as viewing any associated errors and alarms.

2.10.1.16 Tier 2: Statistics Screen

2.10.1.16.a The following statistical information will be provided on the HMI:

2.10.1.16.b Total system runtime

2.10.1.16.c Total peak throughput (bags/hr) (Daily, Weekly and Monthly)

2.10.1.16.d Number of bags processed (Daily, Weekly and Monthly)

2.10.1.16.e CBIS/BHS System availability (Daily, Weekly and Monthly)

2.10.1.16.f IG EDS System availability (Daily, Weekly and Monthly)

2.10.1.16.g Tabular format of faults in descending order by time required to rectify the fault. Provide list of the ten (10) faults of the past twenty-four (24) hours updated every one (1) minute.

2.10.1.16.h Tabular format of faults in descending order by frequency of the fault. Provide list of the ten (10) faults of the past twenty-four (24) hours updated every one (1) minute.

2.10.1.16.i Total number of Emergency stop device operations, quantity.

2.10.1.16.j Total number of Jams reported, quantity, min/max/average fault duration, total fault duration.

2.10.1.16.k Tabular format of time to clear jams in groups of; 0-2 minutes, 2-4 minutes, 4-8 minutes, and longer than 8 minutes, quantity, and percentage.

2.10.1.16.l Total number of E-stop events reported, quantity, min/max/average fault duration, total fault duration.

2.10.1.16.m Total number of Motor Overloads reported, quantity, min/max/average fault duration, total fault duration.

2.10.1.16.n Total number of Shaft Encoder faults, quantity, min/max/average fault duration, total fault duration.

2.10.1.16.o Total number of Security/Fire Door faults, quantity, min/max/average fault duration, total fault duration.

2.10.1.16.p Total number of VFD faults reported, quantity, min/max/average fault duration, total fault duration.

2.10.1.16.q Total number of other CBIS/BHS faults, quantity, min/max/average fault duration, total fault duration.

2.10.1.16.r Acceptance/reject rates for the Standard 3 IG EDS Machine

2.10.1.16.s Acceptance/reject rates for Level 2 and Level 3 IG EDS machine operators

2.10.1.16.t Number of cleared bags (Daily, Weekly and Monthly)

2.10.1.16.u Number of uncleared bags (Daily, Weekly and Monthly)

2.10.1.16.v Number of forced uncleared bags (Daily, Weekly and Monthly)

2.10.1.16.w Number of image timeouts (Daily, Weekly and Monthly)

2.10.1.16.x Number of bags not analysed (Daily, Weekly and Monthly)

2.10.1.16.y Number of EDS BNA bags (Daily, Weekly and Monthly)

2.10.1.16.z Number of BHS miss-track bags (Daily, Weekly and Monthly)

2.10.1.16.aa Number of EDS machine miss-tracked bags (Daily, Weekly and Monthly)

2.10.1.17 Tier 2: On-line Alarm Banner & Extended Screen

2.10.1.17.a For specifics on alarms refer to Part 2 § 2.10.3.

2.10.1.18 Tier 3: Component Screens

2.10.1.18.a When Users need to see more detailed information for a component they shall be able to navigate from the Tier 1 Overview status screen to each applicable Tier 3 component screen by clicking on the particular component within the Tier 1 screen.

2.10.1.18.b Users shall be able to return to the Tier 1 screen from every Tier 3 screen.

2.10.1.18.c The component screens shall contain information about each component as identified below;

2.10.1.18.1 Equipment Details

2.10.1.18.1.a Service counters (e.g. operating hours, stop/starts, loads/discharges)

2.10.1.18.1.b Equipment speeds and ratios

2.10.1.18.1.c Belt lengths and type

2.10.1.18.1.d Motor (type and HP), clutch and brake details

2.10.1.18.1.e Motor controller details (direct start, soft start, VFD)

2.10.1.18.1.f Sensor type details (e.g. shaft encoders, PEC type)

2.10.1.18.2 Additional MCP Details

2.10.1.18.2.a Fuse ID and fuse status as applicable

2.10.1.18.2.b Temperature status

2.10.1.18.d Within the Component screens provide the User with the ability to control the individual equipment using softkeys.

2.10.1.18.e The equipment control shall include run forward, jog forward, stop, run backward, jog backward, manual speed, and manual jog speed.

2.10.1.18.f The equipment control for VSU/VMU/ploughs/diverts shall be provided as necessarily to properly and safely operate the equipment.

2.10.1.19 Support Tier: Equipment Visualization Color Help Legend

2.10.1.19.a Devices such as, but not limited to, security/fire doors that cannot be easily represented in a plan view to depict the status of the door, shall use color coded symbols to present the status of the equipment.

2.10.1.19.b All equipment of the CBIS/BHS and their states shall be reported to the User including, but not limited to the following list. All events shall be recorded in the PLC.

Table 45 Equipment Visualization Color Legend

Equipment Status	Color	State
Running / OK	Light green	Steady
Conveyor fault / abnormal condition	Orange	Steady

Equipment Status	Color	State
Full	Cyan	Steady
Jam	Yellow/Amber	Steady
Cascade / die-back	Magenta	Steady
Stopped	Black	Steady
Intelligent Power Save (IPS) / Energy Save	Dark green	Steady
Maintenance	Brown	Steady
Unavailable	Brown	Flashing
Available, but with fault	Orange	Steady
Over-Height	White	Steady
Over-Length	White	Steady
Over-Width	White	Steady
Emergency-Stop active, not released	Red	Flashing
Emergency-Stop active, released	Red	Steady
Motor overload	Dark blue	Steady
Motor contactor failed to open	Dark blue	Steady
Motor contactor failed to close	Dark blue	Steady
Motor disconnect/isolator open	Dark blue	Steady
Motor disconnect interlock override active	Dark blue	Steady
Shaft encoder fault	Dark blue	Steady
Temperature alert for any panel/rack	Dark blue	Steady
Fuse OK	Light green	Steady
Fuse blown	Orange	Steady
Operational Stop	Cyan	Steady
Inactive	Grey	Steady
Sub-system Locked out	Grey	Steady
No connection / communication	Pink	Steady
Security/fire doors open	Green	Steady
Security/fire doors failed to open	Red	Flashing
Security/fire doors closed	Black	Steady
Security/fire doors failed to close	Red	Flashing
Security/fire doors in process of opening or closing	Green / Black	Alternating at 1 Hz
Security/fire door is open when it should be closed, indicating a potential security breach	Red	Flashing
Security/fire doors overload	Dark blue	Steady
Security/fire doors jam	Amber	Steady
Security/fire door obstruction (no clear space under door to close)	Red	Flashing
Security/fire doors fault	Red	Flashing
Security/fire doors fire signal active	Red	Flashing
MIS (HOA) not in automatic position	Brown	Steady
System authorization key-switch active	Light green	Steady
Screening lane unavailable	Show “unavailable” icon	
Emergency power condition in effect	Orange	Steady
Server Redundant	Light green	Steady
Server Non-Redundant	Orange	Steady
Server failed	Red	Flashing
Network switch/router port up (OK)	Light green	Steady
Network switch/router port down (no link)	Red	Steady
Network switch/router port illegal	Red	Flashing
Media converters OK	Light green	Steady
Media converters failed	Red	Flashing
PLC OK	Light green	Steady
PLC fault	Orange	Steady
PLC failed (heartbeat fault)	Red	Flashing

2.10.1.19.c In addition to the above listed statuses the following equipment status shall be monitored and displayed.

2.10.1.19.1 Additional Equipment Status

2.10.1.19.1.a Abnormal operation of the motor contactor

2.10.1.19.1.b Abnormal operation of the interface to the Clutch/Brake module (clutching when braking is required or clutching and braking at the same time).

2.10.1.19.1.c Abnormal operation (out of tolerance) of a shaft encoder

2.10.1.19.1.d Encoder pulses

2.10.1.19.1.e PEC status (blocked, unaligned, OK)

2.10.1.19.1.f Reverse running direction

2.10.1.19.1.g Equipment locked in one (1) position

2.10.1.19.1.h Other fault conditions that stop equipment

2.10.1.20 Support Tier: Equipment Symbol Help Legend

2.10.1.20.a Provide a legend screen showing the meaning of all symbols and graphical presentations used. The BHS Contractor shall provide the following list including, but not limited to;

Table 46 Visualization Equipment Symbol Legend

Equipment	Comment
Transport conveyor	
Incline conveyor	
Decline conveyor	
Power turn	
EDS machine	Provision for future addition
Security/fire door	
Flat plate carousel	
E-stop pushbutton	
Power panel (PDP, CDP, FDP, MDB)	
PLC CPU	
PLC I/O module	
PLC communication module	
PLC interface module	
PLC power supply	
VFD	
PEC	
Shaft encoder	
Proximity/limit switch	
Oversize detection sensor/array	

2.10.1.20.b The status color of the above-mentioned equipment shall follow the principles defined by the color legend in Table 46.

2.10.1.20.c The priority of equipment status shall be in ascending order as follows;

2.10.1.20.1 Priority of Equipment Statuses

2.10.1.20.1.a No communication to SCADA server

2.10.1.20.1.b No communication to the PLC

2.10.1.20.1.c E-stop

2.10.1.20.1.d Fire Alarm Active

2.10.1.20.1.e Faults / abnormal conditions

2.10.1.20.1.f Motor overload

2.10.1.20.1.g Jams

2.10.1.20.1.h Shaft encoder fault

2.10.1.20.1.i Technical Faults

2.10.1.20.1.j Maintenance mode

2.10.1.20.1.k Locked by operator

2.10.1.20.1.l Equipment stopped

2.10.1.20.1.m Equipment running

2.10.1.20.1.n Energy save

2.10.1.21 Support Tier: Login Screen

2.10.1.21.a For specifics on User rights, and login refer to Part 2 § 2.10.7.

2.10.2 User Control via SCADA

2.10.2.a The User shall be able to control the operational status of the equipment from the visualization screens of the SCADA as follows.

2.10.2.1 Operational State

2.10.2.1.a Users shall be able to turn on (start) and turn off (shutdown) lines, sub-systems etc.

2.10.2.1.b Users shall be able to place equipment in auto/manual/lock modes of operation. A lock-out shall inhibit the operation of a conveyor line. The line shall run empty and stop, if running, and be inhibited from further operation. The security/fire door shall close (if fitted) and alarm the door, if it fails to close properly.

2.10.2.1.c Users shall be able to place sub-systems in intelligent Power Saving (IPS) mode of operation.

2.10.2.1.d Users shall be able to manually start/stop each equipment line.

2.10.2.1.e Download VFD parameters from the PLC to all VFD's.

2.10.2.b The User shall be able to manage equipment service counters from the SCADA as follows.

2.10.2.2 Service Counters

2.10.2.2.a All equipment shall have service counters used for maintenance purposes.

2.10.2.2.b Service counters shall be configurable in hours (run-time) and activations (quantity). The system shall record the grand total service count (non-resettable) and intermediate service counters (since last reset).

2.10.2.2.c It shall be possible to configure the alarm threshold for intermediate service counters for each object/component/part independently.

2.10.2.2.d It shall be possible for operators to reset intermediate service counters.

2.10.2.c The User shall be able to modify the following User configuration parameters.

2.10.2.3 User Configuration

2.10.2.3.a Energy saving shutdown timers.

2.10.2.3.b Turn the Intelligent Power Saving (IPS) on/off by sub-system.

2.10.2.3.c Number of alarm lines shown in alarm window or make this dynamically sizable by the User.

2.10.2.3.d Timeouts for automatic logout.

2.10.3 Alarms

2.10.3.a All alarms shall be recorded and retained electronically for a minimum period of one (1) year such that review and analysis of the alarms can be performed.

2.10.3.b Alarm messages from hardware, and software applications along with operational alarms shall be recorded.

2.10.3.1 On-line Alarm Banner

2.10.3.1.a At the bottom of the screen provide a window with a configurable number of alarm lines/rows showing the most recent alarms in chronological order. The most recent alarm shall be shown at the top. The window shall refresh whenever there is a change to provide an accurate and up-to-date alarm status.

2.10.3.1.b The User shall be able to acknowledge alarms in this window.

2.10.3.1.c The User shall be able to reset alarms in this window.

2.10.3.1.d It shall be possible to configure alarm filtering of the shown alarms.

2.10.3.1.e It shall be possible for the User to minimize (turn on/off) the on-line Alarm Banner.

2.10.3.1.1 Entities of Alarm Banner

2.10.3.1.1.a Time stamp of alarm ([YYYY]-[MM]-[DD]T[hh]:[mm])

2.10.3.1.1.b Full alarm description

2.10.3.1.1.c Alarm Class

2.10.3.1.1.d Alarm Category

2.10.3.1.1.e Alarm Priority

2.10.3.1.1.f Alarm Type

2.10.3.1.1.g Alarm status (pending, acknowledged, unacknowledged, reset)

2.10.3.1.1.h Sub-system identification

2.10.3.1.1.i Equipment type

2.10.3.1.1.j Equipment identification

2.10.3.1.f It shall be possible for the User from an alarm message to automatically open the relevant Tier 3 visualization screen for the particular equipment component.

2.10.3.2 Extended On-line Alarm Window

2.10.3.2.a Is shall be possible for the User to increase the number of alarms that are displayed at once, by maximizing the On-line Alarm Banner to utilize the full screen size.

2.10.3.2.b The Extended On-line Alarm window shall have the same functionality as the On-line Alarm Banner.

2.10.3.c Each alarm shall be assigned properties that allow for easy identification and categorization, which shall allow the User to customize when and how alarm messages are shown in the On-line Alarm and Extended On-line Alarm Banners. The following properties shall as minimum be provided;

2.10.3.3 Alarm Class

2.10.3.3.a Alarm: Event that requires immediate User action

2.10.3.3.b Warning: Warns the User about a certain status of the system

2.10.3.3.c Information: Informative message to the User about a certain aspect of the system

2.10.3.3.d Application: Messages related to the performance or operation of HLC or LLC software applications, e.g. restart a process.

2.10.3.4 Alarm Category

2.10.3.4.a Security: A security related event has occurred, e.g. airport security access system granted authorization at a security door.

2.10.3.4.b Safety: A safety device has been activated, e.g. an Emergency stop or fire alarm signal

2.10.3.4.c Technical: An equipment failure has occurred, e.g. motor overload

2.10.3.4.d Operational: An operational event has occurred, e.g. bag jam, inputs cascade stopped, over-height.

2.10.3.5 Alarm Priority

2.10.3.5.a High: Alarm message of high priority

2.10.3.5.b Medium: Alarm message of medium priority

2.10.3.5.c Low: Alarm message of low priority

2.10.3.6 Alarm Type

2.10.3.6.a Safety

2.10.3.6.b Security

2.10.3.6.c Jam

2.10.3.6.d Cascade

2.10.3.6.e Missing bag

2.10.3.6.f Full condition

2.10.3.6.g Oversize condition

2.10.3.6.h Motor overload

2.10.3.6.i Disconnect/Isolator off

2.10.3.6.j Equipment fault

2.10.3.6.k Component fault

2.10.3.6.l Maintenance mode

2.10.3.6.m HLC hardware fault (server/UPS/database)

2.10.3.6.n Network fault

2.10.3.6.o Software application notices

2.10.3.6.p Operational problem

2.10.3.6.q (List is not exhaustive and shall be further developed by the BHS Contractor during the Design phase).

2.10.3.7 Alarm Status

2.10.3.7.a Pending: The alarm has a start time recorded in the database, but no end time.

2.10.3.7.b Acknowledged: The alarm has been acknowledged by the Operator.

2.10.3.7.c Unacknowledged: The alarm has not yet been acknowledged by the Operator.

2.10.3.7.d Reset: The alarm has an end time recorded in the database.

2.10.3.d It shall be possible for the User to configure how each Alarm Type is displayed, e.g. text color, background color, state of the alarm (steady, flashing, frequency of flashing).

2.10.3.e Each alarm/message event shall have the following information recorded and retained by the system;

2.10.3.8 Alarm Message Data Entities

2.10.3.8.a Alarm start time ([YYYY]-[MM]-[DD]T[hh]:[mm])

2.10.3.8.b User acknowledgement time ([YYYY]-[MM]-[DD]T[hh]:[mm]) and User ID

2.10.3.8.c Alarm end time ([YYYY]-[MM]-[DD]T[hh]:[mm])

2.10.3.8.d Duration of alarm (calculated values shall not be saved)

2.10.3.8.e Alarm comment, if applicable

2.10.3.8.f Alarm Class

2.10.3.8.g Alarm Category

2.10.3.8.h Alarm Priority

2.10.3.8.i Alarm Type

2.10.3.8.j Sub-system identification

2.10.3.8.k Equipment type

2.10.3.8.l Equipment identification

2.10.3.8.m Full alarm description

2.10.3.f It shall not be possible for operators and maintenance staff to modify or delete alarm records unless such messages are more than one (1) year old.

2.10.3.g The system shall besides the equipment status alarms provide the following operational alarms;

2.10.3.9 Operational Alarms

2.10.3.9.a A configurable number of consecutive bags have lost their bag tracking at a given position.

2.10.3.9.b Input has stopped due to a downstream obstruction (system die-back).

2.10.3.9.c (List is not exhaustive and shall be further developed by the BHS Contractor during the Design phase).

2.10.3.10 Alarm Acknowledgement

2.10.3.10.a The system shall record and store the User ID and time stamp when alarms are acknowledged.

2.10.3.10.b Acknowledgement of an alarm from any workstation shall be treated equal and the status of the alarm shall change to acknowledged on all workstations as appropriate.

2.10.3.10.c Once an alarm has been acknowledged the audible and visual warnings shall be turned off.

2.10.3.11 Alarm Commenting

2.10.3.11.a Operators shall be able to create comments to an alarm in both the On-line Alarm Banner and Extended On-line Alarm window. Such comments along with the timestamp and User ID shall be recorded.

2.10.4 Dialogues

2.10.4.1 General

2.10.4.1.a All dialogues shall be easy to use and have a cohesive and consistent appearance.

2.10.4.2 Administration Dialogues

2.10.4.2.a The SCADA shall be provided with dialogues that allow administrators to manage Users and User rights plus monitor who is currently logged into the system. Refer to Part 2 § 2.10.7

2.10.4.3 Analytical / Statistics Dialogues

2.10.4.3.a The SCADA shall be provided with dialogues that allow operators to view, manage and create reports based on the operational data of the system as per section Part 2 § **Error! Reference source not found.**.

2.10.4.4 Export of Data

2.10.4.4.a It shall be possible to export the selected and displayed data from any dialogue to the following file formats.

2.10.4.4.1 File formats

2.10.4.4.1.a HTML

2.10.4.4.1.b PDF

2.10.4.4.1.c RTF

2.10.4.4.1.d CSV

2.10.4.4.1.e XLS.

2.10.5 Performance Dashboard

2.10.5.1 General

2.10.5.1.a The SCADA shall be provided with a Performance Dashboard overview, which visually through graphics and figures give the Users an overview of the current real-time performance of the CBIS/BHS.

2.10.5.1.b It shall be possible to print snap-shots and daily summaries of the Performance Dashboard.

2.10.5.1.c All performance data shall be listed against an User configurable target performance. The actual performance data shall be color coded (green, yellow, orange, red) in relation to the target value, where green means better performance than target, yellow means 0-5% excess over target, orange means 5-20% excess over target, and red means 20% excess over target.

2.10.5.1.d The Dashboard shall show the following data;

2.10.5.2 General Data

2.10.5.2.a Total operating time, hh:mm & percentage of 24 hour day to 1 decimal place.

2.10.5.2.b Current time of the Master Clock

2.10.5.2.c Field to allow input of operational comments by the Users.

2.10.5.3 Performance Data

2.10.5.3.a Total quantity of bags processed.

2.10.6 On-Line Help

2.10.6.a The BHS Contractor shall provide and include a descriptive “Help” functionality within the SCADA such that Users can find answers to any operational questions they may have to the use of the SCADA.

2.10.6.b The Help shall be HTML or Java based such that the content of the Help is searchable and indexed. Hyperlinks shall be provided to allow quick access to desired content.

2.10.6.c From the Help the User shall have access to the O&M manuals and they shall be able to view PDF files of drawings, procedures, and instructions.

2.10.6.d The Help function shall be accessible at all times from any OWS, any screen or dialogue.

2.10.7 User Management and User Rights

2.10.7.a Provide a centrally controlled User Management feature, which shall prevent unauthorized access to all parts of the CBIS/BHS. The User Management shall ensure that the integrity of the system and data is maintained at all times.

2.10.7.b Access to any part of the CBIS/BHS shall be restricted to authorized personnel only. Access shall be granted after verification of Username and password. The integrity of the CBIS/BHS shall be ensured through encryption of data and the use of Virtual Private Network (VPN) tunneling protocols.

2.10.7.1 Login

2.10.7.1.a Upon startup of any OWS, server, computer or other User interface personnel shall be forced to login using their unique Username and password combination.

2.10.7.1.b Should they fail to enter the correct Username and password combination within three (3) attempts a warning shall be sent to the System Administrator and the Username shall automatically be locked out/disabled requiring a security administrator to reset and enable before allowing the Username access.

2.10.7.2 Usernames

2.10.7.2.a Usernames shall be case insensitive (‘JOHN’ shall be the same as ‘John’)

2.10.7.2.b Provide a minimum of one default Username to perform Security tasks only, which shall not be deleteable. An User with a Security profile shall not be allowed access to perform operational tasks.

2.10.7.2.c Provide Users to perform Operational tasks. An operational User shall not be allowed access to security tasks.

2.10.7.2.d Usernames shall be unique of no less than three (3) characters and it shall be possible to configure a username of up to twenty (20) characters.

2.10.7.2.e Provide the ability to disable/enable Usernames without the requirement to delete/add an existing User. Disabled Usernames shall not allow access.

2.10.7.3 User Passwords

2.10.7.3.a Passwords shall fulfill the following minimum requirements

2.10.7.3.1 Passwords Complexity Rules

2.10.7.3.1.a Passwords shall start with an alphabetic character

2.10.7.3.1.b Passwords shall contain least one (1) alpha character.

2.10.7.3.1.c Passwords shall contain least one (1) numeric character.

2.10.7.3.1.d Passwords shall contain at least one (1) special character.

2.10.7.3.1.e Passwords shall contain a minimum of six (6) valid characters and shall allow for at least twenty

(20) characters.

2.10.7.3.1.f At least one character shall be capitalized.

2.10.7.3.1.g All capitalized characters shall not be allowed.

2.10.7.3.1.h Passwords shall be case sensitive ('ALPHA' shall not be the same as 'alpha').

2.10.7.3.1.i Passwords cannot be the same as the Username

2.10.7.3.b Passwords shall expire thirty (30) calendar days after their creation. Upon login an alert shall be presented to the User once the password has expired requiring the password to be changed before allowing the User to proceed.

2.10.7.3.c When changing passwords, the User shall be prompted to enter the current password followed by the new password. A new password confirmation entry shall be provided to verify the password being entered. When the current password has been authenticated and the new password has been verified as valid, the new password shall be set and the User shall be gained entry to the system. If the password change process fails (invalid current or new password), access to the system shall be denied.

2.10.7.3.d When passwords are entered, the screen shall show an asterisk (*) for each character being entered, such that a casual observer cannot see the password. Passwords stored in the database shall be encrypted and not be visible.

2.10.7.3.e If an expired password has not been changed within thirty (30) days (a total of sixty (60) days since the password was created), an alert dialogue shall be provided to the User indicating that the password has been disabled and an administrator is required to reset the password.

2.10.7.3.f When changing a password, entering the expired password as the new password shall generate an error, the password shall not be changed and the Operator shall be prompted to enter a valid password that is not similar. It shall not be possible to reuse old passwords within a running time window of twelve (12) months.

2.10.7.3.g Provide a secure mechanism to allow an administrator to set a default password for situations where an expired password has been disabled.

2.10.7.3.h After an administrator has set a default password, the next time the User accesses the system, a dialogue shall be displayed requiring the User to change the default password as if the password had expired prior gaining access.

2.10.7.4 Logoff

2.10.7.4.a Users with a "Security" profile shall automatically be logged off if the User has been inactive on their OWS, server, computer or other User interface for more than two (2) minutes based on key-board and/or mouse.

2.10.7.4.b Users with a profile other than the "Security" profile shall automatically lock the session that has been inactive on their OWS, computer or other User interface for more than a configurable time period, (typically ten (10) minutes) based on key-board and/or mouse activity requiring the logged in User to re-enter the valid password before gaining access. Setting the configurable time period to zero (0) shall disable the automatic session lock feature.

2.10.7.4.c Only one (1) active session shall be allowed per OWS, computer or other User interface. If a User attempts to login while another User is already logged in the first User shall be automatically logged out (unsaved changes shall be lost) once the Username and password combination for the new User has been validated and access has been granted.

2.10.7.4.d If an User is logged in at a workstation and the same User attempts to login at another workstation, an alert shall be reported on both workstations indicating the workstation ID of the other workstation, an event log entry shall be generated (include timestamp, Username, workstations and session log-in of initial workstation) and access at both workstations shall be logged out.

2.10.7.5 User Profiles

2.10.7.5.a The management of User rights and authorization levels shall be based on User profiles.

2.10.7.5.b It shall be possible to add/delete/edit/assign a required User profile for general and specific actions/commands.

2.10.7.5.c The below table indicate expected User rights per User profile. The BHS Contractor shall

coordinate the detailed User rights per User profile with the Owner.

Table 47 User Profiles and Rights

	Security	Administrator	Supervisor	Engineer	Operator	TSA	Ground Handler[1]	Maintenance
Action / User Right	**User Profile**							
Manage User profile and associated authorization	✓							
Manage relationship between Users and groups of Users with User profiles	✓							
View Real-time Monitoring Sort Allocation plan		✓	✓	✓	✓		✓	
Manage Real-time Monitoring Sort Allocation plan		✓	✓	✓	✓			
View		✓	✓	✓	✓			
Edit/Modify		✓	✓					
Delete		✓						
Save		✓	✓	✓				
User Action		✓	✓	✓	✓			
Equipment control		✓	✓	✓				
Alarm acknowledgement		✓	✓	✓	✓			
Standard reports		✓	✓	✓	✓			
Flight reports		✓	✓	✓	✓		✓	
TSA reports		✓	✓	✓		✓		
SSI data		✓	✓	✓		✓		
Maintenance Station		✓	✓	✓				✓
Configuration of parameters		✓		✓				
Back-up / Restore functions		✓		✓				

2.10.8 System Back-up & Recovery

2.10.8.1 General

2.10.8.1.a The BHS Contractor shall provide all the necessary tools and licenses to allow the Owner to back-up and restore any device with software and/or firmware.

2.10.8.1.b At Substantial Completion the BHS Contractor shall provide two (2) live copies of all operational software such that in the event of a system failure the Owner can install placement memory cards in a like environment and be operating within fifteen (15) minutes.

2.11 EXTERNAL INTERFACES

2.11.1 General

2.11.1.a The BHS Contractor is responsible to coordinate all required external interfaces with the Owner, Airlines, Stakeholders, Main Contractor and other contractors supplying equipment and data for this project in order to provide a fully functional and working airport.

2.11.1.b All interfaces shall be coordinated during the Preliminary and Detail Design Stages and specific protocol agreement documents shall be prepared specific for each interface and signed by the parties affected by the interface. The BHS Contractor is responsible for the preparation of such

[1] Each Ground Handler shall only have permission to view data for airlines that the particular ground handler is serving.

protocol documents and ensures that signatures are obtained prior to submission to the Owner for review and approval.

2.11.1.c The BHS Contractor shall plan for commissioning of the complete CBIS/BHS without the availability of any of the external interfaces. The BHS Contractor shall develop and provide the necessary interface simulators to allow all CBIS/BHS Commissioning and Testing activities to be performed independent of all external interfaces.

2.11.1.d The BHS Contractor shall coordinate with each external interface supplier a methodology to prioritize the data transmission of the most recent and up-to-date information after reestablishing the interface connection after a communication fault rather than flooding the interface with download/transmission of older obsolete information.

2.11.2 Airport Security Authorization System Interface (ASAS)

2.11.2.a The control of fire and security doors is an integral part of the airport security system. Doors controlled by the CBIS/BHS shall not be opened and equipment in public areas shall not start-up without prior authorization from the Airport Security Authorization System (ASAS). Such authorization shall be obtained when authorized staff swipes their ID card in a card reader (provided by others) or is identified by other means.

2.11.2.b The interface with the ASAS shall be provided at the following locations: Each ticketing line, each fire door, each security door and each Claim device.

2.11.2.c For each security door provide one (1) volt free interface signal from the CBIS/BHS to the ASAS indicating when the conveyor under the door is operating/not operating.

2.11.2.d For each security door provide 2 limit switches on the secure side of the door. One (1) fully open and one (1) fully closed. The limit switches shall be wired back to the MCP to provide one (1) volt free interface signal for each security door from the CBIS/BHS to the ASAS indicating when the door is fully open and fully closed.

2.11.2.e Inter-connecting terminals shall be supplied in the MCP and shall be uniquely colored to indicate an external interface (green and red excluded).

2.11.2.f The BHS Contractor shall coordinate with the Owner the interface between the CBIS/BHS and the ASAS prior to the preparation and submittal of Controls & Electrical drawings and functional descriptions.

Table 48 ASAS Logical Interface

Function / Signal	Connection Type	System 1	Direction	System 2
Equipment running	Failsafe potential free dry contact (NC)	BHS LLC	→	ASAS
Door fully open	Failsafe potential free dry contact (NC)	BHS LLC	→	ASAS
Door fully closed	Failsafe potential free dry contact (NC)	BHS LLC	→	ASAS
Authorization to open door approved	Failsafe potential free dry contact (NC)	BHS LLC	←	ASAS
Authorized to start equipment in public view (Ticketing take-away, Claim device)	Failsafe potential free dry contact (NC)	BHS LLC	←	ASAS

2.11.3 Fire Alarm System (FAS) Interface

2.11.3.a The BHS Contractor shall coordinate with the Fire Alarm System (FAS) Supplier the messages to be exchanged between the FAS and BHS HLC and BHS LLC. The following table indicates the minimum anticipated messages, but the list is not all inclusive and the BHS Contractor shall coordinate and provide all additional messages at no cost to the Owner.

Table 49 FAS Logical Interface

Function / Signal	Connection Type	System 1	Direction	System 2
Fire door failed to close	Failsafe potential free dry contact (NC)	BHS LLC	→	FAS
One (1) fire alarm signal per fire zone (two (2) per door, one (1) on either side)	Failsafe potential free dry contact (NC)	BHS LLC	←	FAS
One (1) fire alarm condition	Failsafe potential free dry contact (NC)	BHS LLC	←	FAS

2.11.3.b The Fire Alarm System (FAS) is connected to the CBIS/BHS via a failsafe dry contact (no current) I/O circuit installed in the PDP. The BHS Contractor shall distribute the FAS signal throughout the installation to all fire and security doors.

2.11.3.c The BHS Contractor shall operate and control all fire doors and security doors. Each fire door shall be provided with local detector(s) that stop the equipment under the door and closes the door when the FAS is activated.

2.11.3.d The Owner shall terminate the FAS signal at the PDP or provide Fire Signal boxes from where the BHS Contractor shall obtain the fire signal. If Fire Signal boxes are used the BHS Contractor shall provide cabling and terminating to such boxes from the PDP.

2.11.3.e Interconnection terminals shall be provided in the MCP by the BHS Contractor, separated from other CBIS/BHS terminals and colored red to indicate an external fire interface.

2.11.3.f The BHS Contractor shall coordinate the design based on the fire zoning defined by the Owner and/or his representative.

3 PART 3 - EXECUTION REQUIREMENTS

3.1 QUALITY CONTROL

3.1.1 General

3.1.1.a The BHS Contractor shall comply with the requirements defined in Division 1. In addition to these requirements the following additional requirements shall apply.

3.1.1.b The BHS Contractor shall have his Quality Control Program in place to ensure that all materials and Works are completed in compliance with Contract Documents. The BHS Contractor is solely responsible for Quality Control with the exception of those tests and/or audits that may be conducted by the Owner.

3.1.1.c Test schedules and/or testing requirements for materials used on this project are included in the Contract Documents. Laboratory and field testing identified in the Contract Documents shall be conducted by an Independent Testing Agency (ITA) retained by the BHS Contractor.

3.1.1.d The BHS Contractor is obligated to correct or remove non-conforming materials, whether in place or not. If necessary, the Owner will send written notification to the BHS Contractor to correct or remove the defective materials from the project. If the BHS Contractor fails to respond, the Owner may order correction, removal and/or replacement of defective materials by others, in which case the BHS Contractor shall bear all costs incurred by such actions.

3.1.1.e Materials accepted on the basis of a Certificate of Compliance may be sampled and inspected/tested by the Owner or its designer at any time. The fact that the materials were accepted on the basis of such certification shall not relieve the BHS Contractor of his responsibility to use materials that conform to the Specifications.

3.1.1.f The BHS Contractor shall impose upon his suppliers the same quality control requirements, including inspection and test procedures, as imposed upon him by the Specifications and referenced standards. The BHS Contractor shall apply appropriate controls, designed to ensure that all materials supplied meet the requirements and Specifications.

3.1.1.g The BHS Contractor shall maintain an effective Quality Assurance program during all phases of the project including demolition, construction, testing and/or any other type of Works involved in installing the Works identified in this Specification in accordance with the general conditions of Contract.

3.1.1.h QA issues that are outstanding for more than one (1) week shall be given priority and addressed immediately unless approved by the Owner.

3.1.1.i In the event that the BHS Contractor fails to address QA issues in a timely manner, the Owner reserves the right to delay/stop the Works until such time as the BHS Contractor addresses in full all outstanding QA issues to the satisfaction of the Owner, the Owner has inspected the Works and approved Works/construction to continue. All costs/time associated with the delay shall be borne entirely by the BHS Contractor and no additional time shall be granted. The BHS Contractor is required to absorb the delay by working longer hours or increase man-power to meet the project schedule.

3.1.2 Quality Control Plan

3.1.2.a The Quality Control Plan shall provide a general description of Quality Control monitoring to be performed until Final Completion and Acceptance of the Works by the Owner. It shall include monitoring activities of Works and the worksite during times no construction activity is scheduled to take place.

3.1.2.b The BHS Contractor shall designate an employee as the Quality Control Manager qualified to perform quality control monitoring of the Works. The designated individual shall have the authority to direct Works changes required to bring the Works into conformance with contract requirements including stopping non-conforming Works in progress.

3.1.2.c The BHS Contractor shall for each discipline of the project, if applicable, provide a Quality Control Manager for oversight of the project, who reports directly to the Owner.

3.1.2.d The BHS Contractor shall submit the resume of the proposed Quality Control Manager for the Owner’s review and acceptance. The resume is to include evidence that the Quality Control

Manager has the background, training, and minimum five (5) years' experience to accurately monitor the progress of the Works.

3.1.2.e The Quality Control Manager shall be on-site and available a minimum of forty (40) hours per week or more as required providing quality control inspections of the work being performed.

3.1.2.f The Quality Control Manager shall deliver a daily, weekly, monthly, or more frequently as required, a written report of his inspections provided to the Owner.

3.1.2.g Any discrepancies found or reported by the Quality Control Manager shall be brought to the attention of the Quality Control Manager and the Owner.

3.1.2.h The Quality Control Plan shall address all requirements for quality control. The BHS Contractor shall identify each item requiring submittal and approval/acceptance prior to installation of Works. Also, the BHS Contractor shall identify each item of Works requiring testing by the independent testing agency.

3.1.2.i The Quality Control Plan shall address and establish controls and documentation format to ensure that items or materials that have been accepted through receiving inspection are used or installed. Identification and traceability shall be provided throughout all inspections, test activities and records. For stored items, provisions shall be made for the control of item/material identification, consistent with the expected duration and type of storage.

3.1.2.j Provide methodology of monitoring, testing and use of all quality control equipment to ensure the Works installed is in proper working order.

3.1.2.k The BHS Contractor shall submit a list of suppliers and sub-contractors. This list shall include items to be supplied by each supplier and/or sub-contractor and shall identify Works to be performed by each sub-contractor. The list shall be updated and resubmitted as required.

3.1.2.l Provide emergency contact information including name, company, title, work phone number, home phone number and other means of contact. The Emergency Contact list shall include at least four (4) individuals. The Emergency Contact list shall be maintained on a daily basis. In the event there is any change in any of the information, the BHS Contractor shall forward the updated list to the Owner and the airport Maintenance Control. The Emergency Contact list shall include the project number, project title and date of issue.

3.1.3 Daily Quality Control Report

3.1.3.a The Daily Quality Control Report shall be submitted daily on the form included in Specifications Section 01999. The BHS Contractor may add sheets of information to this form as required.

3.1.3.b The report shall address at a minimum the following: identify number of workers on site each day by trade, identify notifications and discussions with/by Owner's Quality Assurance Inspectors and other agency inspectors, identify quality of Works performed that day and any deviations and/or corrections required to bring the Works into conformance with the contract.

3.1.3.c Daily reporting shall be computerized or typed on the approved form. Legible, hand-written reports on the approved form may be accepted under special circumstances.

3.1.3.d Submit one (1) copy of the Daily Quality Control Report to the Owner the day following the work. The report shall be signed by the BHS Contractor's Quality Control Manager and the BHS Contractor's Superintendent.

3.1.4 Corrective Action Report (CAR)

3.1.4.a Conditions adverse to quality will be reviewed by the BHS Contractor to determine the cause and to recommend a corrective action that will prevent recurrence. The condition, its cause and the corrective action planned shall be reported to the Owner prior to implementation. Follow-up action shall be taken to verify implementation of the corrective action.

3.1.4.b The BHS Contractor will document the corrective action and a copy of the Corrective Action Report (CAR) will be transmitted to the Owner.

3.1.5 Remedial Action Request (RAR)

3.1.5.a The Owner will request the BHS Contractor to take remedial action when nonconforming Works is discovered and/or when test results indicate nonconforming Works.

3.1.5.b The Owner will document remedial action that cannot be taken immediately (the same day) by issuing a Remedial Action Request form to the BHS Contractor. Remedial Action Requests are appropriate when the affected element of Works is in-progress and discrepancies can be rectified as the Works proceeds. RAR's shall be written when Works can be brought back into conformance with the Contract Documents.

3.1.5.c When issued, a Remedial Action Request will preclude payment for elements noted and will remain in effect until corrective actions have been submitted, approved, and performed.

3.1.5.d Upon satisfactory completion of the remedial action, the BHS Contractor shall transmit the RAR form with the BHS Contractor's statement of action taken (including any applicable test results) to the Owner. The Owner will perform a follow-up inspection to verify the RAR has been satisfactorily completed. The RAR then will be closed.

3.1.6 Nonconformance Report (NCR)

3.1.6.a The Owner will issue a Nonconformance Report to the BHS Contractor whenever there are violations of the terms of the contract that cannot be immediately brought back into conformance, including materials received and/or items of the Work found not to be in conformance with contract requirements. When issued, a Nonconformance Report will preclude payment for elements noted and will remain in effect until corrective actions have been submitted, approved, and performed.

3.1.6.b The Nonconformance Report form will describe the nature and extent of nonconforming elements and will include space for the BHS Contractor's corrective action proposal, the designer's review of the BHS Contractor's proposal, re-inspection and/or verification of approved corrective rework and space for the Owner’s opinion on the nonconformance matter. Copies of the Nonconformance Report, at each step of its processing (i.e., initial issuance to BHS Contractor through final disposition) will be sent to the Owner.

3.1.6.c The Owner will make the disposition of nonconforming items/materials.

3.1.7 Documentation

3.1.7.a The BHS Contractor shall not change or alter approved submittals, procedures, Specifications, drawings or other pertinent documentation without the Owner’s written authorization.

3.1.7.b All records and documents that are quality related shall be prepared, identified, and maintained by the BHS Contractor and shall be made available to the Owner upon request. Records shall be protected from damage, deterioration, or loss. A copy of the records and documents shall be maintained at the Works site at all times unless the Owner has approved other locations in writing. Retention time for all quality records shall be not less than three (3) years from date of Final Completion and Acceptance of the Works.

3.1.7.c The BHS Contractor shall maintain records at the actual worksite and at the BHS Contractor's office to show the inspection status of materials and items installed in order to ensure that the required inspections and tests have been performed in a timely and correct manner.

3.1.8 Quality Inspections and Tests

3.1.8.a Inspection and tests, conducted by persons or agencies other than the BHS Contractor, shall not in any way relieve the BHS Contractor of his responsibility and obligation to meet all Specifications and the referenced standards.

3.1.8.b The BHS Contractor's designated Quality Control Manager shall inspect the Works and shall ensure the Works complies with the contract requirements prior to any requests for inspection or testing.

3.1.8.c When the Specifications, laws, ordinances, rules, regulations or orders of any public agency having jurisdiction require the Owner’s surveillance of inspections or tests, the BHS Contractor shall notify the Owner of the place, date and time 48 hours prior to the inspection and/or test.

3.1.8.d The BHS Contractor shall be responsible for notifying and requesting inspection by other agencies including but not limited to the Building Inspection Division, Fire Department and Water Department. Prior to request for other agency inspections, the BHS Contractor shall meet and plan inspection times with the Owner.

3.1.8.e Special inspections or tests may be required by the Specifications, local, City, State and/or Federal Agencies in addition to those tests already performed. The BHS Contractor shall notify the Owner at least forty-eight (48) hours in advance of the additional inspections or tests.

3.1.8.f The BHS Contractor shall utilize the following six-point (6) inspection plan to ensure the Works performed by the BHS Contractor meets the requirements of the Contract Documents, the referenced codes and standards and the approved submittals.

3.1.8.1 Pre-work Coordination

3.1.8.1.a A coordination meeting shall be held prior to the following:

3.1.8.1.1 Coordination Meetings

3.1.8.1.1.a Prior to the start of construction Works on the Contract

3.1.8.1.1.b Prior to the start of Works under each separate Specification section

3.1.8.1.1.c Prior to the start of Works where a change in a construction operation is contemplated by the BHS Contractor and

3.1.8.1.1.d Prior to a new sub-contractor starting Works

3.1.8.1.b The following personnel shall attend the coordination meetings:

3.1.8.1.2 Attendees

3.1.8.1.2.a The BHS Contractor's Superintendent

3.1.8.1.2.b The BHS Contractor's Quality Control

3.1.8.1.2.c The BHS Contractor's Safety representative(s)

3.1.8.1.2.d The Independent Testing Agency (ITA) representative

3.1.8.1.2.e The Owner

3.1.8.1.2.f The Owner’s Inspectors.

3.1.8.1.2.g Supervisory, Safety and Quality Control, representatives of all applicable sub-contractors.

3.1.8.1.c The BHS Contractor's Quality Control Manager shall chair, prepare and distribute minutes of Quality Control meetings. Meeting minutes shall be distributed within twenty-four (24) hours of the meeting.

3.1.8.1.d The purpose of the meeting is to ensure that the BHS Contractor’s personnel have no misunderstandings regarding their safety and quality procedures as well as the technical requirements of the contract. The following items shall be presented and reviewed by the BHS Contractor:

3.1.8.1.3 Meeting Agenda

3.1.8.1.3.a Contract requirements and Specifications

3.1.8.1.3.b Shop drawings, certifications, submittals, and as-built drawings

3.1.8.1.3.c Testing and inspection program and procedures

3.1.8.1.3.d BHS Contractor's Quality Control program

3.1.8.1.3.e Familiarity and proficiency of the BHS Contractor's and Sub-BHS Contractor's workforce to perform the operation to required workmanship standards including certifications of installers.

3.1.8.1.3.f Safety, security and environmental precautions to be observed.

3.1.8.1.3.g Any other preparatory steps dependent upon the particular operation.

3.1.8.1.3.h The BHS Contractor's means and methods for performing the Works.

3.1.8.2 Initial Inspection

3.1.8.2.a Upon completion of a representative sample of a given feature of the Works and no later than two (2) weeks after the start of a new or changed operation, the Owner and/or the Owner's designated representatives shall meet with the BHS Contractor's Quality Control Manager and applicable sub-contractor's supervisor and their Quality Control representatives to check the following items, at a minimum:

3.1.8.2.1 Inspection Items

3.1.8.2.1.a Workmanship to established quality standards.

3.1.8.2.1.b Conformance to Contract Drawings, Specifications, and the accepted shop drawings

3.1.8.2.1.c Adequacy of materials and articles utilized.

3.1.8.2.1.d Results of inspection and testing methods.

3.1.8.2.1.e Adequacy of as-built drawings, which shall be maintained daily.

3.1.8.2.b Once accepted, the representative sample will become the physical baseline by which ongoing Works is compared for quality and acceptability. To the maximum practical extent, approved representative samples of Works elements shall remain visible until all Works in the appropriate category is complete. Acceptance of a sample does not waive or alter any contract requirements or show acceptance of any deviation from the contract not approved in writing by the Owner.

3.1.8.3 Follow-up Inspection

3.1.8.3.a The BHS Contractor's Quality Control representative will monitor the Works to review the continuing conformance of the Works to the workmanship standards established during the preparatory and initial inspections.

3.1.8.4 Completion Inspection

3.1.8.4.a Forty-eight (48) hours prior to the completion of an item or segment of Works and prior to covering up any Works, the BHS Contractor will notify the Owner who will verify that the segment of Works is complete, all inspections and tests have been completed and the results are acceptable.

3.1.8.4.b The purpose of this inspection is to allow further corrective Works upon, or integral to, the completed segment of Works. THIS IS NOT AN ACCEPTANCE INSPECTION. If any items are determined to be deficient, need correction or are non-conforming, a Action Item List will be prepared and issued to the respective BHS Contractor for correction, repair or replacement of any deficient or non-conforming items. The Owner and BHS Contractor's Quality Control Manager will verify the correction of the deficient and/or non-conforming items prior to the start of the next operation.

3.1.8.5 Practical Completion Inspection

3.1.8.5.a Prior to requesting a Practical Completion Inspection by the Owner, all Works and operational systems to be inspected shall be satisfactorily completed and tested by in accordance with the Contract Documents. In addition, Final Operations and Maintenance Manuals, software, source code, and User access lists have been provided by the BHS Contractor to the Owner.

3.1.8.5.b The request for inspection shall include a list of all know deficiencies (Punch List) detailing when outstanding items will be corrected. If the list is too large or contains too many significant items, in the opinion of the Owner, no inspection will be held because of the incompleteness of the Works.

3.1.8.5.c Upon the BHS Contractor's written request for this inspection the Owner shall schedule the inspection within ten (10) days.

3.1.8.5.d The Owner will schedule the Practical Completion Inspection and will prepare a list of deficient items (Punch List) discovered during the inspection. If during the inspection the list identifies considerable defects or defects of more than minor in nature the inspection may be canceled and the BHS Contractor shall rectify the defects and resubmit request for additional Practical Completion Inspections.

3.1.8.6 Substantial Completion Inspection

3.1.8.6.a Prior to requesting a Substantial Completion Inspection by the Owner, all Works and operational systems to be inspected shall be satisfactorily completed and tested in accordance with the Contract Documents. In addition, all As-Built documentation and software has been provided by the BHS Contractor to the Owner.

3.1.8.6.b The request for inspection shall certify that all known deficiencies have been corrected and provide a completed Punch List as evidence of such rectification.

3.1.8.6.c Upon the BHS Contractor's written request for this inspection the Owner shall schedule the inspection within ten (10) days.

3.1.8.6.d The Owner will schedule the Substantial Completion Inspection and will prepare a list of deficient items (Punch List) discovered during the inspection. If during the inspection any defects are identified, the inspection may be canceled and the BHS Contractor shall rectify the defects and resubmit request for additional Substantial Completion Inspections.

3.1.8.7 Final Completion and Acceptance Inspection

3.1.8.7.a After the BHS Contractor has completed all items on the Punch List, clean-up work and all required deliverables, the BHS Contractor shall request a Final Completion and Acceptance Inspection.

3.1.8.7.b All areas must be cleaned and ready for turnover prior to this inspection. The Owner, the design consultant, a representative of the funding agency (if applicable) and other interested parties will inspect the Works to ensure that all deficiencies have been satisfactorily attended to and that no new deficiencies have appeared and that all systems are completely functional.

3.1.9 Samples

3.1.9.a The BHS Contractor shall maintain a copy of all samples submitted and accepted by the Owner at the worksite. Samples shall be made available to the designer or the Owner's designated representatives for review and comparison in the field. The Owner must accept all items and materials prior to use on the project.

3.1.9.b The installed Works will be compared to the samples and if any of the Works is not of the same quality, material, finish, color, texture, or appearance as the sample, that portion that is not the same will be considered defective and in nonconformance.

3.1.9.c BHS Contractor selection of samples will only be considered if taken at random. The BHS Contractor shall permit representatives of the Owner to witness the selection of samples. Inspection or tests of items or materials that fail shall be sufficient cause to terminate further inspections/tests of the same brand, make or source of that product.

3.1.9.d The BHS Contractor is obligated to correct any item deemed deficient.

3.1.10 New Equipment

3.1.10.a All materials required for the contract shall be new except as submitted, reviewed, and accepted by the Owner.

3.1.10.b Defective or damaged materials shall be replaced or repaired, prior to Substantial Completion, in a manner acceptable to the Owner and at no additional cost to the Owner.

3.1.11 Owner Inspections

3.1.11.a The Owner may elect to perform additional inspections and/or tests at the place of the manufacture, the shipping point or at the destination to verify conformance to applicable Specifications. Inspections and tests performed by the Owner shall not relieve the BHS Contractor from the responsibility to meet the Specifications, nor shall such inspections/tests be considered a guarantee for acceptance of materials that will be delivered at a later time.

3.1.11.b The Owner or his authorized representative may inspect at its source any material or assembly to be used in the Works. Manufacturing plants may be inspected from time to time for the purpose of determining compliance with specified manufacturing methods or materials to be used in the Works and to obtain samples for testing and further inspection.

3.1.11.c The Owner shall have the right to take samples and perform testing of samples at different intervals or at intervals concurrent to the BHS Contractor's testing program. The BHS Contractor shall be issued a Nonconformance Report or a Remedial Action Request in the event the Owner tests fail.

3.1.11.d Should the Owner conduct plant inspections the following conditions shall exist:

3.1.11.1 Manufacturing Inspections

3.1.11.1.a The Owner shall have the cooperation and assistance of the BHS Contractor and the producer with whom the BHS Contractor has contracted for materials.

3.1.11.1.b The Owner shall have full access during scheduled production or warehousing working hours to parts of the plant that are concerned with the manufacture, production, storage, or shipping of materials being furnished.

3.1.11.1.c The BHS Contractor shall arrange for reasonable office or work space, needed for conducting a plant inspection. Office or working space shall be conveniently located with respect to the plant and/or warehouse as required by the Owner.

3.1.11.1.d It is understood and agreed that the Owner shall have the right to re-test at the Owner’s expense any materials that have been tested and accepted at the source of supply after it has been

delivered to the site.

3.1.12 Configuration Management Plan

3.1.12.a The BHS Contractor shall issue configuration management information as defined by the General Conditions of Contract to the Owner. At a minimum the following areas shall be itemized;

3.1.12.1 Contents of Configuration Management Plan

3.1.12.1.a Documentation.

3.1.12.1.b Drawings.

3.1.12.1.c Submittals.

3.1.12.1.d Software development

3.1.12.1.e Software implementation

3.1.12.b The BHS Contractor shall keep up to date a detailed configuration management schedule for all software modified and/or provided by the BHS Contractor from the first release of any software.

3.1.12.c OR acceptance by the Owner for any portion of the Works.

3.1.12.d OR TSA certification has been completed for any portion of the Works.

3.1.12.e The BHS Contractor shall issue to the Owner as changes are made, on a monthly basis or as requested, an up to date copy of all changes made by the BHS Contractor until the completion of Warranty (refer to Part 1 § 1.13 for submittal requirements).

3.1.13 Punch List

3.1.13.a The BHS Contractor shall maintain a Punch List throughout the project, which shall be categorized using the below categories.

3.1.13.1 Major items

3.1.13.1.a Safety

3.1.13.1.b Performance

3.1.13.1.c Availability

3.1.13.1.d Reliability

3.1.13.1.e Functionality

3.1.13.1.f Quality

3.1.13.1.g Secure function

3.1.13.1.h Restricted Maintenance access

3.1.13.1.i Ergonomics

3.1.13.2 Punch List Minor items

3.1.13.2.a Defects not covered by the Major Item category at the Owner's sole discretion.

3.2 BHS CONTRACTOR'S PROJECT ORGANIZATION

3.2.1 Project Staffing

3.2.1.a The BHS Contractor shall provide the following minimum on-site staffing

3.2.1.1 Key On-Site Personnel

3.2.1.1.a Project Manager

3.2.1.1.b Schedule Manager

3.2.1.1.c PLC Manager

3.2.1.1.d Mechanical Site Supervisor

3.2.1.1.e Electrical Site Supervisor

3.2.1.1.f Logistics Manager

3.2.1.1.g Quality Control Manager

3.2.1.1.h Health & Safety Manager

3.2.1.1.i Test Manager

3.2.1.b The BHS Contractor shall at all times have an updated and current organizational chart illustrating the project team including supporting design/engineering staff.

3.2.2 Replacement of Team Members

3.2.2.a The BHS Contractor shall not replace any staff without prior written approval by the Owner. Requests for replacements shall be thoroughly explained and documented for the Owner's review.

3.2.2.b The Owner reserves the right to dismiss any on-site staff if such staff is deemed not qualified for this type of project or behaves inappropriately.

3.2.3 Site Staff

3.2.3.a Prior to the start of any Works by a BHS Contractor or Sub-contractor employee, the BHS Contractor shall provide the Owner with a list of its employees, sub-contractor's employees and other personnel the BHS Contractor has requested to work at the airport, who have signified in writing that they have been briefed on, or have read and understand, the BHS Contractor's Safety Plan, which shall comply with the requirements as per Division 1, Section 01110.

3.2.4 Off-Site Project Support

3.2.4.a The BHS Contractor's field office shall be supported by the BHS Contractor's main office, engineering department and manufacturing department as required.

3.2.4.b The BHS Contractor shall provide any computer or diagnostic dial-in tools as required to support the project.

3.3 FIRE REGULATIONS

3.3.1 General

3.3.1.a The BHS Contractor is advised that the Fire Department and Fire Prevention Bureau requires permitting for the following activities as they apply to the Scope of Works. The BHS Contractor is responsible for obtaining the appropriate permits necessary to complete the Works.

3.3.1.b All costs associated with this permitting and policy compliance shall be the responsibility of the BHS Contractor.

3.3.1.c All reference the International Fire Code (IFC).

3.3.1.1 Work Requiring Permits

3.3.1.1.a "Hot work", which is defined as the operation of any equipment or tool that creates sparks, hot slag, or radiant or convective heat as a result of the Works. This includes, but is not limited to, welding, cutting, brazing, grinding, or soldering.

3.3.1.1.b Use and storage of compressed gas for both temporary storage and permanent facility installation. This includes, but is not limited to, flammable gas (excluding propane-LPG), oxidizer (including oxygen), and inert and/or simple asphyxiates.

3.3.1.d In addition to the permits listed above, the Fire Department may require other permits that are associated with the specific Works in the Contract Documents.

3.3.1.e Policies provided by the Fire Department are meant to provide basic information for the most common conditions and situations. In any given situation, many other Uniform Fire Code requirements may be enforced. These should be addressed with the Fire Department before construction begins and during construction with premises inspection(s).

3.3.1.f The BHS Contractor shall maintain records on site of all permits acquired by federal, state, and local agencies. Posting of permits shall conform to requirements of the respective agencies.

3.3.1.g At the completion of any inspection by other agencies, the BHS Contractor shall forward copies of the status of the inspection and copies of any approved or "signed-off" inspections by the respective agencies to the Owner.

3.3.1.h At the time of request for Substantial Completion, the BHS Contractor shall forward to the Owner all permits approved by the respective agencies.

3.4 SAFETY

3.4.1 General

3.4.1.a All safety precautions during the construction process are the responsibility of the BHS Contractor. The BHS Contractor is responsible for the health and safety of his employees, agents, sub-contractors and their employees, visitors, and other persons on the worksite; for the protection and preservation of the Works and all materials and equipment to be incorporated therein; and for the worksite and the area surrounding the worksite. The BHS Contractor shall take all necessary and reasonable precautions and actions to protect all such persons and property.

3.4.1.b These safety requirements shall be interpreted in their broadest sense for the protection of persons and property by the BHS Contractor and no action or omission by the Owner or his authorized representatives shall relieve the BHS Contractor of any of its obligations and duties defined herein.

3.4.1.c The BHS Contractor is fully aware that the Works will be taking place around and overhead of airline operations. The BHS Contractor understands that the BHS Contractor must take all necessary and reasonable precautions to protect personnel and equipment.

3.4.1.d In areas with open grating floors the BHS Contractor shall pay special attention to keep all objects from falling through the grating and disrupting operations below.

3.4.1.e Maintain the worksite to permit access by other Owner contractors as required and to allow access by emergency personnel.

3.4.2 Safety Plan

3.4.2.a The BHS Contractor's Safety Plan must meet all applicable federal, state and local government requirements, including the following;

3.4.2.b Name of the BHS Contractor's site safety representative. If the BHS Contractor is running multiple shifts or working more than forty (40) hours per week, the name of an assistant BHS Contractor's safety representative, who can act in the absence of the site safety representative.

3.4.2.c Twenty-four (24) hours per day emergency phone numbers of BHS Contractor site management to be used in case of injury or accident. Provide at least four (4) contacts.

3.4.2.d How injuries or accidents will be handled including samples of the forms used to report injuries or accidents.

3.4.2.e How employees will be handled who do not safely perform their duties, including how the BHS Contractor will determine whether an employee is safely performing his duties.

3.4.2.f How and when equipment will be checked to see that it is safe, that all safety guards are in place and that the equipment is being used for its designed purpose and within its rated capacity.

3.4.2.g How and when all electrical devices will be checked for proper grounding and insulation. What system will be used to lock-out electric systems that should not be energized.

3.4.2.h How trash and human feces will be disposed of.

3.4.2.i How snow and ice will be removed by the BHS Contractor in his project area.

3.4.2.j How flammable materials will be stored and handled, and how any spills will be cleaned up and removed for disposal.

3.4.2.k What plan and procedures will be used to prevent fires, and if fires do occur who will be trained to fight them. Also what firefighting equipment will the BHS Contractor have available and how will this equipment’s condition be monitored.

3.4.2.l How materials will be received, unloaded, stored, moved, and disposed of.

3.4.2.m How personnel working above ground level will be protected from falling.

3.4.2.n How people working underneath work will be protected.

3.4.2.o What will be done to protect personnel in case of severe weather

3.4.2.p How adequate lighting will be provided and monitored.

3.4.2.q How air quality will be monitored and personnel removed or protected from air that is hazardous for humans.

3.4.2.r How the safety of work platforms, man lifts, material lifts, ladders, shoring, scaffolding, etc. will be ensured relating to load capacity and the protection of personnel using or working around them.

3.4.3 Implement and Monitor BHS Contractor's Safety Plan

3.4.3.a If the BHS Contractor experiences lost time or an injury rate ten percent (10%) greater than the national average for all construction, the BHS Contractor shall audit its safety procedures and submit a plan to reduce its rates.

3.4.3.b If at any time the lost time or injury rates experienced by the BHS Contractor are fifty (50%) percent more than the national average for construction, the BHS Contractor shall immediately hire an independent safety professional, who shall audit the BHS Contractor's procedures and operations and make a report of changes that the BHS Contractor should implement to reduce the rate including changing personnel. One (1) electronic copy of this report shall be submitted to the Owner.

3.4.3.1 Safety Rectifications

3.4.3.1.a The BHS Contractor shall immediately begin implementing the recommendations of the Safety Audit report.

3.4.3.1.b A weekly report shall be submitted by the BHS Contractor on the status of the implementation of the recommendations.

3.4.3.1.c Failure to comply with these requirements is a basis to withhold a portion of progress payments.

3.5 NEW WORK TO COMPLETE

3.5.1 General

3.5.1.a The system shall be properly commissioned by the BHS Contractor prior to System Acceptance Testing.

3.5.1.b The system shall be tested in accordance with procedure identified in Part 2 and Part 3 of this Specification.

3.5.2 Ticketing

3.5.2.a Conveyors, security/fire doors and miscellaneous equipment in the Lobby ticketing sub-systems shall be provided in accordance with the Contract Drawings.

3.5.2.b Control equipment and functions shall be provided as defined in Part 1 and Part 2 of this Specification.

3.5.3 Screening

3.5.3.a Conveyors, screening equipment and integration in the screening sub-systems shall be provided in accordance with the Contract Drawings.

3.5.3.b The BHS Contractor shall coordinate with the screening equipment supplier to properly integrate the EDS screening machines into the CBIS/BHS in order to provide the functions defined in Part 1 of this Specification.

3.5.3.c Control equipment and functions shall be provided as defined in Part 1 and Part 2 of this Specification.

3.5.4 CBRA

3.5.4.a Conveyors and workstations in the CBRA area shall be provided in accordance with the Contract Drawings.

3.5.4.b Control equipment and functions shall be provided as defined in Part 1 and Part 2 of this Specification.

3.5.5 SCADA

3.5.5.a A SCADA system to control and monitor the CBIS/BHS shall be provided as defined in Part 1 and Part 2 of this Specification.

3.6 WORK CONSTRAINTS

3.6.1 Site Constraints

3.6.1.a Access to the project shall be generally as indicated in the Contract Documents. Access shall be organized and planned by the BHS Contractor to ensure no disruption of airline or airport operations.

3.6.1.b Access to work sites will be strictly monitored and must comply with the Airport Operations and FAA Regulations. The BHS Contractor shall provide monitoring and escorts as required by the Owner's Operations in the area of the Works.

3.6.1.c The BHS Contractor's staging area will be as indicated in the Contract Documents. The BHS Contractor shall not store any materials at any time on the exterior of the building or in areas outside of the area of Works. The BHS Contractor is responsible for the security of material and equipment stored at the BHS Contractor's staging area.

3.6.1.d At no point in time shall the Work interfere with ongoing daily operations and maintenance of the existing BHS. If interruptions cannot be avoided, the BHS Contractor shall coordinate with the Owner. Any interruptions of ongoing operations require the written permission of the Owner prior to commencing the Work.

3.6.1.e The BHS Contractor shall use the haul routes specified in the plans.

3.6.1.f If required, the BHS Contractor shall provide a bus and driver to transport the BHS Contractor's employees between the designated employee parking area and the work sites. No separate payment will be made for this bus and driver. The cost shall be included in the bid item "Mobilization". A bus driver shall be provided at all times when BHS Contractor employees are working on the project.

3.6.1.1 On-Site Parking Requirements

3.6.1.1.a The BHS Contractor shall be responsible for all costs associated with on-site parking for their personnel and transportation of personnel to the worksite.

3.6.1.2 Off-Site Parking Requirements

3.6.1.2.a The BHS Contractor shall be responsible for providing off-site parking and all costs associated with parking and transportation of personnel to the worksite.

3.6.2 Working Hours

3.6.2.a Submit schedule of Works, which will be performed at times other than during the working day of Monday through Friday, 07:00 to 18:00, and five (5) day working week to the Owner for review and acceptance not less than seventy-two (72) hours in advance of those times.

3.6.2.b Working hours shall be coordinated with the Owner. Areas with ongoing operations below the construction shall be contained to prevent interference with dust, noise, falling objects etc. Approval to work at night may be obtained after BHS Contractor presents a written program outlining special precautions to be taken to control the additional hazards presented by night work. That program shall include, but not be limited to, supplementary lighting of work areas, availability of medical facilities, security precautions and noise limitations.

3.6.3 System Interruptions

3.6.3.a The BHS Contractor shall submit any written requests for system interruptions such as fire alarm, HVAC, CBIS/BHS, electrical, water systems or other systems on approved forms. The request forms shall be submitted only during the normal work week (Monday through Friday) between 08:00 and 16:00.

3.6.3.b System interruptions shall not be considered, if the interruptions interfere with airport operations or tenant operations. If interruptions cannot be avoided, the BHS Contractor shall coordinate with the Owner (see below). Interruptions or system shut down shall be limited to the hours of 23:00 and 05:30 and need to be coordinated with the Owner.

3.6.3.c Upon approval of a system shutdown, the BHS Contractor's representatives and the individuals performing the Works shall remain at the worksite and shall remain in contact with Maintenance Control until such time as the system is restored to working condition. The requesting party shall assume liability for the system until the system is restored to proper working order.

3.6.3.1 Fire Systems, HVAC, and Plumbing

3.6.3.1.a Submit requests five (5) working days prior to the time of requested interruption.

3.6.3.2 Electrical System Interruptions

3.6.3.2.a Submit requests five (5) working days prior to the time of requested interruption.

3.6.3.3 Roadway Interruptions

3.6.3.3.a Roadway shutdown times are to be coordinated with Airport Operations and the Owner prior to submitting a request for approval to shut-down a roadway.

3.6.3.3.b Submit requests five (5) working days prior to the time of requested interruption.

3.6.3.4 Baggage Handling System Interruptions

3.6.3.4.a Shutdown of the existing operational baggage handling system shall be limited.

3.6.3.4.b Submit requests five (5) working days prior to the time of requested interruption.

3.6.3.4.c Interruptions require the written approval of the Owner before commencing the Work.

3.6.3.4.d Prior to and during work in any area that requires access adjacent to, under, or above existing baggage systems including manual operations, the BHS Contractor shall coordinate with Airline representatives and the Owner.

3.6.3.4.e Work in these areas shall be limited and must be approved by the Owner and coordinated with the respective airlines. The BHS Contractor shall schedule and plan activities within these areas during the shutdown to ensure removal of personnel and equipment.

3.6.3.4.f The BHS Contractor shall coordinate with the Owner and the airline representatives to develop detailed scheduling on a day-to-day basis.

3.6.3.4.g The BHS Contractor shall maintain an on-going three (3) week look-ahead schedule of shutdown/lockout requests including areas identified on plan diagrams. This look-ahead schedule shall be provided at the weekly construction meeting.

3.6.3.4.1 Shutdown and Lockout

3.6.3.4.1.a Prior to the start of the shutdown, the BHS Contractor's Superintendent/Supervisor and the BHS Contractor's Safety Representative/Safety Manager shall meet with the Airlines' baggage system representatives and the Owner's representatives to review the areas or zones to be inactivated to allow the BHS Contractor to proceed with Works.

3.6.3.4.1.b Baggage Mechanical Systems Lockout. Protection of equipment and other barriers are to be provided by the BHS Contractor.

3.6.3.4.1.c Baggage Electrical Systems Lockout. A representative from the Airlines, in conjunction with BHS Contractor representatives, shall place locks on power cabinets supporting baggage equipment for the identified contractor work zone. Each party shall provide a lock.

3.6.3.4.1.d The BHS Contractor may begin Works in baggage system zones after the BHS Contractor's Safety Representative has confirmed lockdown and lockout have been completed. The BHS Contractor shall begin Works by first providing covers and protection of the baggage system and building systems to preclude damage during BHS Contractor activities.

3.6.3.4.2 System Activation

3.6.3.4.2.a The system shall be activated at 04:00. Before 04:00 the BHS Contractor shall begin clearance and removal of equipment, materials, barriers, and personnel in areas and envelopes of the baggage system. The BHS Contractor shall take all steps to ensure that all baggage system envelopes are clear of personnel, protective coverings, and equipment prior to 04:00.

3.6.3.4.2.b The BHS Contractor's safety representative shall inspect areas of work to ensure removal by the BHS Contractor of all personnel, materials and equipment between 03:30 and 04:00 and then shall contact the Airline representative. At 04:00 the baggage system will be activated. After this time until the next shift (22:00), BHS Contractor personnel or equipment shall not be mobilized in the area of the baggage system.

3.6.4 Airfield Operations at Merced Yosemite Regional Airport

3.6.4.a Full airport and aircraft operations are underway adjacent to this project. The BHS Contractor is required to obtain a Manual from the Security Manager and must follow the guidelines in the manual.

3.6.4.b If any Works contains requirements for work activities or access through or in the restricted area, reference Specifications Section 01015 and 01016 for requirements. If not in a restricted area, the BHS Contractor personnel must still be badged; reference Specifications Section 01015.

3.6.5 Conduct of Persons Using the Airport System

3.6.5.a BHS Contractor activities shall comply with Airport Operations regulations and the regulations shall be followed. These regulations are available from Airport Operations.

3.6.6 Operational Safety on Airports during Construction

3.6.6.a All Works shall be accomplished in accordance with FAA Advisory Circular AC150/5370-2C, "Operational Safety on Airports During Construction", FAR Part 139 and FAR Part 107 except as herein modified.

3.6.7 Cleaning Equipment

3.6.7.a Discharge of water, liquids, or chemicals into the building waste, drain systems or storm drainage systems is prohibited. The BHS Contractor shall comply with all federal, state, and local requirements for disposal of chemicals. The BHS Contractor shall maintain and service containers for discharge of water from cleaning of any construction equipment or removal of water in work areas.

3.6.8 Radio and Cell Phone Use

3.6.8.a The BHS Contractor shall have in place prior to initiation of Works in the tunnel or basements communications equipment either by use of cell phone and or radio. The Owner shall not be required to ensure cell phone coverage throughout the worksite. The BHS Contractor shall at his own cost overcome any lack of cell phone coverage. Radio equipment shall be submitted to the Owner for approval at least fourteen (14) days prior to intended use. Radio equipment frequencies shall be submitted. Frequencies shall be subject to Owner approval.

3.6.9 Keys

3.6.9.a The BHS Contractor shall be required to contact the Airport Maintenance Control to procure keys for access to all rooms having locks in order to gain access. Keys may be checked out at the beginning of each work shift by the BHS Contractor and shall be returned to the Airport Maintenance Control at the end of each work shift.

3.6.10 Site Inspections

3.6.10.a The BHS Contractor shall immediately inspect an area that is released to the BHS Contractor and within ten days submit a report to the Owner identifying any differing in the site conditions. This inspection shall confirm all dimensions and all items the BHS Contractor is to connect to, run through or use and whether they are different than the bid condition.

3.6.10.b Failure to provide this report within the time stated or failure to list any difference shall signify that the BHS Contractor accepts the area turned over and shall be responsible for performing any modifications required to comply with the Contract without any additional cost to the Owner.

3.7 PHASING OF THE WORKS

3.7.1 General

3.7.1.a The BHS Contractor shall phase the Works in accordance with the approved phasing drawings supplied for the contract.

3.7.1.b Any interference requiring a deviation from the approved phasing drawings in order to complete Works shall be brought to the attention of the Owner within 48 hours of the interference being identified. A detailed plan shall be submitted by the BHS Contractor in writing to the Owner identifying, in detail, how to resolve the interference.

3.7.1.c Works defined in the BHS Contractor's deviation plan shall only commence after the Owner has reviewed the plan and provided approval in writing. The BHS Contractor shall clearly identify any slippage to the project schedule as a result of the deviation and shall make every effort to minimize slippage. Every effort shall be made to bring the project back onto schedule in the shortest possible time frame.

3.7.2 Black-out Days

3.7.2.a Black-out days shall be coordinated with the Owner during development of the Construction Schedule.

3.7.2.b No construction, installation, commissioning and/or testing Works shall be performed during agreed 'black-out day' periods. No additional time shall be granted as a result of black-out days.

3.7.2.c No software modifications shall be performed on operational systems on a Friday on the last day before a long weekend created by officially recognized holidays.

3.7.2.d No software modifications shall be performed on operational systems during and immediately prior to any 'black-out day' periods identified above with the exception of emergency changes approved by the Owner needed to ensure the integrity of the system and operations.

3.8 CONTRACT RECORDS

3.8.1 General

3.8.1.a The BHS Contractor shall maintain, at the worksite, on a current basis, one (1) record copy of all drawings, Specifications, addenda, Change Orders, approved shop drawings, working drawings, product data and samples in good order and marked currently to record all changes made during construction.

3.8.1.b Maintain at the field office one (1) copy of the following record documents.

3.8.1.1 Contract Documents

3.8.1.1.a Contract Drawings with all clarifications, requests for information, directives, changes, and as-built conditions clearly posted.

3.8.1.1.b Contract Specifications with all clarifications, requests for information, changes, directives, and record of manufacturer actually used along with product trade name.

3.8.1.1.c Reference standards in accordance with Specifications Section 01091.

3.8.1.1.d Affirmative Action Plan and documents.

3.8.1.1.e One (1) set of drawings. The drawings shall reference the applicable submittal.

3.8.1.1.f Field changes of dimensions and details including as-built elevations and location (station and offset).

3.8.1.1.g Details not on original Contract Drawings, but obtained through requests for information or by other communications with the Owner.

3.8.1.2 BHS Contractor Records

3.8.1.2.a Daily QC Reports

3.8.1.2.b Certificates of compliance for materials used in construction

3.8.1.2.c Nonconformance Reports (NCRs)

3.8.1.2.d Remedial Action Requests (RARs)

3.8.1.2.e Completed inspection list

3.8.1.2.f Inspection and test reports

3.8.1.2.g Test procedures

3.8.1.2.h Qualification of personnel

3.8.1.2.i Approved submittals

3.8.1.2.j Material and equipment storage records

3.8.1.2.k Safety Plan

3.8.1.2.l Erosion, sediment, hazardous and quality plans

3.8.1.2.m Hazardous material records

3.8.1.2.n Injury reports.

3.8.2 Document Recording

3.8.2.a Label each document page or article "PROJECT RECORD" in 2" high printed letters.

3.8.2.b Keep record documents current daily.

3.8.2.c Legibly mark copies of the Contract Drawings to record actual construction.

3.8.2.d Legibly mark up each section of the Specifications and Contract Drawings to record:

3.8.2.1 Mark-ups

3.8.2.1.a Manufacturer, trade name, catalog number and supplier of each product and item actually installed

3.8.2.1.b Changes made by Change Orders, requests for information, substitutions and variations approved by submittals.

3.8.3 Document Maintenance

3.8.3.a Make documents available for inspection by the Owner and any others having jurisdiction.

3.8.3.b Prior to any application for payment, the Owner or his designated representative may inspect the BHS Contractor's Contract Records to ensure that they are being maintained and contain the most current data.

3.8.3.c If, during the inspection, the Owner determines that the documents are not being maintained and kept current to as-constructed, an amount may be withheld from the payment request and deducted from the contract value to cover the Owner's unexpected cost of collecting and recording the contract data.

3.8.3.d Provide Contract Records including files, folders, and binders of documents to maintain in clean, dry and legible condition, which shall be turned over to the Owner ten (10) days prior to Substantial Completion. Such records shall not be used for construction activities.

3.9 CONSTRUCTION PHOTOGRAPHS

3.9.1 General

3.9.1.a Photographs shall be submitted to Owner with the Progress Report, indicating the progress of Works for the previous month.

3.9.1.b Location of views and time of photography will be as required by the Owner.

3.9.1.c After construction operations have been initiated at the Worksite and until completion and acceptance of the Works, make the following photographs:

3.9.1.1 Minimum Pictures

3.9.1.1.a Photograph the area around the Works.

3.9.1.1.b Photograph the area inside the Works

3.9.2 Photographs

3.9.2.a Each digital photo shall have a minimum resolution of 1024 x 1536 pixels, with a print resolution of 300 dpi.

3.9.2.b Each digital photo shall be provided in base line (standard) jpeg format, and be compatible with Windows software.

3.9.2.c All photos must show the date taken as part of the photo.

3.9.3 Storage Media

3.9.3.a Submit each set of digital progress photos electronically on a USB memory stick. The USB memory stick must have a product lifetime warranty.

3.9.3.b Identify each USB memory stick with the following information; Project title and number, name of BHS Contractor and time period represented by photos.

3.9.4 Photographs for out of State Fabrications

3.9.4.a The BHS Contractor may submit photographs to verify the progress of out of state fabrications to document the Works for payment purposes. One (1) photograph in the photographic series must include in the picture the front page of the local daily newspaper publication for the day that the picture was taken. The photograph shall be of a sufficient distance to show details of the front page. The copy of the actual front page shall be submitted with the photograph exhibit.

3.9.4.b The Owner shall determine if photographs are acceptable for determining the progress of out of state fabrications or whether a shop visit is necessary to determine progress.

3.9.4.c If a photograph exhibit is approved, the Owner shall identify the quantity and types of photographs that will be required.

3.10 PROTOTYPING

3.10.1 General

3.10.1.a Any equipment which does not fulfill the requirements for service proven technology shall be subject to rigorous testing and specific Owner approval. The BHS Contractor shall invite the Owner to witness factory acceptance tests of such prototype equipment and such equipment shall not be brought on-site or used in the system until Owner approval has been obtained.

3.10.1.b All costs associated with prototype testing, inspection and approval shall be borne by the BHS Contractor.

3.10.1.c Prototype testing shall prove the following elements;

3.10.1.1 Prototype Test Requirements

3.10.1.1.a Processing rates

3.10.1.1.b Mean time between failures

3.10.1.1.c Repair time and maintainability

3.10.1.1.d Equipment lifetime under varying operational environmental conditions.

3.11 MOBILIZATION

3.11.1 General

3.11.1.a Provide personnel, products, construction materials construction tools, equipment, materials and supplies of the type and quantities that will facilitate the timely execution of the Works. The delivery shall be accomplished in conformance with local governing regulations.

3.12 SHIPPING

3.12.1 General

3.12.1.a The BHS Contractor shall ship all equipment, materials, and supplies to the Site and make all necessary receiving inspections.

3.13 EQUIPMENT DELIVERY, STORAGE AND HANDLING

3.13.1 General

3.13.1.a Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter, and also protect equipment during all phases of installation and commissioning on the site. Methods of storage of materials shall protect the materials from damage, weather, rust, air-borne grit, and other construction debris. Deteriorated equipment shall not be installed and be replaced by the BHS Contractor at no cost to the Owner.

3.13.1.b Consider the safety of the Works and that of the people and property on and adjacent to the worksite when determining amount, location, movement and use of materials and equipment on worksite.

3.13.1.c The BHS Contractor is responsible for all equipment in storage, including damage and shrinkage. The BHS Contractor shall provide security staff and inventory control staff at his storages.

3.13.1.d Palletized materials, products, and supplies, which are to be incorporated into the construction, shall be stored off the ground. Material and equipment shall be stored only in those areas that are indicated as storage areas on the Contract Drawings and on the reviewed and accepted working drawings. Store these items in a manner which will prevent damage and which will facilitate inspection.

3.13.1.e Leave seals, tags, and labels intact and legible. Maintain access to products to allow inspection.

3.13.1.f Protect products that would be affected by adverse environmental conditions.

3.13.1.g Periodically inspect stored products to ensure that products are being stored as stipulated and that they are free from damage and deterioration.

3.13.1.h Do not remove items from storage until they are to be incorporated into the Works.

3.13.1.i The BHS Contractor shall ensure that all protective wrappings and coverings are secure and ballasted to prevent any items from deterioration and/or subsequent dislodgment. All items on the worksite that are subject to becoming windborne shall be ballasted or anchored.

3.13.2 On-Site Construction Storage

3.13.2.a It should be anticipated that the BHS Contractor may be required to stage and store materials at a site remote from the terminal building, if the space allocated by the Owner is not sufficient for the BHS Contractor's needs.

3.13.2.b The following construction areas shall not be used for storage of equipment/materials so as to avoid potentially unsafe operations;

3.13.2.1 Areas Off-Limits for Storage

3.13.2.1.a Areas handed over to the Owner.

3.13.2.1.b Areas operating and transporting live baggage.

3.13.2.1.c Areas under commissioning and/or testing.

3.13.2.c The BHS Contractor shall coordinate with the Owner for an on-site storage area.

3.13.2.d Storage of equipment/materials shall not under any circumstances interfere with baggage operations and/or the operation of tenants.

3.13.2.e On-site construction storage shall be limited to a maximum of materials for three (3) days of installation Works or until the designated on-site area is full.

3.13.2.f The construction site shall not be used for on-site storage of equipment/materials that will not be installed within the next twenty-four (24) hour period.

3.13.2.g The BHS Contractor shall ensure that the on-site storage area;

3.13.2.2 Requirements for On-site Area

3.13.2.2.a Is adequately marked off so that personnel do not enter.

3.13.2.2.b Is free of debris at all times.

3.13.2.2.c Has equipment/materials stacked in a safe and approved methodology.

3.13.2.h The BHS Contractor shall relocate the on-site storage area from time to time as directed by the Owner at the expense of the BHS Contractor.

3.13.3 Off-Site Storage

3.13.3.a The BHS Contractor shall be required to provide off-site storage at his cost.

3.13.4 Handling

3.13.4.a Avoid bending, scraping, denting, or overstressing products. Protect projecting parts by blocking with wood, by providing bracing or by other approved methods.

3.13.4.b Protect products from soiling and moisture by wrapping or by other approved means.

3.13.4.c Package small parts in containers such as boxes, crates, or barrels to avoid dispersal and loss. Firmly secure an itemized list and description of contents to each container.

3.13.5 Transportation

3.13.5.a Conduct the loading, transporting, unloading and storage of products so that they are kept clean and free from damage.

3.13.6 Storage

3.13.6.a Store items in a manner that shall prevent damage to the Owner's property. Do not store hydraulic fluids, gasoline, liquid petroleum, gases, explosives, diesel fuel and other flammables in excavations, except in open excavations where one (1) day's supply of diesel fuel may be stored.

3.13.6.b Provide sheltered weather-tight or heated weather-tight storage as required for products subject to weather exposure.

3.13.6.c Provide blocking, platforms, or skids for products vulnerable to damage by contact with the ground.

3.13.6.d Store products in accordance with the manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight enclosures; maintain within temperature and humidity ranges required by the manufacturer's instructions.

3.13.6.e For exterior storage of fabricated products, place on sloped supports above ground. Cover products subject to deterioration with impervious sheet covering and provide ventilation to avoid condensation.

3.13.6.f Arrange storage to provide access for inspection. Periodically inspect to assure products are undamaged and are maintained under required conditions.

3.13.6.g All material shall be stored according to the manufacturer’s recommendations. Any material that has to be stored within specified temperature or humidity ranges shall have a 24-hour continuously written recording made by an automated thermometer and hygrometer of the applicable condition. Should the recording show that the material was not stored within the recommended ranges the material shall be considered defective and in nonconformance. If a certification from the manufacturer's engineering design representative is provided stating that the actual variations are acceptable and will in no way harm the material or affect warranties, then the deficiency will be considered corrected.

3.13.6.h Store hazardous material separately, with all material marked with a label showing the hazard and how to treat exposure to the material.

3.13.7 Labels

3.13.7.a Storage cabinets and sheds that contain flammable substances and explosive substances shall be labeled FLAMMABLE--KEEP FIRE AWAY and NO SMOKING with conspicuous lettering, conforming to OSHA requirements.

3.13.8 Scaffolding, Rigging and Hoisting

3.13.8.a Provide all scaffolding, rigging, hoisting and services necessary for erection and delivery into the premises of any equipment and apparatus furnished; remove same from premises when no longer required. Conform to OSHA requirements and standards.

3.14 SUBSTITUTIONS

3.14.1 General

3.14.1.a The Request for Substitution form, found in Section 01999, shall be used when the BHS Contractor wishes to substitute an approved or agreed upon item after the BHS Contractor receives the Notice to Proceed.

3.14.1.b If the substitution changes the Scope of Works, Contract Cost or Contract Time, a Change Order is required.

3.14.1.c As-built drawings and Specifications must include all substitutions even if a Change Order is not issued.

3.14.1.d By submitting a Request for Substitution, the BHS Contractor waives all rights to claim for extra cost or change in contract time other than those outlined in the request and approved by the Owner. The BHS Contractor, by submitting a Request for Substitution, also accepts all liability for cost and scheduling impact on other contractors or the Owner due to the substitution.

3.14.1.e Included with the Request for Substitution shall be the following statement: "The substitution being submitted is equal to or superior in all respects to the contract-required item or process. All differences between the substitution and the contract-required item or process are described in this request along with all cost and scheduling data." The statement shall be signed and dated by the BHS Contractor's Project Manager.

3.14.1.f A substitution must provide the same quality as what it is replacing. The level of quality is defined by the following.

3.14.1.1 Prerequisites for Substitutions

3.14.1.1.a Maintenance and operating cost

3.14.1.1.b Reliability

3.14.1.1.c Durability

3.14.1.1.d Life expectancy

3.14.1.1.e Ease of cleaning

3.14.1.1.f Ability to be upgraded as needed

3.14.1.1.g Ease of interacting with other systems or components

3.14.1.1.h Ability to be repaired

3.14.1.1.i Availability of replacement parts

3.14.1.1.j Established history of use in similar environments

3.14.1.1.k Performance equal or superior to that which it is replacing

3.14.2 Procedure for Substitutions

3.14.2.a A complete Request for Substitution using the form in Section 01999 must be made at least 60 days prior to when an order needs to be placed or a method needs to be changed.

3.14.2.b The submittal shall contain, as appropriate, detailed product data sheets for the specified items and the substitution. Samples and shop drawings shall also be submitted of the substitution as applicable. The submittal shall contain all the data required to be submitted for acceptance of the originally specified item or process.

3.14.2.c Provide the following information as applicable with the Request for Substitution on the item or process that is being requested to be substituted:

3.14.2.1 Minimum Information Provided in Substitution Requests

3.14.2.1.a A complete description of the item or process

3.14.2.1.b Utility connections including electrical, plumbing, HVAC, fire protection and controls

3.14.2.1.c The physical dimensions and clearances

3.14.2.1.d A parts list with prices

3.14.2.1.e Samples of color and texture

3.14.2.1.f Detailed cost comparisons of the substitution and the contractually specified item or process

3.14.2.1.g Manufacturer warranties

3.14.2.1.h Energy consumption over a one-year period

3.14.2.1.i What local organization is certified to maintain the item

3.14.2.1.j Performance characteristics and production rates

3.14.2.1.k A list of any license fees or royalties that must be paid

3.14.2.1.l A list of all variations for the item or method specified

3.14.2.1.m A list of at least three (3) other projects of similar nature to this contract where the products or methods have been in use for at least one (1) year including telephone number and name of the person to contact at these other projects

3.14.2.1.n An analysis of the effect of the substitution on the schedule and contract cost and on the overall project as it relates to adjoining Works.

3.14.2.d The formal Request for Substitution will be evaluated by the Owner and the Designer of Record based on the following criteria:

3.14.2.2 Evaluation Criteria

3.14.2.2.a Compatibility with the rest of the project

3.14.2.2.b Reliability, ease of use and maintenance

3.14.2.2.c Both initial and long term cost

3.14.2.2.d Schedule impact

3.14.2.2.e The willingness of the BHS Contractor to share equally in any cost savings.

3.14.2.2.f The ability of the item or process to meet all applicable governing regulations, rules and laws along with funding agency requirements

3.14.2.2.g The cost of evaluating the substitution.

3.14.2.e Based upon the above evaluation the Owner will make a final determination of what is in the best interest of the Owner and either approve, disapprove, or approve as noted the requested substitution.

3.15 SITE PREPARATION

3.15.1 Site Access and Temporary Controls

3.15.1.a Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

3.15.1.b Do not close or obstruct roads, streets, walks, walkways, or other adjacent occupied or used facilities without written authorization from the Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways, if required by governing regulations.

3.15.1.c Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.

3.15.2 Temporary Facilities

3.15.2.a Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities.

3.15.2.b Provide protection to ensure safe passage of people around selective demolition area, and to and from occupied portions of buildings.

3.15.2.c Provide temporary weather protection during intervals between selective demolition operations of existing construction on exterior surfaces and new construction to prevent water leakage and damage to structure and interior areas.

3.15.2.d Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.

3.15.2.e Cover and protect furniture, furnishings and equipment that have not been removed.

3.15.3 Temporary Enclosures

3.15.3.a Provide temporary enclosures for protection of existing buildings and construction projects, both in progress and completed, from exposure, weather, and other construction operations.

3.15.3.b Provide temporary weatherproof enclosures for building exteriors.

3.15.3.c Where heating or cooling is needed and permanent enclosures are not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.

3.15.4 Temporary Partitions

3.15.4.a Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.

3.16 PROTECTION

3.16.1 General

3.16.1.a The BHS Contractor shall ensure that Works in progress is protected against damage until Substantial Completion and/or Beneficial Use, whichever occurs first.

3.16.1.b The BHS Contractor shall ensure that his Works does not impact the Works of other trades/tenants working in the area. Any Works damaged by the BHS Contractor shall become the BHS Contractor's responsibility to repair as directed by the other trade.

3.16.1.c Any building and/or structural members damaged by the BHS Contractor shall be inspected and a written report identifying rectification Works certified by an approved expert shall be submitted to the Owner. Works shall only be undertaken when approved by the Owner in accordance with the General Conditions of Contract.

3.16.1.d Precautions must be taken to prevent damage to existing roadway surfaces. The BHS Contractor shall repair any damage to the existing roadway surfaces to the satisfaction of the Owner.

3.16.1.e The BHS Contractor shall perform non-invasive inspections of any portions of work area that the BHS Contractor needs to interface with in order to identify hidden hazards. Should the BHS Contractor identify a hidden hazard, the BHS Contractor shall submit a mitigation plan to eliminate any effect created by the hazard for approval by the Owner. Works shall only be undertaken when approved by the Owner in accordance with the general conditions of the Contract.

3.16.1.1 Hidden hazards include but are not limited to;

3.16.1.1.a Existing Services

3.16.1.1.b Reinforcing bar.

3.16.1.1.c Electrical/data conduits and/or wires.

3.16.1.1.d Water, gas and/or other pipes.

3.16.1.1.e Ductwork.

3.17 WORK BY OTHERS

3.17.1 General

3.17.1.a The BHS Contractor is notified that there may be other construction activities within the project area and at other locations at the airport throughout the duration of this Contract.

3.17.1.b It is the BHS Contractor's responsibility to keep appraised of such projects and how they may affect the Works. The BHS Contractor shall maintain contact with the Owner and with other contractors and schedule Works so as to minimize the effect of such construction and activities.

3.17.1.c The BHS Contractor is notified that the Works will include working in areas that are under normal use by the airport, tenants, passengers, airlines, and others. It is the BHS Contractor's responsibility to be aware of this normal operation and how it may affect the Works.

3.18 SITE COORDINATION

3.18.1 General

3.18.1.a The BHS Contractor shall perform site coordination with the Owner, Main Contractor, Airlines, Authorities, Sub-contractors, and other trades. Such coordination shall at a minimum cover;

3.18.1.1 Coordination with Other Trades

3.18.1.1.a Floor painting activities

3.18.1.1.b Fire proofing activities

3.18.1.1.c Sprinkler installation

3.18.1.1.d Building lighting installation

3.18.1.1.e Emergency lighting installation

3.18.1.1.f Fire alarm interface

3.18.1.1.g Building Management System interface

3.18.1.1.h Access dates

3.18.1.1.i Date of building weatherproof

3.18.1.1.j Date of permanent power

3.18.1.1.k Date of permanent HVAC

3.18.1.b Coordinate execution of the Works with those public utilities, governmental bodies, private utilities, and other contractors performing work on and adjacent to the worksite. Eliminate or minimize delays in the Works and conflicts with those utilities, bodies, and contractors. Schedule governmental, private utility and public utility Works, which relies upon survey points, lines and grades established by the BHS Contractor to occur immediately after those points, lines and grades have been established. Confirm coordination measures for each individual case with the Owner in writing.

3.18.1.c In coordinating work performed by others, the BHS Contractor shall obtain and refer to equipment locations and other layouts, as available, to avoid interface problems.

3.18.1.d The Owner reserves the right to permit access to the site of the work for the performance of work by other contractors and persons at such times that the Owner deems proper. The exercise of such reserved right shall in no way or to any extent relieve the BHS Contractor from liability for loss and damage to the Works due to or resulting from its operations or from responsibility for complete execution of the Contract. The BHS Contractor shall cooperate with other contractors and persons in all matters requiring mutual effort.

3.18.1.e Site coordination includes coordination efforts, which must be provided by the BHS Contractor to ensure that work by others in the contractually designated work area and adjacent areas does not negatively impact the Works and overall project.

3.18.1.f The construction schedule shall reflect all interfaces and coordination efforts as specified in contracts and procurement documents.

3.18.1.g The BHS Contractor will establish regular working relations with all contractors, tenants and the Airport Maintenance Department working in the same area and areas adjacent to the construction site.

3.18.1.h The BHS Contractor will assign a member of his staff to act as a coordinator, who will work to coordinate the BHS Contractor's work with other parties doing work at the Airport site.

3.18.1.2 Minimum Cooperation Requirements

3.18.1.2.a Regular meeting (weekly or more often)

3.18.1.2.b Construction schedule coordination

3.18.1.2.c Staging area and access planning (to include employee shuttle routes)

3.18.1.2.d Deliveries

3.18.1.2.e Traffic control.

3.18.1.i When and where required, the BHS Contractor shall develop appropriate coordination drawings for use in interfacing with adjacent parties using the site.

3.18.2 Project Meetings

3.18.2.a The meetings will be held at the worksite or at a location selected by the Owner.

3.18.2.b The meetings shall be chaired by the Owner or his representative unless the Owner decides to delegate this role to the BHS Contractor.

3.18.2.c The BHS Contractor's personnel shall attend unless otherwise agreed by the Owner.

3.18.2.d The BHS Contractor shall issue meeting agendas 2 days before each meeting. All participants shall be able to place issues/subjects for the agenda.

3.18.2.e The BHS Contractor shall prepare minutes of meetings for each meeting. The minutes shall be published for review no later than one (1) working day after the meeting took place. Meeting participants shall provide comments and/or corrections to the draft minutes within two (2) working days after publication of the draft minutes of meeting.

3.18.2.1 Pre-Construction Meeting

3.18.2.1.a A Preconstruction Meeting will be scheduled by the Owner after the Contract has been signed by all parties. The purpose of this meeting is to introduce the Owner’s representatives to their counterparts in the BHS Contractor's organization and to establish lines of communication between these representatives and outline some contract requirements. At a minimum, the BHS Contractor's Superintendent and Quality Control Representative(s) and Project Manager shall attend this meeting.

3.18.2.1.b The Owner will distribute a notice of this meeting, along with an agenda of the subjects to be addressed.

3.18.2.1.c The Owner will explain and discuss the responsibilities, organization, and authorities of the Owner and the Engineer.

3.18.2.1.d The Owner will provide highlights of the following information at this meeting:

3.18.2.1.1 Owner’s Area of Responsibility

3.18.2.1.1.a Equal Employment Opportunity (EEO), Small Business Enterprise (SBE) and Disadvantaged Business Enterprise (DBE) requirements.

3.18.2.1.1.b List requirements in terms of insurance, laws, codes, traffic regulations and permits of public agencies and their regulations.

3.18.2.1.1.c Procedures for processing Change Orders.

3.18.2.1.1.d Procedures for submitting shop and working drawings, product data and samples.

3.18.2.1.1.e Monthly pay estimate cutoff dates.

3.18.2.1.1.f Payment procedures.

3.18.2.1.1.g Request for information procedures.

3.18.2.1.1.h Communication procedures.

3.18.2.1.1.i BHS Contractor-required daily report showing the quantitative progress of Works, the use of men, material and equipment, problems, potential delays, weather, work shift, down equipment, material and equipment received and information received from the Owner. Daily reports will be submitted to the Owner within 48 hours of start of work. Daily reports are required every day, including weekends and holidays.

3.18.2.1.1.j Scheduling and coordination requirements.

3.18.2.1.1.k Quality control/assurance procedures.

3.18.2.1.1.l Environmental requirements and permits.

3.18.2.1.1.m As-built documents.

3.18.2.1.1.n Project closeout requirements.

3.18.2.1.e The BHS Contractor will introduce the BHS Contractor's representatives and briefly describe each person's responsibilities. The BHS Contractor will provide the following:

3.18.2.1.2 BHS Contractor's Area of Responsibility

3.18.2.1.2.a A list of all sub-contractors.

3.18.2.1.2.b Office, storage areas and construction area layouts, along with temporary easements.

3.18.2.1.2.c Safety, first aid, emergency actions and security procedures including the name of the BHS Contractor's insurance company.

3.18.2.1.2.d Sixty (60) days detailed preliminary schedule and full general schedule.

3.18.2.1.2.e Sequence of Works.

3.18.2.1.2.f Construction methods and general worksite layout and haul plan.

3.18.2.1.2.g Housekeeping procedures. Include a written plan for dealing with and preventing FOD (Foreign Object Damage).

3.18.2.1.2.h The BHS Contractor‘s general erosion and sedimentation control plans, noise, hazardous material, air and water pollution control plans and Quality Control Plan.

3.18.2.1.2.i Coordination and notification for utility work.

3.18.2.1.2.j The BHS Contractor's procedures to coordinate its work with the Works of other contractors and its procedures for sharing access to the worksite.

3.18.2.1.2.k Deliveries and priorities of major equipment.

3.18.2.1.f Explanations provided by the Owner will not amend, supersede or alter the terms or meaning of any Contract Document, and the BHS Contractor shall not claim reliance on such explanations as a defense to any breach or failure by the BHS Contractor to perform as specified in the contract.

3.18.2.2 Design Meetings

3.18.2.2.a The BHS Contractor shall plan and execute Design Meetings with the Owner and/or his representative to allow coordination and review of general design issues such as;

3.18.2.2.1 Design Considerations

3.18.2.2.1.a Mechanical layout, elevations, and sections

3.18.2.2.1.b Building interface and integration (interference coordination)

3.18.2.2.1.c Power distribution and electrical design

3.18.2.2.1.d Samples

3.18.2.2.1.e Equipment approvals

3.18.2.2.1.f PLC system architecture

3.18.2.2.1.g FDS

3.18.2.2.1.h DDS

3.18.2.2.1.i External interface requirements with other airport systems

3.18.2.2.1.j Hardware requirements

3.18.2.2.1.k Software requirements

3.18.2.2.1.l Production/testing schedule

3.18.2.2.1.m Operational procedures (e.g. start/stop, jam, E-stop, operational stop, maintenance call)

3.18.2.2.1.n Fallback operation and procedures

3.18.2.2.b At each Design Meeting, the BHS Contractor shall provide update on progress since previous meeting and log outstanding issues from meeting to meeting.

3.18.2.3 Construction Progress Meetings

3.18.2.3.a The BHS Contractor shall attend construction progress meetings and shall coordinate work as described in these Specifications. The BHS Contractor shall program and schedule a construction/progress meeting as follows;

3.18.2.3.1 Meeting Schedule

3.18.2.3.1.a Monthly on a designated day as directed by the Owner until construction commences.

3.18.2.3.1.b Progress meetings will be scheduled weekly and more often as necessary by the Owner to promote the competent and timely execution of the contract.

3.18.2.3.b The BHS Contractor shall provide teleconference services for personnel to attend the meeting off-site using telephone or internet meeting services.

3.18.2.3.c At a minimum, the following items will be addressed at each meeting. The items addressed in the meeting do not waive notification or submittal requirements as required elsewhere in the contract.

3.18.2.3.2 Meeting Agenda

3.18.2.3.2.a The BHS Contractor shall report any safety issues

3.18.2.3.2.b The BHS Contractor's Quality Control representative shall present and review all RARs, CCRs, and NCRs issued and the status of each item.

3.18.2.3.2.c The BHS Contractor's Quality Control representative shall present and discuss the Independent Testing Agency weekly test report and/or testing schedule.

3.18.2.3.2.d The BHS Contractor's Quality Control representative shall report on inspections by other agencies and any follow-up activity required.

3.18.2.3.2.e The Owner will present and discuss issues regarding quality control and quality assurance.

3.18.2.3.2.f The BHS Contractor and Owner shall have open discussions regarding design issues as required for the coordination and execution of the project.

3.18.2.3.2.g The BHS Contractor shall provide four (4) copies of and review the BHS Contractor's submittal schedule and provide any updated information and/or changes to the schedule.

3.18.2.3.2.h The BHS Contractor shall provide information on the status of submittals requiring re-submittal.

3.18.2.3.2.i The BHS Contractor shall review any changes to an accepted submittal that the BHS Contractor plans to re-submit with changes.

3.18.2.3.2.j The BHS Contractor and Owner shall have open discussions regarding construction activities, including coordination items with other contractors and or agencies.

3.18.2.3.2.k The BHS Contractor shall provide four (4) copies of the BHS Contractor's two (2) week look-ahead schedule (2 weeks beyond the current week and any time remaining of the current week) and review at the meeting the items on the schedule. The schedule shall be in Gantt chart format based on the approved Critical Path Method (CPM), and shall include dates of testing activities, anticipated dates of inspection by the Owner and other agencies, items in progress, percentage of completion of items, and sub-contractor responsible for each item.

3.18.2.3.2.l The BHS Contractor shall describe the progress made and activities since last meeting along with planned activities for next reporting period. The BHS Contractor shall at each meeting compare actual progress with planned progress and describe countermeasures to be taken to absorb any negative discrepancies.

3.18.2.3.2.m These meetings shall be used to discuss issues with the design, fabrication, shipping, installation, commissioning, testing, safety, schedule, and payment or as deemed necessary for the effective execution of the project.

3.19 SITE SUPPORT EQUIPMENT

3.19.1 General

3.19.1.a The BHS Contractor shall provide all on-site installation support equipment such as, but not limited to, forklifts, scissor lifts, trucks, welding machines, cutters, grinders, power generators, temporary power panels, portable restrooms.

3.19.1.b The BHS Contractor shall provide any and all temporary power and lighting that may be required for and during the course of the installation and testing of the Works. All temporary power and lighting must be approved by the Owner.

3.19.1.c CNG-powered equipment is allowed within the buildings. No other fossil fuel powered equipment may be used within the buildings unless the equipment is directly vented to the building exterior.

3.19.1.d When equipment is operating outdoors, such equipment may be driven by fossil fuels as long as relevant safety regulations are upheld.

3.19.1.e All vehicles require permitting including electric carts. Permits may be acquired at the Airport Security Office.

3.20 NOISE CONTROL

3.20.1 General

3.20.1.a The BHS Contractor must conduct construction activities in such a manner that are compliant with all code requirements. The noise levels measured at the closest point adjacent to the worksite in normal use by the public must not exceed the limits shown in Part 1 § 1.16.11.

3.20.1.b The BHS Contractor shall conduct regular, periodic measurements of sound levels at the nearest receptors and maintain records of the measurements for inspection by the Owner.

3.20.1.c Notwithstanding the specific noise level limitations specified herein, utilize the following noise mitigation measures in order to minimize noise levels to the greatest extent feasible.

3.20.1.d Use alternative procedures of construction and selection of the proper combination of techniques that shall generate the least overall noise and vibration consistent with the design Specifications and other provisions hereof

3.20.1.e Use construction equipment modified to dampen noise and vibration emissions.

3.20.1.f Maximize the physical separation, to the extent feasible, between noise generators and noise receptors.

3.20.1.g Minimize noise intrusive impacts during the most noise sensitive hours.

Table 50 Allowable Noise Levels (dB(A)) during Construction

Residential		Commercial		Industrial		Public	
07:00-22:00	22:00-07:00	07:00-22:00	22:00-07:00	07:00-22:00	22:00-07:00	07:00-22:00	22:00-07:00
55	50	65	60	80	75	75	70

3.20.1.h These maximum permissible sound pressure levels shall not apply to sounds emitted from any commercial power equipment operated upon any residential, commercial, industrial, or public premises between 07:00 and 22:00 provided that such equipment does not exceed a sound pressure level of eighty-eight (88) dB(A) when measured twenty-five (25) feet from the noise source and further provided that between 22:00 and 07:00 such equipment does not exceed the maximum sound pressure levels as specified in Part 1 § 1.16.11.

3.21 POLLUTION CONTROL

3.21.1 Dust Control

3.21.1.a Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt. Comply with governing environmental protection regulations.

3.21.1.b Do not use water when it may damage existing construction or create hazardous or objectionable conditions such as ice, flooding, and pollution.

3.21.1.c Wet mop floors to eliminate trackable dirt and wipe down walls and doors of demolition enclosures. Vacuum carpeted areas.

3.21.2 Disposal

3.21.2.a Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

3.21.3 Cleaning

3.21.3.a Clean adjacent structures and improvements of dust, dirt and debris caused by selective demolition operations. Return adjacent areas to the condition existing before selective demolition operations began.

3.22 CLEANING (HOUSE KEEPING)

3.22.1 General

3.22.1.a Maintain the worksite in a neat, orderly, and hazard-free manner in conformance with all federal, state and local rules, codes, regulations and orders, including all OSHA requirements, until Final Completion and Acceptance of the Works and the BHS Contractor has vacated the site.

3.22.1.b Keep catwalks, underground structures, worksite walks, sidewalks, roadways, and streets, along with public and private walkways adjacent to the worksite, free from hazards caused by construction activities. Inspect these areas regularly for hazardous conditions caused by construction activities

3.22.1.c The BHS Contractor shall not use Owner controlled dumpsters or other contractor's dumpsters for material removal.

3.22.1.d The BHS Contractor may locate a trash dumpster adjacent to the work site. All accumulated trash must be carted to the dumpster on a daily basis. The area around the BHS Contractor's dumpster shall be kept clean and free of debris. The dumpster shall be covered at all times and comply with security regulations.

3.22.1.e The BHS Contractor shall keep the construction site clear of debris at the end of each workday. The BHS Contractor shall regularly empty his dumpster to prevent spillage of its contents.

3.22.1.f Emergency escape routes shall be kept clear of debris, materials, or equipment at all times.

3.22.1.g The BHS Contractor shall clean all equipment after installation has been completed and before commissioning commences to avoid reduction in the service life of the equipment.

3.22.1.h The BHS Contractor shall perform a system wide clean-up before Practical Completion, Substantial Completion and Final Completion and Acceptance.

3.22.2 Hazardous Waste

3.22.2.a Store volatile wastes in covered metal containers and remove those wastes from worksite daily.

3.22.2.b Do not accumulate wastes which create hazardous conditions.

3.22.2.c If volatile and noxious substances are being used in spaces that are not naturally ventilated, provide artificial ventilation.

3.22.2.d Hazard controls shall conform to the applicable federal, state, and local rules and regulations.

3.22.2.e Provide appropriate waste receptacles in all areas in which employees are working. Waste receptacles shall be kept covered at all times. All materials on site shall be anchored and covered to prevent any objects from becoming wind-borne.

3.22.3 Washing Plan

3.22.3.a The BHS Contractor shall prepare a plan describing the specific procedures and materials to be utilized for any equipment, vehicle, etc. washing activities. The plan must be submitted to the Owner and also approved by the Owner and Environmental Services.

3.22.3.b Outdoor washing at the airport is not allowed unless the materials will be collected or managed in a manner to ensure that they will not enter the municipally-owned separate storm sewer system

(MS4). The materials can only be disposed of at a location pre-approved by Environmental Services. Failure to comply with this requirement would result in the discharge of non-storm water.

3.22.3.c Indoor washing must be conducted in accordance with the Best Management Practices (BMPs). In addition, all indoor washing must be conducted in a manner that ensures that there are no prohibited discharges to the sanitary sewer system.

3.22.4 Cleaning Materials

3.22.4.a Use the type of cleaning materials recommended by the manufacturer for the surfaces to be cleaned.

3.22.4.b Maintain current Material Safety Data Sheets (MSDS) on site for all chemicals.

3.22.4.c Environmental Services must approve the chemicals used prior to discharge to the sanitary sewer system.

3.22.4.d Ensure proper disposal of all wastes generated from the use of these materials. Must ensure compliance with all environmental regulations. No wastes can be disposed of on the airport property.

3.22.5 Interim Cleaning

3.22.5.a Clean the worksite every shift/workday for the duration of the construction contract. Maintain structures, grounds, storage areas and other areas of worksite, including public and private properties immediately adjacent to worksite, and keep them free from accumulations of waste materials caused by construction operations. Place waste materials in covered metal containers. All hard concrete, steel, wood, and finished walking surfaces shall be swept clean daily.

3.22.5.b Remove or secure loose material on open decks and on other exposed surfaces at the end of each workday or more often in a manner that will keep the worksite hazard free. Secure material in a manner that will prevent dislodgment by wind and other forces.

3.22.5.c Sprinkle waste materials with water or acceptable chemical palliative to prevent blowing of dust.

3.22.5.d Promptly empty waste containers when they become full and legally dispose of the contents at dumping areas off the Owner’s property.

3.22.5.e Control the handling of waste materials. Do not permit materials to be dropped or thrown from structures.

3.22.5.f Immediately remove spillage of construction related materials from haul routes, work site, private property, public rights of way, or on the Airport site.

3.22.5.g Clean only when dust and other contaminants will not precipitate upon newly painted surfaces.

3.22.5.h Cleaning shall be done in accordance with manufacturer's recommendation.

3.22.5.i Cleaning shall be done in a manner and using such materials as to not damage the Works.

3.22.5.j Clean areas prior to painting or applying adhesive.

3.22.5.k Clean all heating and cooling systems prior to operations. If the BHS Contractor is allowed to use the heating and cooling system, it shall be cleaned prior to testing.

3.22.5.l Clean all areas that will be concealed prior to concealment.

3.22.5.m Dispose of all fluids according to the approved Washing Plan.

3.22.6 Final Cleaning

3.22.6.a Inspect interior and exterior surfaces, including concealed spaces, in preparation for completion and acceptance.

3.22.6.b Remove dirt, dust, litter, corrosion, solvents, misplaced paint, stains, and extraneous markings.

3.22.6.c Remove surplus materials, except those materials intended for maintenance.

3.22.6.d Remove all tools, appliances, equipment, and temporary facilities used during the construction.

3.22.6.e Remove detachable labels and tags. File them with the manufacturer's specifications for that specific material for the Owner’s records.

3.22.6.f Repair damaged materials to the specified finish or remove and replace.

3.22.6.g After all trades have completed their Works and just before Final Completion and Acceptance, all catch basins, manholes, drains, strainers, and filters shall be cleaned; roadway, driveways, floors, steps, and walks shall be swept. Interior building areas shall be vacuumed and mopped.

3.22.6.h Final clean up applies to all areas, whether previously occupied and operational or not.

3.22.6.i Dispose of all fluids according to the approved Washing Plan.

3.23 PREVENTIVE MAINTENANCE DURING CONTRACT EXECUTION

3.23.1 General

3.23.1.a The BHS Contractor shall provide preventive maintenance of the complete CBIS/BHS system from commencement of Pre-Commissioning activities until Beneficial Use/Substantial Completion following the standard recommended maintenance guidelines for the CBIS/BHS equipment provided.

3.23.1.b Upon Beneficial Use/Substantial Completion to the Owner the CBIS/BHS equipment shall be in near new condition and all maintenance activities shall be up-to-date.

3.24 INSTALLATION

3.24.1 General

3.24.1.a The requirements of the latest edition of the “OSHA construction standards” shall be followed by all BHS Contractors, fabricators, and suppliers.

3.24.1.b All Works for the construction and installation of the CBIS/BHS shall be in accordance with all codes and standards and local laws and regulations, applicable to the design and construction of this type of equipment, which are generally accepted and used as good practice throughout the industry. I.e. NFPA, Underwriter’s Laboratories, OSHA, SAE publications, National Electrical Code (NEC), American National Standards, etc.

3.24.2 Installation Tolerances

3.24.2.a The maximum allowed gap between adjacent end rollers on consecutive conveyors shall not exceed 1” with ½” being the installation objective.

3.24.2.b Adjacent equipment shall be installed true and parallel to each other. Any angle off-set shall be kept to a minimum and shall not exceed 1/8” over the width of a standard size conveyor (42”).

3.24.3 Construction Drawings

3.24.3.a The BHS Contractor shall ensure that the latest and most current approved Construction Drawings are maintained on-site at all times during installation including demolition, construction, testing and/or any other type of work involved in installing the Works identified in the Contract Documents.

3.24.3.b In the event that the most current approved Construction Drawings are not kept on site by the BHS Contractor, the Owner reserves the right to delay/stop the Works until such time as the BHS Contractor provides complete, current and approved drawings on site, the Owner has inspected the drawings and approved work/construction to continue. All costs/time associated with the delay shall be borne entirely by the BHS Contractor and no additional time shall be granted. The BHS Contractor is required to absorb the delay by working smarter, faster, longer hours and/or increase manpower to meet the project schedule.

3.24.4 On-Site Benchmark Installation (Owner Accepted Installation)

3.24.4.1 General

3.24.4.1.a The BHS Contractor shall within five (5) days after the installation of the first typical installation of each part, component, or assembly, invite the Owner for an official inspection of such installation.

3.24.4.1.b The quality of workmanship and compliance with the Contract shall be reviewed by the Owner. Any non-conformity shall be rectified immediately by the BHS Contractor. Comments or suggestions for design or installation improvements shall be coordinated with the Owner in good faith.

3.24.4.1.c Once the typical installation has been accepted by the Owner it shall be left untouched and marked "Reference Installation". The Reference Installation shall then be used as a reference for all future installations and any discrepancies found in future installations compared with the Reference Installation shall be rectified immediately by the BHS Contractor at no cost to the Owner. Omission by the Owner to point out any non-compliance issue during the inspection of the "Reference Installation" shall not relieve the BHS Contractor from Contract requirements.

3.24.5 Reference Points (Datum Point)

3.24.5.a Protect and preserve reference points, airport grid control points, benchmarks, and section corner monuments. Coordinates shown on the drawings are based on the Owner's coordinate system unless otherwise noted.

3.24.5.b Report damaged or destroyed reference points, grid coordinate points and benchmarks to the Owner.

3.24.5.c The Owner will not be responsible for any increased costs or delays to the BHS Contractor relating to reference points, grid control points, or bench marks, which are damaged, moved, altered or destroyed by the BHS Contractor or its Sub-contractors, suppliers, agents or employees or other contractors working on the site.

3.24.5.d If reference points, coordinate points or benchmarks are damaged, moved, altered or destroyed by the BHS Contractor, the Owner's cost of reestablishing such points shall be borne by the BHS Contractor.

3.24.5.e The use of control monuments for construction surveying other than those shown on the Contract Documents or furnished by or approved by the Owner is prohibited. Use of other monuments is at the BHS Contractor's sole risk.

3.24.5.f The Owner may draw the BHS Contractor's attention to errors or omissions in lines or grades, but the failure to point out such errors or omissions shall not give the BHS Contractor any right or claim nor shall in any way relieve the BHS Contractor of his obligations according to the terms of the Contract.

3.24.5.g Control traverse field surveys and computations shall be performed to an accuracy and precision of at least 1:40,000.

3.24.5.h The tolerances generally applicable in setting survey stakes shall be as set forth in the local Survey Manual, latest edition. Such tolerances shall not supersede stricter tolerances required by the drawings or Specifications and shall not otherwise relieve the BHS Contractor of responsibility for measurements in compliance therewith.

3.24.5.i The BHS Contractor shall use the reference points, airport grid control points, benchmarks, and section corner monuments as reference for all installations.

3.24.6 Vibration

3.24.6.a Provide all mounted components (pulleys, sprockets, rollers, and so on) with methods to preventing the loosening of the component (e.g. snap rings, cotter pints).

3.24.7 Structural Steel

3.24.7.1 Welding

3.24.7.1.a Inspection of welding shall be in accordance with Specifications Section 05999 Welding and applicable AWS codes.

3.24.7.1.b The Independent Testing Agency shall inspect welds per ASTM E 329 as follows;

3.24.7.1.1 Required Inspections

3.24.7.1.1.a All welds shall be 100% visually inspected.

3.24.7.1.1.b All full penetration or partial penetration groove welds require 100% ultrasonic testing.

3.24.7.1.1.c All fabricated trusses including all fabricated trusses acting as girders shall be 100% magnetic particle tested.

3.24.7.1.1.d All core wall embedded plates shall be 100% stud hammer tested.

3.24.7.1.1.e 20% of curtain wall embeds shall be stud hammer and magnetic particle tested.

3.24.7.1.1.f All other welded connections shall be 10% magnetic particle tested.

3.24.7.2 Bolting

3.24.7.2.a Bolt tension quality control (Self-indicating) - inspection of installed high strength fasteners shall insure that the requirements of Section 6 inspection of the "Specification for structural joints using ASTM A325 or A490 bolts" of the American Institute of Steel Construction are met by inspection.

3.24.7.2.1 For direct tension indicator washers the following shall be used:

3.24.7.2.1.a A visual inspection thereafter shall insure that all washer nubs have been flattened per ASTM F959.

3.24.7.2.1.b When nubs are not flattened, the testing agency will determine that proper bolt tension requirements exist by the application of a properly calibrated testing torque. All cost of any torque inspection will be borne by the BHS Contractor.

3.24.7.2.1.c A minimum of 2 percent of each batch or shipment of high strength bolts shall be tested for compliance with ASTM A325 or A490 as appropriate.

3.24.7.2.2 For torque control bolts the following shall be used:

3.24.7.2.2.a A visual inspection shall ensure that all spline shanks have been cleanly broken without excessive distortion.

3.24.7.2.2.b If distortion is encountered, the bolts should be tightened to a snug connection, followed by final tightening with the manufacturer's approved installation tool until the splines are sheared. Each such bolt shall then be torque tested. All cost of torque inspection will be borne by the BHS Contractor.

3.24.7.2.2.c A minimum of 0.5% of each batch or shipment of bolts shall be tested for tension and ductility values and for compliance with ASTM A325 or A490.

3.24.7.3 Stud Connectors

3.24.7.3.a Shall be inspected per requirements of Specifications Section 05999 Welding.

3.24.7.3.b Correct deficiencies in structural steel work that inspections and laboratory test reports have indicated to be not in compliance with requirements. Perform additional tests, at BHS Contractor's expense, as may be necessary to reconfirm any non-compliance of original Works, and as may be necessary to show compliance of corrected Works.

3.24.8 Welding Equipment, Procedures and Constraints

3.24.8.a Provide welded connections for fabrication and installation of work wherever bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts.

3.24.8.b Natural gas-powered portable welders or “Powcon Inverter” welders are the only acceptable welding equipment to be used inside of building basement or tunnel areas. Acceptability of equipment other than the equipment noted above shall be at the sole discretion of the Owner. If the BHS Contractor proposes other types of inverter welding equipment, testing of equipment for harmonics by the BHS Contractor must be completed prior to the request by the BHS Contractor for use of the equipment.

3.24.8.c Welding activities inside buildings require submittal of a System Interruption Request. Prior to welding in any area, the BHS Contractor shall locate smoke detectors and shall request interruption of the fire alarm system. Subsequent to the interruption of the fire alarm system and prior to welding activities, the BHS Contractor shall cover and protect smoke detectors until Works is complete. Prior to expiration of each interruption of the system, the BHS Contractor shall uncover the smoke detectors.

3.24.8.d The BHS Contractor shall be responsible for verifying with the Owner or representatives’ locations acceptable for accessing electrical power for welders and other electrical equipment feeders. The BHS Contractor shall be responsible for all Works and equipment required to install temporary or permanent electrical modifications for construction power and lighting.

3.24.8.1 Temporary Electrical Hook-up

3.24.8.1.a Pigtails wired into electrical panels - temporary only:

3.24.8.1.b The BHS Contractor may not begin operation of the equipment prior to request for inspection by the Owner’s representatives and acceptance of the installation.

3.24.8.2 Permanent Electrical Hook-up

3.24.8.2.a Permanent installation shall require conduit, labeling, and all requirements of Division 16 Specifications.

3.24.8.2.b Provide 20 amp, 3 pole plugs.

3.24.8.2.c Wire shall be (4) #10 copper

3.24.8.2.d 208V, 3 phase, 3 pole, 4 wire twist lock ground line

3.24.8.2.e NEMA L15-20R

3.24.8.2.f The BHS Contractor may not begin operation of the equipment prior to request for inspection by the Owner's representatives and acceptance of the installation.

3.24.8.3 Welding Practices

3.24.8.3.a All standard safe welding practices must be followed, including but not limited to the following:

3.24.8.3.b Flash protection for surrounding areas

3.24.8.3.c BHS Contractor fire extinguisher in area

3.24.8.3.d One (1) person solely designated as fire watch for each welder

3.24.8.3.e Protect all equipment, cable trays and contents, etc. in area.

3.24.8.3.f Use fire blankets and other appropriate materials to confine sparks and molten metal from the welding, cutting, and/or grinding activities.

3.24.8.3.g All welders shall have been qualified through welding tests in accordance with applicable welding code, such as but not limited to AWS, ASME, API, within one (1) year prior to welding taking place. Evidence of qualification shall be through Welding Performance Qualification Records (WPQR).

3.24.8.3.h All welder qualifications tests shall be or shall have been administered and witnessed by an Independent Testing Agency (ITA), AWS Certified Welding Inspector (CWI).

3.24.8.3.i If re-certification of welders is required, delay costs and retesting costs shall be borne by the BHS Contractor.

3.24.8.4 Grounding

3.24.8.4.a Review with the Owner's representative area of work prior to beginning work to ensure ground procedures do not induce undesirable charges in steel building system or other systems. This review should take place subsequent to the pre-work meeting. Do not ground to adjacent building systems, baggage system, hangers, or devices that support mechanical or electrical equipment.

3.24.9 Spot Painting

3.24.9.a All works-applied paint which is damaged during the erection process shall be made good and all bare patches touched up the satisfaction of the Project Manager and in accordance with the recommendations of the paint manufacturer before work in other trades connected with the item is commenced.

3.24.10 Fireproofing

3.24.10.a The BHS Contractor shall replace and/or repair any fireproofing materials to an equal depth at attachment locations, which has been removed for the proper installation of CBIS/BHS equipment.

3.24.11 Workmanship

3.24.11.1 General

3.24.11.1.a Any changes or deviations from the drawings and Specifications must be accepted in writing by the Owner. All errors in installation shall be corrected at the expense of the BHS Contractor. All equipment shall be installed as detailed on the drawings. Where details or specific installation requirements are not provided, manufacturer recommendations shall be followed.

3.24.11.1.b Upon completion of Works, all equipment and materials shall be installed complete, thoroughly tested, checked, correctly adjusted, and left ready for intended use or operation. All Works shall be thoroughly cleaned and all residues shall be removed from surfaces. Exterior surfaces of all material and equipment shall be left in a perfect, unblemished condition.

3.24.11.2 Mechanical

3.24.11.2.a Ensure that the installation of equipment is rigid and no rattling is observed when equipment is operational.

3.24.11.3 Electrical

3.24.11.3.a Only quality workmanship will be accepted. Use the NECA Standard of Installation as a minimum for installation of equipment. Poor workmanship, improper layout of work and lack of coordination of work, as determined by the Owner, is not acceptable and shall be corrected at the BHS Contractor's cost.

3.24.11.3.b The BHS Contractor shall include no more than one (1) apprentice per journeyman electrician. Apprentices shall be under the direct supervision of a licensed electrician at all times.

3.24.11.3.c BHS Contractor's personnel and sub-contractors selected to perform the Works shall be well versed and skilled in the trades involved.

3.24.12 Belt Tracking

3.24.12.a Belt tracking shall be accomplished using a method, which does not induce unequal belt edge tensions.

3.24.13 Sideguards

3.24.13.a Sideguards shall be flared down-stream.

3.24.13.b Punched and dimpled PEC holed from inside of conveyor toward the outside. PEC reflectors shall be fully visible by the PEC. Reflector shall be free of mounting bolts/screws.

3.24.13.c Sideguards shall not contain any catch points.

3.24.13.d Transitions between sections shall be smooth.

3.24.13.e Sideguards shall have thirty (30°) degree transition pieces at change of sideguard heights

3.24.13.f Sideguards shall be bolted together. Butt joints are not allowed.

3.24.13.g No equipment shall be attached to removable sideguards.

3.24.13.h No gaps shall be allowed between the slider bed and conveyor frame and the sideguards.

3.24.13.i Sideguards shall not obstruct equipment installed on building walls.

3.24.14 Maintainability

3.24.14.a Equipment components requiring frequent or scheduled inspection and servicing must be readily accessible.

3.24.14.b For the conveyors, access holes in frames or guards are acceptable but shall be kept to a minimum number and size, and shall not create protrusions or discontinuities detrimental to the baggage being conveyed..

3.24.14.c The provision of the walkways and platforms shall be sufficient to allow access to all items requiring maintenance, to all manned locations and to all parts of the system to allow bags to be removed in the event of baggage jams or system stoppage.

3.24.15 Conduit

3.24.15.a Size conduit for conductor type installed or for Type THW conductors, whichever is larger, ¾" minimum size. For communication, 1" is the minimum.

3.24.15.b The maximum size conduit in slabs above grade shall not exceed ¾" .

3.24.15.c Conduits crossing each other may not be larger than ¾" .

3.24.15.d Exposed conduits shall be rigid steel for installations 8'-0" above floor, deck or grating except in electrical, communications and mechanical rooms.

3.24.15.e Thread rigid conduit with Standard National Pipe Thread threading dies. Engage a minimum of five (5) threads on all connections; use an approved pipe dope for all connections except where lock nuts are used.

3.24.15.f Use only factory cast hubs for fastening conduit to cast boxes, and use steel or malleable iron hubs for fastening conduit to sheet metal boxes or equipment in damp or wet locations.

3.24.15.g Use PVC-coated rigid steel factory elbows for bends in conduit runs.

3.24.15.h Install Owner approved expansion joints with external code sized bonding jumpers where conduit crosses building expansion joints.

3.24.15.i Use suitable conduit caps to protect installed conduit against entrance of dirt and moisture during construction.

3.24.15.j Empty conduits shall be capped. Provide a 200 lbs. nylon measuring pull string in all empty conduits.

3.24.15.k Under freestanding equipment conduits with conductors shall be sealed with duct seal.

3.24.15.l All vibrating equipment such as motors, transformers, and generators shall be connected with flexible steel conduit.

3.24.15.m Flexible conduit shall not be less than ½" in diameter. Flexible steel conduit runs shall not exceed 3' in length when connecting equipment, 6' in length when connecting light fixtures or when fished in hollow spaces with written approval by the Owner and shall contain a grounding conductor.

3.24.15.n Cut rigid steel conduit square using a saw or pipe cutter; de-burr cut ends.

3.24.15.o Cut electrical metallic tubing steel conduit and flexible steel conduit with saw only. Bring conduit to the shoulder of fittings and tighten securely.

3.24.15.p Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 2" size.

3.24.15.q Arrange conduit to maintain headroom and present a neat appearance. Install conduit in locations where it is not exposed to damage by moving vehicles or equipment.

3.24.15.r In public areas, conduit runs and raceways shall be inconspicuous by running under cover plates, behind conveyors or otherwise concealed from public view.

3.24.15.s Arrange conduit supports to prevent distortion of alignment by wire pulling operations. Fasten conduit using galvanized straps, lay-in adjustable hangers, clevis hangers, or bolted split stamped galvanized hangers.

3.24.15.t Maintain a minimum of 6" between conduit and other piping. Maintain 12" clearance between conduit and a heat source such as heating pipes, exhaust flues and heating appliances.

3.24.15.u Group conduit in parallel runs where practical and use conduit rack constructed of steel channel with conduit straps or clamps.

3.24.15.v Do not fasten or support conduit with wire or perforated pipe straps. Remove all wire used for temporary conduit support during construction before conductors are pulled.

3.24.15.w Do not support conduit from cable tray or cable tray supports.

3.24.15.x Support conduit at a maximum of 7' on center, within 2' of a box or fitting, and at each change of direction.

3.24.15.y Conduit stubbed up shall be 2" above slab or housekeeping pad/plinth.

3.24.15.z Install no more than the equivalent of four (4) ninety (90°) degree bends between pull boxes or the equivalent of three (3) ninety (90°) degree bends for communication.

3.24.15.aa All exposed and concealed conduit runs shall be squared with the building lines. Use conduit bodies to make changes in direction around beams or columns.

3.24.15.bb Avoid moisture traps where possible; where unavoidable, provide junction boxes with drain fittings at the conduit low point.

3.24.15.cc Electrical installations in hollow spaces, vertical shafts, and ventilation or air ducts shall be made such that the possible spread of fire or products of combustion will not be substantially increased. Openings around electrical penetrations through fire-resistant-rated walls, partitions, floors or ceilings shall be fire stopped using UL approved, classified, listed or labeled material and/or methods to maintain the fire-resistant rating.

3.24.15.dd Where conduit penetrates fire-rated walls, concrete and/or masonry walls and floors, it shall be sleeved. Seal opening around conduit with a product listed for the purpose.

3.24.15.ee Any electrical work penetrating concrete walls or floors shall require saw cutting and/or core drilling and shall require approval by the Owner.

3.24.15.ff All conduits shall be supported by approved hangers. Supports installed and used by other trades such as duct hangers, pipe hangers, ceiling hangers, etc. shall not be used for conduit support. No conduit shall be hung from air handling ductwork of any kind. Electrical conduit systems shall stand alone.

3.24.15.gg When anchoring to a dual sheet metal pan deck and concrete, anchors of any type when placed from below the deck shall be placed only in the lower pan form. No anchors shall be installed in the upper (high) pan. All concrete type anchors shall be installed in drilled holes. All holes shall be drilled with a protected hammer drill, one that shuts off when in contact with a grounded object.

3.24.15.hh X-ray or ground penetrating radar studies shall be made of concrete floors, walls or CMU walls and an interpretation of the findings shall be provided to the Owner prior to any core drilling or saw cutting.

Table 51 Conduit Application

Application	Conduit Type
Underground Installations More Than Five (5) Feet From Foundation Wall	Polyvinyl Chloride (PVC) conduit Schedule 40. All bends in non-metallic conduit shall be galvanized rigid steel conduit with a factory coating of polyvinyl chloride (PVC).
Installation In Concrete Slab	Not allowed.
In Slab Above Grade	Not allowed.
Exposed Outdoor Locations:	Rigid steel
Wet Interior Locations	Rigid steel
Concealed Dry Interior Locations	Electrical metallic tubing
Exposed Dry Interior Locations	Rigid steel up to eight feet (8') AFF, Electrical metallic tubing in electrical, mechanical, and communication rooms and above 8' AFF

3.24.15.1 Conduit Color Coding

3.24.15.1.a Exposed conduit (visible from the floor or above a suspended ceiling) shall have bands painted in the below defined color at the on center spacing for the entire length. The paint band shall be within 3 feet of all equipment, control panels fire alarm panels, fire alarm devices, panelboards, switchboards, switches, devices, and boxes (readily visible when standing in front of equipment).

3.24.15.1.b All junction, pull boxes and their covers shall have the same color as the applicable conduit.

Table 52 Conduit Color Coding

Conduit Application	Color	Color Marking Spacing
Electrical emergency power and fire alarm conduits	Red	5'
CBIS/BHS Data and LLC conduit	Brown	5'
Paging system conduits	Green	5'
Security system conduits	Blue	5'
Closed circuit television (CCTV) conduits	Yellow	5'

3.24.16 Wire-Ways/Cable Trays

3.24.16.a Wire-ways/cable tray and cable tray supports shall not be used to support conduits or other equipment. Cable tray and cable tray supports "shall stand alone."

3.24.16.b Wire-ways/cable tray shall not be installed in stairways or on the exterior of any building.

3.24.16.c Arrange wire-ways to maintain headroom and present a neat appearance.

3.24.16.d Arrange wire-ways supports to prevent distortion of alignment by wire pulling operations. Fasten wire-ways using galvanized straps, lay-in adjustable hangers, clevis hangers, or bolted split stamped galvanized hangers.

3.24.16.e Maintain a minimum of 6" between wire-ways and other piping. Maintain 12" clearance between wire-ways and a heat source such as heating pipes, exhaust flues and heating appliances.

3.24.16.f Group wire-ways in parallel runs where practical and use wire-way rack constructed of steel channel with wire-way straps or clamps. Provide space for twenty-five percent (25%) additional cabling in each wire-ways.

3.24.16.g Do not fasten or support wire-ways with wire or perforated pipe straps. Remove all wire used for temporary wire-ways support during construction before conductors are pulled.

3.24.16.h Do not support wire-ways from conduit supports.

3.24.16.i Support wire-ways at a maximum of 7' on center and at each change of direction.

3.24.16.j Wire-ways stubbed up shall be 2" above slab or housekeeping pad/plinth.

3.24.16.k All wire-ways shall be squared with the building lines. Use wire-way bodies to make changes in direction around beams or columns.

3.24.17 Copper Wiring

3.24.17.a All conductors shall be copper.

3.24.17.b Wiring shall be installed only after conduits have been cleaned and a continuity test has been performed.

3.24.17.c All power cables (208 VAC) cables shall be enclosed in separate wire-ways/conduit to low voltage controls cables, communication cables and LAN cables. Adequate cable segregation with metallic dividers or shielding to prevent noise and signal interference shall be provided. Where low voltage and communication cabling needs to cross power cabling, it shall cross perpendicular.

3.24.17.d Pull all conductors into a raceway at the same time. Use a listed wire pulling lubricant for pulling No. 4 AWG and larger wires.

3.24.17.e Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to damage conductors has been completed.

3.24.17.f Completely and thoroughly clean raceway system before installing conductors.

3.24.17.g Non-metallic conduit temperature rating shall be used when determining the amperage for a conductor to be installed in a non-metallic conduit.

3.24.17.h Conductors shall not be pulled in concrete encased conduits before concrete is placed.

3.24.18 Cable Installation

3.24.18.a Provide protection for exposed cables where subject to damage.

3.24.18.b Use suitable cable fittings and connectors.

3.24.18.c All cable shall be racked and supported in manholes.

3.24.18.d Pulling winches and other necessary pulling equipment shall be of adequate capacity to ensure a continuous pull on the cable. Strain gages shall be used to monitor the cable pulling tension.

3.24.18.e Cable and wire pulling lubricants that are non-corrosive and harmless to hands and clothes shall be used. Lubricants shall be compatible with cable jackets and insulation.

3.24.18.f Check wire as it is being pulled into the raceway.

3.24.19 Wiring Connection and Terminations

3.24.19.a Electrical connections shall be installed in accordance with equipment manufacturer's written instructions and with recognized industry practices, and comply with applicable requirements of UL, NEC and NECA's "Standard of Installation" to ensure that products and their installation fulfill requirements.

3.24.19.b Each feeder circuit to panelboards, switchboards, motor control centers, transformers, and 208-volt (and higher) motor circuits shall have an insulated equipment ground conductor.

3.24.19.c All medium voltage splices and terminations are to be made by an appropriate cable splicer/terminator.

3.24.19.d Electrical service and feeders are to be maintained to occupied areas and operational facilities when temporary service is required during interruptions to existing facilities. Momentary outages for replacing existing wiring systems with new wiring systems shall be scheduled. When the "cutting-over" has been successfully accomplished, temporary wiring is to be removed.

3.24.19.e Splices shall be covered with electrical insulating material equivalent to, or of greater insulation rating, than electrical insulation rating of those conductors being spliced.

3.24.19.f Cables and wires shall be stripped as long as reasonably feasible and routing shall be arranged to facilitate inspection, testing and maintenance.

3.24.19.g Connectors and terminals, including screws and bolts, shall be tightened in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Proper torquing tools, including torque screwdriver, beam-type torque wrench, and ratchet wrench with adjustable torque settings shall be used to comply with torquing values contained in UL 496A or the manufacturer's literature.

3.24.19.h Splice only in accessible junction and outlet boxes.

3.24.19.i For No. 10 AWG and smaller, use insulated spring wire connectors with plastic caps.

3.24.19.j Use irreversible compression for copper wire splices and taps, No. 8 AWG and larger. Tape un-insulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor – protect edges from wear.

3.24.19.k Thoroughly clean wires before installing lugs and connectors.

3.24.19.l Make splices, taps and terminations to carry full amperage of conductors without perceptible temperature rise. Temperature rating/amperage of conductor shall comply with the temperature rating of the termination.

3.24.19.m Terminate spare conductors with electrical tape and mark as spare.

3.24.19.n All control cable and conductor splices shall be made on numbered terminal strips. Wire nuts are not acceptable for control cable and conductor splices.

3.24.19.o Install pre-finished cord set where connection with attachment plug is indicated or specified, use attachment plug with suitable strain-relief clamps.

3.24.19.p Provide suitable strain-relief clamps for cord connections to outlet boxes and equipment connection boxes.

3.24.19.q Make wiring connections in control panel or in wiring compartment of pre-wired equipment in accordance with manufacturer's instructions. Provide interconnecting wiring as required for a complete operating system.

3.24.20 VFD

3.24.20.a The BHS Contractor shall take special precautions with the installation of VFD's to ensure that the cable length between the motor and VFD is as short as possible.

3.24.20.b The cable between the motor and VFD shall be shielded.

3.24.21 Chases, Openings, Cutting and Patching

3.24.21.a Carefully lay out all work in advance so as to eliminate where possible, cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings and roofs. Any damage to the building, structure, piping, ducts, equipment, or any defaced finish shall be repaired by skilled personnel of the trades involved to the satisfaction of the Owner and at no additional cost to the Owner.

3.24.21.b Any necessary cutting, channeling, drilling or welding as required for the proper support, concealment, installation or anchoring of CBIS/BHS equipment shall be performed in a professional damage free manner, and shall be pre-approved by the Owner.

3.24.21.c All openings made in fire-rated walls, floors, or ceilings shall be sealed and made tight in a manner conforming to the fire rating for the barrier penetrated.

3.24.21.d All penetrations required through completed concrete construction shall be core drilled at the minimum required size. All penetrations in concrete require an x-ray or ground penetrating radar to determine if the location is clear of reinforcing steel and embedded systems. Precautions shall be taken when drilling to prevent damage to structural concrete. The BHS Contractor shall provide an interpretation of the x-rays or radar shot and obtain written acceptance from the Owner before proceeding with drilling.

3.24.22 Control Stations (Operator Panels)

3.24.22.a Panels shall be fully enclosed, suited to the environment where they are located.

3.24.22.b Panels shall be dust proof and where located in close proximity to water discharge, capable of withstanding a deluge of water from above as might be experienced by a faulted sprinkler system.

3.24.23 Control Cabinets

3.24.23.a Control cabinets/racks shall be fully enclosed, suited to the environment where they are located.

3.24.23.b Cabinets shall be dust proof and where located in close proximity to water discharge, capable of withstanding a deluge of water from above as might be experienced by a faulted sprinkler system.

3.24.23.c All cabinets/racks shall have forced air flow for cooling purposes. The BHS Contractor shall provide A/C, if necessary considering ambient conditions.

3.24.23.d Air flow shall be filtered to remove airborne particles.

3.24.23.e Air flow shall be based on a positive pressure technique.

3.24.23.f Air flow shall enter at the bottom of the cabinet and exhaust through the top of the cabinet to maximize use of convection currents.

3.24.23.g The BHS Contractor shall ensure that there is a minimum of 3’-4” in front of any cabinet or panel to the nearest opposing equipment to provide safe operator access.

3.24.24 Motor Control Panels (MCP)

3.24.24.a Motor control panels shall consist of floor-mounted code gauge sheet steel, painted or powder coated enclosures with hinged doors, handles and locks.

3.24.24.b MCP’s shall be fully enclosed, suited to the environment where they are located.

3.24.24.c Panels shall be dust proof and where located in close proximity to water discharge, capable of withstanding a deluge of water from above as might be experienced by a faulted sprinkler system.

3.24.24.d MCP’s shall be properly secured in place on panel manufacturers standard steel base plinths bolted to the floor. A minimum of four (4) anchors shall be used. Where MCP’s are located in or adjacent to a drive aisle, impact protection shall be provided to protect the MCP from damage.

3.24.24.e MCP’s containing sensitive electronic equipment including but not limited to PLCs and their peripheral components (I/O), network switches, computers, etc, shall have forced air flow for cooling purposes.

3.24.24.f Air flow shall be filtered to remove airborne particles.

3.24.24.g Air flow shall be based on a positive pressure technique.

3.24.24.h Filtered air flow shall enter at the bottom of the cabinet and exhaust through the top of the cabinet to maximize use of convection currents.

3.24.24.i The BHS Contractor shall ensure that there is a minimum of 3’-4” in front of any panel to the nearest opposing equipment to provide safe operator access.

3.24.25 Grounding (Earthing)

3.24.25.a Provide a # 6 AWG copper grounding conductor at point of service entrance and connect to nearest referenced ground plate.

3.24.25.b Bond together at separately derived systems: neutral conductor; equipment enclosures; all non-current carrying metal parts of electrical equipment; metal raceway systems; grounding conductor in raceways and cables; and grounding electrode connector.

3.24.25.c An insulated equipment ground conductor shall be installed continuous from the main switchgear or service entrance to all branch panel boards, motor control centers, transformers, and all motors. This conductor shall be bonded to the conduit and metal enclosures that it passes through utilizing bonding bushings and terminal devices.

3.24.25.d Provide a separate, insulated, equipment-grounding conductor in all branch circuit conduits.

3.24.25.e Provide isolated and insulated ground conductors for all microprocessor and data processing equipment.

3.24.25.f Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, connections are to be tightened to comply with tightening torque values specified in UL 486A to assure permanent and effective grounding.

3.24.25.g Provide code-sized ground cable bonding jumpers, installed with ground clamps, across all conduit expansion couplings and fittings, including flexible steel conduit used as expansion fittings.

3.24.25.h Provide a corrosion-resistant finish to field connections, buried metallic bonding products, and where factory applied protective coatings have been destroyed.

3.24.25.i All continuous runs of cable tray and all isolated sections of cable tray shall be bonded and grounded.

3.24.25.j Provide an equipment-grounding conductor in all conduits. Metal conduit shall not be substitute for a proper earth/grounding conductor.

3.24.25.k A non-continuous metallic raceway enclosing the separately derived system grounding electrode conductor shall be bonded at each end of the conduit to the grounding electrode conductor. If bonding jumpers are used, they shall be sized per N.E.C. table 250-66.

3.24.25.l All receptacles and switches shall be provided with ground jumper from outlet box to ground terminal of the device, with the exception of isolated ground receptacles.

3.24.25.m Provide parallel equipment bonding jumper for parallel conduit feeders.

3.24.25.n Provide bonding jumpers around all concentric or eccentric knockouts.

3.24.25.o Test the ground resistance to earth of each ground rod prior to connection to the system. Where test show resistance to ground is over 5 OHMS, report to the Owner the locations and values.

3.24.25.p Upon completion of installation of electrical grounding system, test ground resistance to earth in accordance with ANSI / IEEE 81 submit test results to the Owner.

3.24.26 Equipment Identification

3.24.26.a The BHS Contractor shall ensure that all equipment is marked and identified in a consistent and logical manner.

3.24.26.1 Cable/Conductor Identification

3.24.26.1.a The application of cable/conductor identification, with circuit number, on each wire / cable in each box/enclosure/cabinet/panel is required. The identification shall match the marking system used in panelboards, shop drawings, and Contract Documents.

3.24.26.1.b All cabling (power, controls, and communications) shall be properly identified at both ends of the cable with machine printed labels or identification markers. The use of handwritten labels/markers is not allowed.

3.24.26.1.c Markers are to be affixed on each terminal conductor, as close as possible to the point of connection.

3.24.26.2 Junction Box and Pull Box Identification

3.24.26.2.a On the cover of each junction box or pull box: the panel name and circuit number(s) of the enclosed conductors are identified with machine printed labels. The system shall be identified for:

3.24.26.2.1 System Identification

3.24.26.2.1.a FO (fiber optics)

3.24.26.2.1.b CCTV (closed circuit television)

3.24.26.2.1.c RF (radio frequency)

3.24.26.2.1.d FA (fire alarm)

3.24.26.2.1.e EM (emergency work).

3.24.26.3 Operational Identification and Warnings

3.24.26.3.a Self-adhesive plastic signs or similar equivalent identification, instruction or warnings on switches, outlets and other controls, devices and covers of electrical enclosures shall be provided wherever required to ensure safe and efficient operation and maintenance of electrical systems, and electrically connected mechanical systems and general systems and equipment, including prevention of misuse of electrical facilities by unauthorized personnel. Where detailed instructions or explanations are needed, provide plasticized tags with clearly written messages adequate for intended purposes.

3.24.26.4 Danger Signs

3.24.26.4.a Danger signs shall be provided on switches and similar controls, regardless of whether concealed or locked up, where untimely or inadvertent operation could result in danger to persons, or damage to equipment, or damage to or loss of property.

3.24.26.4.b The following red danger sign is to be provided on the equipment “Danger this Machine Starts Automatically”.

3.24.26.5 Caution Signs

3.24.26.5.a The following red caution sign is to be provided for all circuit breakers and switchboards, where turning off a circuit will automatically start an emergency operation: "Caution Turning Off this Circuit will Automatically Start Emergency Operation”

3.24.26.5.b The following red caution sign is to be provided for all automatic transfer switches, switches, circuit breakers, equipment, and emergency panels that are energized by the emergency power system: "Caution Automatically Energized by Emergency Power Supply System".

3.24.26.6 Equipment/System Identification

3.24.26.6.a An engraved, plastic laminate sign is to be provided on each unit of electrical equipment furnished; for units including central and master units and also for all electrical systems including communication, control, signal and alarm.

3.24.26.6.b Provide a single line of text when possible and multiple lines when required. Letter height shall be as specified herein, black lettering on white field for normal and white letters on a red field for emergency.

3.24.26.6.c Provide text matching terminology and numbering of the Contract Documents and shop drawings. The sign shall include unit designation, source circuit number, circuit voltage, and other data specifically indicated. Also, the sign shall indicate normal source circuit number ("Fed from . . .") and emergency source circuit number when the equipment is a transfer switch or fed directly from a transfer switch.

3.24.26.6.d Include signs for each unit of the following categories of electrical work: List is not exhaustive.

3.24.26.6.1 Minimum Electrical Signs

3.24.26.6.1.a Switchboards, panelboards (include main bus ampacity on sign), electrical cabinets and enclosures.

3.24.26.6.1.b Access panel/doors to electrical facilities.

3.24.26.6.1.c Major electrical switchgear (include main bus ampacity on sign).

3.24.26.6.1.d Disconnect switch.

3.24.26.6.1.e Push buttons, selector switches, indicating lights. (Circuit number and voltage not required on sign).

3.24.26.6.1.f Power transfer equipment: Contactors and transfer switches.

3.24.26.6.1.g Transformers. (Include primary and secondary voltages)

3.24.26.6.1.h Battery racks.

3.24.26.6.1.i Power generating units.

3.24.26.6.1.j Telephone cabinets and switching equipment. (Circuit number and voltage not required on sign.)

3.24.26.6.1.k Fire alarm panels.

3.24.26.6.1.l Security monitoring master station.

3.24.26.6.1.m Relays

3.24.26.6.1.n Lighting contactors

3.24.26.6.1.o Individual distribution circuit breakers

3.24.26.6.e The installation of signs are required at locations indicated or, where not otherwise indicated, at location for best convenience of viewing without interference in operation and maintenance of equipment. The sign shall be secured to the substrate with fasteners, but adhesive may be used when fasteners should not or cannot penetrate substrate.

3.24.26.6.f All panel boards shall have a typed panel schedule indicating the date, BHS Contractor, type of equipment served and its location.

3.24.27 Definition of Installation Completion

3.24.27.a In order to measure progress accurately the following must have been completed by the BHS Contractor for installation to be considered complete.

3.24.27.1 Mechanical Installation Complete

3.24.27.1.a All supports and vibration damping installed

3.24.27.1.b All mechanical safety equipment installed including but not limited to safety cages, protective guards, impact protection, bollards, safety chains, hinged safety doors, bearing caps.

3.24.27.1.c All conveyor frames, slider beds, rollers, pulleys, take-up sections complete

3.24.27.1.d All belts are installed

3.24.27.1.e All sideguards and sideguard transition pieces are installed

3.24.27.1.f All under guarding is installed

3.24.27.1.g All finger guarding is installed

3.24.27.1.h All motors and gearboxes are installed

3.24.27.1.i All gap pans are installed

3.24.27.1.j All drip pans are installed

3.24.27.1.k All bag slides are installed

3.24.27.1.l All touch up painting has been completed

3.24.27.1.m The CBIS/BHS equipment is physically ready to operate under safe and intended conditions.

3.24.27.1.n All equipment stencil labeling is complete

3.24.27.2 Electrical and LLC Installation Complete

3.24.27.2.a All MCPs, PLC and power distribution panels have been installed with associated electrical devices, operators, relays, switches, and touch screens. Panel lighting is operational.

3.24.27.2.b All communication bus, couplers, repeaters, routers and connectors have been installed

3.24.27.2.c All PEC, shaft encoders, light curtains, proximity sensors, limit switches and other sensory equipment has been installed and connected to controls

3.24.27.2.d All rigid and flexible conduit and cable trays have been installed

3.24.27.2.e All electrical, power, control, sensory and safety equipment including security and customs screening machines has been terminated and labeled

3.24.27.2.f All equipment disconnectors have been installed

3.24.27.2.g All equipment controllers, VFD and soft starters have been installed

3.24.27.2.h All beacons and audible horns have been installed

3.24.27.2.i All control station and control stations have been installed

3.24.27.2.j All displays have been installed

3.24.27.2.k All E-stop pushbuttons, lanyards and press lines have been installed and operational

3.24.27.2.l The CBIS/BHS equipment is operating under safe and intended conditions.

3.24.27.2.m All controls label plates are installed

3.24.27.2.n All SCADA visualization status screens are available and functional

3.24.27.2.o All SCADA dialogues are available and functional

3.24.27.2.p All reports are available and functional

3.24.27.2.q All wire labeling has been completed

3.24.27.2.r All action list items have been completed and closed out

3.25 PRE-COMMISSIONING

3.25.1 General

3.25.1.a After the installation of equipment, the BHS Contractor shall perform the necessary inspections and checks to verify that the installed equipment can operate safely and according to intended purposes as preparation for the following BHS Contractor commissioning activities.

3.25.1.b Pre-Commissioning shall be performed by the BHS Contractor in a structured and meticulous manner to verify proper installation. The BHS Contractor shall develop and execute a detailed Pre-Commissioning Plan, which shall follow the below structure and contain the listed checks, inspections, and tests at a minimum.

3.25.1.c The BHS Contractor shall develop methods and procedures to capture information and results of all pre-commissioning activities. Such information shall be transmitted to the Owner for information.

3.25.1.1 Required Pre-Commissioning Documentation

3.25.1.1.a Provide completed check lists

3.25.1.1.b Data recordings

3.25.1.1.c Sequential log files

3.25.1.1.d Trends

3.25.1.d In order to verify that the installation has been done correctly and according to the design documents the BHS Contractor shall at least check the following aspects of the physical installation;

3.25.1.2 Post-Installation Checkout

3.25.1.2.a Perform point to point electrical tests

3.25.1.2.b Perform network tests

3.25.1.2.c Perform I/O checks

3.25.1.2.d Perform insulation resistance tests

3.25.1.2.e Perform E-stop checks

3.25.1.2.f Perform conveyor running direction checks

3.25.1.2.g Perform speed checks

3.25.1.2.h Perform belt tracking

3.25.1.2.i Perform 24 hour run-in

3.25.1.2.j Emergency power connection checks

3.26 COMMISSIONING

3.26.1 General

3.26.1.a Following pre-commissioning, the BHS Contractor shall perform the necessary testing in order to commission and verify the correct and proper operation, performance and functionality of the individual components, sub-systems and the complete system as a whole before the BHS Contractor invites the Owner to witness System Acceptance Tests.

3.26.1.b Commissioning shall be performed by the BHS Contractor on a building block basis performing basic tests first to verify proper installation, followed by more complex and integrated tests to verify proper operations. The BHS Contractor shall move from one testing block to the other only after demonstrating the successful completion of the current testing block.

3.26.1.c The BHS Contractor shall develop and execute a detailed Commissioning Plan, which shall follow the below structure and contain the listed checks, inspections, and tests at a minimum. The omission of specific tests below shall not relieve the BHS Contractor from conducting such tests to ensure compliance with the contract requirements.

3.26.1.d The BHS Contractor shall develop methods and procedures to capture information and results of all commissioning activities, such that functions and procedures can be properly verified. Such information shall be transmitted to the Owner for information.

3.26.1.1 Required Commissioning Documentation

3.26.1.1.a Provide completed check lists

3.26.1.1.b Data recordings

3.26.1.1.c Sequential log files

3.26.1.1.d Trends

3.26.2 Component Tests

3.26.2.a In order to verify that the individual component performs correctly and according to the design documents, the BHS Contractor shall at least check the following functional aspects;

3.26.2.b Perform load test (start-up under full load (weight) condition)

3.26.2.c Perform checks to verify that the component's associated control station (operator panel) operates correctly.

3.26.2.d Perform checks to verify that the equipment status is correctly displayed and updated at the Local Visualization Status Screen in the PLC.

3.26.2.e Perform the following minimum checks to verify that equipment component control from the Local Visualization Status Screen in the PLC is working.

3.26.2.1 SCADA Control

3.26.2.1.a On/off

3.26.2.1.b Start/stop

3.26.2.1.c Lock/unlock

3.26.2.1.d Manual/automatic

3.26.2.f Check that all appropriate alarms are generated by the component and that these are displayed correctly.

3.26.3 Sub-system Tests

3.26.3.a In order to verify that interconnected components forming part of a sub-system perform correctly and according to the design documents, the BHS Contractor shall at a minimum check the following functional aspects;

3.26.3.b Perform noise level tests as defined in Part 3.

3.26.3.c Perform the following functional tests as applicable to the sub-system being commissioned.

3.26.3.1 Standard PLC Functions

3.26.3.1.a Manual Operation

3.26.3.1.b Start-up

3.26.3.1.c Operational Stop

3.26.3.1.d Shut-down

3.26.3.1.e Cascade stop

3.26.3.1.f Jam

3.26.3.1.g E-stop & E-stop zoning (Cause & Effect)

3.26.3.1.h Energy conservation

3.26.3.1.i Intelligent Power Save (IPS)

3.26.3.1.j Lamp test

3.26.3.1.k Alarm silence

3.26.3.2 Add-on PLC Functions

3.26.3.2.a Oversize detection

3.26.3.2.b Fire system interface

3.26.3.2.c Security/fire door operation

3.26.3.2.d Airport security access interface (card readers)

3.26.3.d Perform checks to verify that the equipment status is correctly displayed and updated at the Local Visualization Status Screen at the PLC.

3.26.3.e Perform the following minimum checks to verify that equipment component control from the Local Visualization Status Screen is working

3.26.3.3 SCADA Control

3.26.3.3.a On/off

3.26.3.3.b Start/stop

3.26.3.3.c Lock/unlock

3.26.3.3.d Manual/automatic

3.26.3.f Check that all appropriate alarms are generated by the sub-system and that these are displayed correctly on the Local Visualization Status Screen.

3.26.3.g Perform data integrity tests for passing information between PLCs

3.26.3.h Perform the following minimum checks to verify the sub-system performance

3.26.3.4 Performance Tests

3.26.3.4.a Maximum and minimum bag size transportation tests

3.26.3.4.b Perform throughput testing to verify that the minimum defined throughputs are achieved

3.26.4 System Wide Tests

3.26.4.a In order to verify the operation and performance of the complete Scope of Works as an integrated system, the BHS Contractor shall at least check the following functional aspects to ensure that the system performs correctly and according to the Contract Documents;

3.26.4.b Perform the following minimum performance checks

3.26.4.1 Performance Tests

3.26.4.1.a Perform throughput testing to verify that the minimum defined throughputs are achieved

3.26.4.1.b Perform availability tests

3.26.4.1.c Perform fire alarm tests

3.26.4.1.d Perform operational tests with Airport Security Authorization System Interface (ASAS) (card readers)

3.26.4.c Perform the following minimum redundancy checks

3.26.4.2 Redundancy Tests

3.26.4.2.a Mechanical failure

3.26.4.2.b Electrical failure

3.26.4.2.c Power failure

3.26.4.2.d Failure of safety PLC used for E-stop

3.26.4.2.e PLC failure, including associated Hot-back-up switch-over and Cold-Backup PLC replacement.

3.26.4.2.f Failure of external interfaces

3.27 TRAINING

3.27.1 General

3.27.1.a The BHS Contractor shall train the Owner's personnel in the operation and mainteance of the equipment. The training shall be completed during the System Acceptance Testing such that the Owner's staff can become familiar with the system prior to Practical Completion.

3.27.1.b The training shall cover operation functions of the system and all related sections of the Operations Manual.

3.27.1.c The training program shall be submitted to the Owner for review and approval. Refer to submittals for information relating to training material Part 1 § 1.13.13

3.27.1.d The BHS Contractor shall provide training to airport representatives in the correct and approved methods for operating and maintaining of the CBIS/BHS to ensure trouble free and sustained operation as defined within this Specification.

3.27.2 Training Schedule & Material

3.27.2.a The BHS Contractor shall submit to the Owner for approval a schedule thirty days (30) prior to commencement of training or at the commencement of System Acceptance Testing whichever occurs first.

3.27.2.b The schedule shall consider the working schedule of the persons being trained as well as their availability and shall ensure that all hours of the day and days of the week can be addressed to ensure personnel on shift work or unusual working schedules can be accommodated.

3.27.2.c The BHS Contractor shall provide all materials, equipment (including specialized tools) and resources necessary to properly instruct personnel and train persons in the proper operation, use and/or maintenance of the equipment/components incorporated into the CBIS/BHS. The BHS Contractor shall not rely on the Owner's purchase of equipment (spare parts or specialized tools) necessary to properly operate the CBIS/BHS for training.

3.27.2.1 Training shall consist of a combination of;

3.27.2.1.a Class-room instruction.

3.27.2.1.b And hands-on operation including assembly and disassembly.

3.27.2.d The BHS Contractor shall provide workbooks and manufacturers literature as part of the training material that identifies all aspects of the systems being trained. As part of training, extensive reference to the Operations and Maintenance manuals shall be made.

3.27.2.e Workbooks shall be submitted to the Owner for approval thirty (30) days prior to training commencing.

3.27.2.f If, at the completion of all training, the Owner believes that more training is necessary, the BHS Contractor shall provide additional training as requested by the Owner at rates agreed with the Owner.

3.27.2.g The BHS Contractor shall be fully responsible for additional training requirements and ensure that additional training requirements are properly incorporated into official schedules and materials for all options taken up by the Owner.

3.27.2.h Training as a minimum shall cover the following disciplines.

3.27.2.2 Safe Operation in and around the Baggage System.

3.27.2.2.a This training shall be general to all personnel who work in close proximity to any CBIS/BHS equipment.

3.27.2.3 Ticketing Operation

3.27.2.3.a The BHS Contractor shall cover all areas related to ticketing operation including but not limited to the following;

3.27.2.3.b Access control.

3.27.2.3.c Baggage hygiene;

3.27.2.3.d Placement of baggage on the conveyor.

3.27.2.3.e Baggage separation.

3.27.2.3.f Orientation so as to ensure proper alignment with downstream EDS screening equipment.

3.27.2.3.g Startup, operational stop, and shutdown.

3.27.2.3.h Fault detection and reset (oversize, jams, etc).

3.27.2.4 General Conveyor Operation

3.27.2.4.a The BHS Contractor shall cover all areas related to conveyor operation including but not limited to the following;

3.27.2.4.b Startup and shutdown.

3.27.2.4.c Emergency Stop.

3.27.2.4.d Jams (conveyors, doors, diverters, etc).

3.27.2.4.e Oversize.

3.27.2.4.f Manual operation of equipment (conveyors, Security doors, carousels, etc.).

3.27.2.4.g EDS fault identification.

3.27.2.5 CBRA and TSA Operation

3.27.2.5.a The BHS Contractor shall cover all areas related to CBRA and TSA operation including but not limited to the following;

3.27.2.5.b Access control.

3.27.2.5.c User interface operation.

3.27.2.5.d Startup and shutdown.

3.27.2.5.e Handling of Out-of-Gauge bags.

3.27.2.5.f Handling of Odd-size bags.

3.27.2.5.g Fault detection and reset as directed by the Owner.

3.27.2.6 Inbound System

3.27.2.6.a The BHS Contractor shall cover all areas related to inbound operation including but not limited to the following;

3.27.2.6.b Baggage hygiene;

3.27.2.6.c Placement of baggage on the oversize slide.

3.27.2.6.d Operations regarding the security door on the oversize slide

3.27.2.6.e Handling of Odd-size bags.

3.27.2.7 Operation & System Monitoring

3.27.2.7.a The BHS Contractor shall cover all areas related to CBIS/BHS operation including but not limited to the following;

3.27.2.7.b Starting/restarting equipment.

3.27.2.7.c Operation of hardware.

3.27.2.7.d Understanding the interface and being able to navigate through the different Graphical pages.

3.27.2.7.e Proper identification of faults.

3.27.2.7.f Actions required to initiate in order to rectify/mitigate faults identified within the CBIS/BHS.

3.27.2.7.g Generation of reports and understanding content.

3.27.2.8 Maintenance

3.27.2.8.a Under direction from the Owner, maintenance training shall be provided to the following groups of personnel.

3.27.2.8.b General mechanical components

3.27.2.8.c The BHS Contractor shall cover all areas related to general mechanical components including but not limited to the following;

3.27.2.8.d Ticketing conveyors,

3.27.2.8.e General transport conveyors.

3.27.2.8.f Specialist mechanical components

3.27.2.8.g The BHS Contractor shall cover all areas related to specialist mechanical components including but not limited to the following;

3.27.2.8.h Security doors.

3.27.2.9 Electrical/Controls

3.27.2.9.a The BHS Contractor shall cover all areas related to Electrical/Control components including but not limited to the following;

3.27.2.9.b Electrical schematics.

3.27.2.9.c Power feeds including all power voltages used by the system.

3.27.2.9.d MCP’s and internal hardware including but not limited to;

3.27.2.9.e Contactors/Relays.

3.27.2.9.f Terminal rails/termination points.

3.27.2.9.g Disconnects.

3.27.2.9.h Timers (if applicable).

3.27.2.9.i Power supplies.

3.27.2.9.j Motor Overloads.

3.27.2.9.k Fuses.

3.27.2.9.l PLC’s

3.27.2.9.m PLC I/O.

3.27.2.9.n VFD.

3.27.2.9.o Soft starts

3.27.2.9.p Shaft encoders.

3.27.2.9.q Photocells, operation, and alignment.

3.27.2.9.r Clutch brakes.

3.27.2.9.s Operator stations.

3.27.2.9.t Warning devices.

3.27.2.9.u Wiring, electrical schematics.

3.27.2.10 Specialized Controls Components

3.27.2.10.a The BHS Contractor shall cover all areas related to Specialized Control components including but not limited to the following;

3.27.2.10.b Interfaces (EDS, PLC, fire, ASAS, etc).

3.27.2.10.c CBRA workstations.

3.27.2.11 Software (Computer Systems and PLC's)

3.27.2.11.a The BHS Contractor shall cover all areas related to software including but not limited to the following;

3.27.2.11.b Workstation applications (SCADA, PLC, etc).

3.27.2.11.c PLC's, application structure and function.

3.27.2.11.d Software updates (OS and applications).

3.27.2.i The BHS Contractor shall maintain a complete and accurate attendance register of all personnel who attend training and submit to the Owner.

3.28 SYSTEM ACCEPTANCE TESTING (SAT)

3.28.1 General

3.28.1.a When the BHS Contractor has performed the necessary testing in order to commission and verify the correct and proper operation and functionality of the individual components, sub-systems and the complete system as a whole as defined in Part 3 § 3.25, the BHS Contractor shall invite the Owner to witness the following System Acceptance Tests.

3.28.1.b It is the responsibility of the BHS Contractor to plan, execute and document all tests as directed by the Owner during System Acceptance Testing. The BHS Contractor shall at a minimum, perform the tests defined herein. The BHS Contractor shall conduct other Owner defined tests as deemed necessary by the Owner at no cost to the Owner.

3.28.1.c System Acceptance Testing shall demonstrate to the Owner that the components, sub-systems, and system are compliant with all Contract requirements. Should System Acceptance Tests fail due to inadequate BHS Contractor commissioning or if preparation and retesting is required, the Owner shall have the right to deduct progress payments for his additional time required for retesting.

3.28.1.d BHS Contractor demonstrations in accordance with the agreed System Acceptance Plan and requirements laid out below shall be performed as final end to end tests on an integrated test basis to verify proper operation.

3.28.1.e An example of a test includes, but is not limited to the following tasks;

3.28.1.1 Generic Test Procedure

3.28.1.1.a Physically create a jam on a conveyor with a piece of test baggage.

3.28.1.1.b Verify that the correct conveyors stop.

3.28.1.1.c Verify proper upstream and downstream system operation.

3.28.1.1.d Verify that the correct alarming occurs in the field.

3.28.1.1.e Verify the correct reporting/alarming on the SCADA system.

3.28.1.1.f Verify statistical data collection.

3.28.1.1.g Clear and reset the jam in the field.

3.28.1.1.h Verify proper restart of the system, reset of faults generated and statistical data collection.

3.28.2 Function Level Testing

3.28.2.a At a minimum, the following tests shall be completed by the BHS Contractor and witnessed by the Owner or the Owner's representative to demonstrate proper function and operation.

3.28.2.1 Component Acceptance Tests

3.28.2.1.a Noise testing.

3.28.2.1.b Load testing.

3.28.2.1.c Vibration testing.

3.28.2.2 Integrated Acceptance Tests

3.28.2.2.a Start up, manual and automatic operation. Start-up following a fault shall also be tested but may be incorporated into other tests.

3.28.2.2.b Shut-down, including energy conservation.

3.28.2.2.c Oversize detection and handling.

3.28.2.2.d Dieback. This test may be incorporated into other testing (e.g. Jams), but shall be an identifiable line item and must include a minimum of five (5) upstream conveyors.

3.28.2.2.e Jams.

3.28.2.2.f Emergency stop. This test may be incorporated into other testing but shall be an identifiable line item.

3.28.2.2.g Fire system activation with baggage being processed.

3.28.2.2.h Maximum and minimum bag size transportation.

3.28.2.3 SCADA Acceptance Tests

3.28.2.3.a Verify accurate alarming.

3.28.2.3.b Verify accurate representation during changes of state.

3.28.2.3.c Verify agreed layout.

3.28.2.3.d Verify compliance with response times.

3.28.2.3.e Verify reporting. The BHS Contractor shall pay special attention to accuracy in data collection and reporting.

3.28.2.4 System Redundancy Acceptance Tests

3.28.2.4.a Conveyor faults

3.28.2.4.b PLC failure, error reporting, switch-over and recovery.

3.28.2.5 External Interfaces Acceptance Tests

3.28.2.5.a Delivery of data from/to external systems at rate including but not limited to the following list. Tests shall include an unexpected, uncontrolled, and extended dump of data from the external system to verify that the BHS is capable of properly performing core screening and sorting functions without error.

3.28.2.5.b FAS interface.

3.28.2.5.c ASAS interface.

3.28.3 System Performance Demonstration

3.28.3.a As a part of the System Acceptance Testing, once all other testing has been completed, the System Performance Demonstration shall be performed by the BHS Contractor and witnessed by the Owner or his representative to verify proper design and integration of the complete installation.

3.28.3.b The BHS Contractor shall demonstrate the system's ability to achieve and maintain the minimum design throughput rate for a period of no less than one (1) consecutive hour.

3.28.3.1 Conditions of Acceptance

3.28.3.1.a Meet or exceed throughput requirements defined elsewhere in this Specification over a minimum period of one (1) consecutive hour.

3.28.3.1.b No bag jams.

3.28.3.1.c No down-time.

3.28.3.1.d Proper baggage separation is maintained and/or restored.

3.28.3.1.e No false triggers.

3.28.3.1.f Properly report the state of the system at all times.

3.28.3.1.g Baggage sizes shall be a representation of live operations and at a minimum shall be based on the following.

3.28.3.1.1 Bag Mix

3.28.3.1.1.a No more than 15% of test pieces shall be tubs.

3.28.3.1.1.b 90% of test pieces shall be between 20”-35” in length.

3.28.3.1.1.c 1% of test pieces shall be of minimum length (9”-12”) .

3.28.3.1.1.d 1% of test pieces shall be of maximum length (50”-54”) .

3.28.3.c Failure of the BHS Contractor to meet the minimum performance conditions contained in this Specification and/or any of the conditions of acceptance detailed above shall invalidate the test and the BHS Contractor shall be required to perform the following work;

3.28.3.2 BHS Contractor’s Rectification

3.28.3.2.a Rework all areas, which resulted in the test failing.

3.28.3.2.b Demonstrate that the items reworked operate properly and as intended. Mini-testing may be required in order to validate rework and shall be performed by the BHS Contractor at the discretion of the Owner.

3.28.3.2.c Repeat the test in its entirety.

3.28.4 Reliability, Availability and Confidence Trials

3.28.4.1 General

3.28.4.1.a Availability, reliability, and confidence testing shall be carried out by the BHS Contractor on completion of system commissioning and acceptance testing in the presence of the City representative.

3.28.4.1.b A detailed test schedule and procedures for the tests shall be provided no later than thirty (30) days prior to the commencement of testing.

3.28.4.2 Reliability Test

3.28.4.2.a A reliability test shall be conducted on each element of the system. This shall include all control and computer hardware and software including servers, PLCs, i/o modules, power supplies, UPS, and other control system components.

3.28.4.2.b Each element of the conveyor system shall be subject to an eight (8) hour, five (5) consecutive day working reliability trial. During this period, the conveyors shall run continuously with all down time recorded. The trial shall be repeated in the event of a failure in excess of fifteen (15) minutes on any part of the system until the trial period has been successfully completed. Any system changes or modifications made during this period shall be notified to the City.

3.28.4.2.c The Reliability Test shall be carried out under simulated operating conditions using test baggage and labor employed by the BHS Contractor including attendance by the BHS Contractor’s specialist suppliers.

3.29 SOFTWARE REVISION CONTROL

3.29.1 General

3.29.1.a The BHS Contractor shall keep a detailed log of all software changes made after commencement of System Acceptance Testing.

3.30 PERMITS

3.30.1 General

3.30.1.a The BHS Contractor shall obtain and pay for all required labor, permits, taxes, insurances, inspection fees and certificates related to all phases of the CBIS/BHS construction.

3.31 CONTRACT CLOSEOUT

3.31.1 General

3.31.1.a Before requesting inspection for Final Completion and Acceptance of the Works by the Owner, inspect, clean, and repair the Works as required.

3.31.1.b When the BHS Contractor considers that the Works is complete, the BHS Contractor shall submit written certification that:

3.31.1.1 BHS Contractor Certificates

3.31.1.1.a Works has been inspected by the BHS Contractor for compliance with Contract Documents.

3.31.1.1.b Works has been completed in accordance with Contract Documents.

3.31.1.1.c Works is ready for final inspection by the Owner.

3.31.1.1.d All required as-built documents have been submitted and accepted.

3.31.1.1.e All damaged or destroyed real estate, personal, public, or private property has been repaired or replaced.

3.31.1.1.f All operation and maintenance manuals have been submitted and accepted

3.31.1.1.g All required training has been completed.

3.31.1.1.h All personnel badges and vehicle permits have been returned to the Airport Security.

3.31.1.1.i All Punch List items have been completed and closed out.

3.31.2 Final Inspection

3.31.2.a The Owner will inspect to verify the status of completion with reasonable promptness after receipt of such certifications. The inspection of the Works will be done in accordance with the General Conditions.

3.31.2.1 Identification of Incomplete or Defective Works

3.31.2.1.a The Owner may, at the Owner's sole discretion, either terminate the inspection or prepare a Punch List and notify the BHS Contractor in writing, listing incomplete or defective Works.

3.31.2.1.b The BHS Contractor shall take immediate steps to remedy stated deficiencies and send a second written certification to the Owner that Works is complete.

3.31.2.1.c The Owner will then reinspect the Works.

3.31.2.2 Reinspection

3.31.2.2.a Should the Owner perform reinspection due to failure of the Works to comply with the claims of status of completion made by the BHS Contractor:

3.31.2.2.b The BHS Contractor shall compensate the Owner for such additional services at the rate of $75.00 per man-hour.

3.31.2.2.c The Owner shall deduct the amount of such compensation from the final payment to the BHS Contractor.

3.31.3 Final Adjustment of Accounts

3.31.3.a Submit a Final Statement of Accounting to the Owner.

3.31.3.b The Final Statement of Accounting shall reflect all adjustments to the contract amount and shall include the following:

3.31.3.1 Contract Adjustments

3.31.3.1.a The original contract amount

3.31.3.1.b Additions and deductions resulting from

3.31.3.1.0.a Previous Change Orders.

3.31.3.1.0.b Allowances.

3.31.3.1.0.c Final quantities for unit price items, with detailed justification of quantities

3.31.3.1.0.d Deductions or corrected Works.

3.31.3.1.0.e Penalties.

3.31.3.1.0.f Deductions for liquidated damages.

3.31.3.1.0.g Deductions for re-inspection payments.

3.31.3.1.0.h Owner resurveys required due to the BHS Contractor.

3.31.3.1.0.i Other adjustments.

3.31.3.1.c Adjusted contract amount.

3.31.3.1.d Previous payments.

3.31.3.1.e Sum remaining due.

3.31.3.c If required, the Owner will prepare a final Change Order, reflecting approved adjustments to the Contract sum, which were not previously made by Change Orders.

3.31.4 Final Payment

3.31.4.a The BHS Contractor shall submit the final application for payment in accordance with the procedures and requirements stated in the General Conditions

3.32 START-UP SYSTEM MONITORING & SUPPORT BY THE BHS CONTRACTOR

3.32.1 General

3.32.1.a The Start-up System Monitoring & Support provided by the BHS Contractor contains two (2) parts; on-site and off-site support activities.

3.32.1.b The Start-up System Monitoring & Support period commences with Beneficial Use of the system, where the BHS Contractor shall monitor the status of the system and assist the Owner's operational personnel with operational support for the periods defined in Part 1 § 1.9.1.

3.32.1.c The BHS Contractor shall ensure that a robust support process and sufficient resources and procedures are in place to achieve an effective startup and operations whenever Beneficial Use commence.

3.32.1.d In the event that it during the Start-up System Monitoring & Support period is identified that the CBIS/BHS installation fails to meet the requirements of the Contract Documents, the BHS Contractor shall prepare a detailed rectification plan/schedule and submit such to the Owner for review, comments, and approval. Once the Owner has approved the rectification plan and agreed to the schedule, the BHS Contractor shall complete all rectification work. Once the rectification work has been completed, the BHS Contractor shall notify the Owner and the Start-up System Monitoring & Support period shall restart as a new period for the full duration as per Part 1 § 1.9.1.

3.32.2 On-Site Operational Start-up Support by the BHS Contractor

3.32.2.a During the On-site Start-up Support period the BHS Contractor shall provide the following staff on-site to cover all disciplines;

3.32.2.1 Disciplines

3.32.2.1.a Mechanical Engineer

3.32.2.1.b Electrical Engineer

3.32.2.1.c LLC Engineer

3.32.2.b The BHS Contractor's on-site support engineers shall have worked in the specialty of responsibility during the construction and commissioning of this project. The BHS Contractor shall submit resumes (curriculum vitae) of all proposed on-site support engineers two (2) months prior to the BHS Contractor's request for Practical Completion.

3.32.2.c The BHS Contractor's on-site support engineers shall be on-call twenty-four (24) hours per day, seven (7) days per week during this Start-up Support period.

3.32.2.d The working hours and shift rosters for the on-site support personnel shall be arranged to maximize the shift coverage of the airport's operational hours such that support for each discipline is present at most shifts and to ensure that at any operational hour the BHS Contractor support staff are on-site at all times including weekends.

Table 53 Minimum On-Site Start-up & Support Personnel

Time Period	On-Site Staff
First seven (7) days of Beneficial Use	1
Day eight (8) to end of on-site Support period	1

3.32.2.e Shift rosters and work hours of the support engineers shall be submitted for Owner approval. Each shift shall cover a minimum of eight (8) hours and each engineer shall work five (5) shifts a week.

3.32.2.2 BHS Contractor Response Times

3.32.2.2.a For durations where the shift rosters of the on-site support engineers prevent the personnel from being present on-site, the BHS Contractor shall ensure the engineering support provides the below response times at all operational times including weekends.

Table 54 Maximum Response Times

Period	Response Time
For the first seven (7) days of operations	Telephone response within fifteen (15) minutes of a problem being reported. On site within one (1) hour of a problem not being resolved by telephone support of more than fifteen (15) minutes.
Day eight (8) to end of on-site Support period	Telephone response within thirty (30) minutes of a problem being reported. On site within four (4) hours of a problem not being resolved by extended telephone support of more than one (1) hour.

3.32.2.3 BHS Contractor On-site Activities

3.32.2.3.a The BHS Contractor shall ensure that suitably qualified personnel are available to support operational problems encountered by the Owner and/or their representative, including, but not limited to, any of the following;

3.32.2.3.1 Minimum Support Activities

3.32.2.3.1.a Support the Owner's operational personnel in the preparation of daily operational reports using the standard reporting features of the SCADA.

3.32.2.3.1.b Support the Owner's operational personnel with the daily operation of the system.

3.32.2.3.1.c Support troubleshooting and break-down activities.

3.32.2.3.1.d Investigate and rectify any operational problem identified.

3.32.2.3.1.e Make necessary adjustments due to inconsistencies/errors.

3.32.2.3.1.f Support troubleshooting due to software bugs/errors.

3.32.2.3.b At the end of this part of the Start-up System Monitoring & Support period, the BHS Contractor shall prepare a System Performance Compliance Report detailing the achieved performance during the period.

3.32.2.3.c The System Performance Compliance Report shall contain operational information compiled using the daily operational reports from SCADA.

3.32.3 Off-Site Operational Start-up Support by the BHS Contractor

3.32.3.a Once the on-site support activities have elapsed and the system performs as per these Specifications, the BHS Contractor's monitoring and support regime shall transition to remote off-site support unless issues can't be resolved without physical on-site presence.

3.32.3.b The BHS Contractor's Off-Site Start-up Support shall continue until the end of the General Warranty period.

3.32.3.1 BHS Contractor Response Times

3.32.3.1.a The BHS Contractor shall ensure that the following maximum response times are provided during the Off-site Start-up Support period for all operational hours of the airport including weekends.

Table 55 Maximum Response Times

Period	Response Time
Day fourteen (14) through day forty-four (44) after operations commences	Telephone response within thirty (30) minutes of a problem being reported. On site within eight (8) hours of a problem not being resolved by extended telephone support of more than one (1) hour.
Day forty-four (44) to the end of the General Warranty period after operations commences.	Telephone response within sixty (60) minutes of a problem being reported. On site within twenty (24) hours of a problem not being resolved by extended telephone support of more than four (4) hours.

3.32.3.1.b The BHS Contractor shall ensure that suitably qualified personnel are available to support operational problems encountered by the Owner and/or their representative including, but not limited to, any of the following;

3.32.3.1.1 Minimum Support Activities

3.32.3.1.1.a Adjustment inconsistencies/errors.

3.32.3.1.1.b Equipment failure/fault.

3.32.3.1.1.c Improper operation.

3.32.3.1.1.d Software bugs/errors.

3.32.3.1.1.e Answer questions to O&M Manual by O&M personnel.

3.33 DEMOBILIZATION

3.33.1 General

3.33.1.a Upon completion of the Works, remove construction tools, apparatus, equipment, unused materials and supplies, plant, trash, and personnel from the jobsite.

End of Section 34 77 16

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Recycling nonhazardous construction waste.
2. Disposing of nonhazardous demolition and construction waste.

B. Related Requirements:

1. Section 011200 "Multiple Contract Summary" for coordination of responsibilities for waste management.
2. Section 042000 "Unit Masonry" for disposal requirements for masonry waste.
3. Section 044313.13 "Anchored Stone Masonry Veneer" for disposal requirements for excess stone and stone waste.
4. Section 044313.16 "Adhered Stone Masonry Veneer" for disposal requirements for excess stone and stone waste.
5. Section 311000 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building, structure, and site improvement materials resulting from demolition operations.

C. Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner’s property.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition and construction waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 7 days of date established for the Notice to Proceed .

1.6 INFORMATIONAL SUBMITTALS

A. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

B. Qualification Data: For .

1.7 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with transportation and disposal regulations of authorities having jurisdiction.

1.8 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of demolition site-clearing and construction waste generated by the Work. Use Form CWM-1 for construction waste and Form CWM-2 for demolition waste . Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Use Form CWM-3 for construction waste . Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
2. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
3. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there were no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Use Form CWM-5 for construction waste . Include the following:

1. Total quantity of waste.
2. Estimated cost of disposal (cost per unit). Include transportation and tipping fees and cost of collection containers and handling for each type of waste.
3. Total cost of disposal (with no waste management).
4. Revenue from salvaged materials.
5. Revenue from recycled materials.
6. Savings in transportation and tipping fees by donating materials.
7. Savings in transportation and tipping fees that are avoided.
8. Handling and transportation costs. Include cost of collection containers for each type of waste.
9. Net additional cost or net savings from waste management plan.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of 65 percent by weight of total nonhazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials .

1. Demolition Waste:

a. .

2. Construction Waste:
   a. Construction Office Waste: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following construction office waste materials:
      1) Paper.
      2) Aluminum cans.
      3) Glass containers.
   b. .

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

1. Distribute waste management plan to everyone concerned within three days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged and recycled.
2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 RECYCLING DEMOLITION [**AND**] CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor .

C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
   a. Inspect containers and bins for contamination and remove contaminated materials if found.
2. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
3. Store components off the ground and protect from the weather.
4. Remove recyclable waste from Owner's property and transport to recycling receiver or processor as often as required to prevent overfilling bins.

3.3 RECYCLING DEMOLITION WASTE

A. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.

B. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

C. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

D. Metals: Separate metals by type.

1. Structural Steel: Stack members according to size, type of member, and length.
2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

E. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

F. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

G. Metal Suspension System: Separate metal members, including trim and other metals from acoustical panels and tile, and sort with other metals.

H. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.

1. Store clean, dry carpet and pad in a closed container or trailer provided by carpet reclamation agency or carpet recycler.

I. Carpet Tile: Remove debris, trash, and adhesive.

1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by carpet reclamation agency or carpet recycler.

J. Piping: Reduce piping to straight lengths and store by material and size. Separate supports, hangers, valves, sprinklers, and other components by material and size.

K. Conduit: Reduce conduit to straight lengths and store by material and size.

L. Lamps: Separate lamps by type and store according to requirements in 40 CFR 273.

3.4 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
   a. Comply with requirements in Section 329300 "Plants" for use of clean sawdust as organic mulch.

C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.
   a. Comply with requirements in Section 329300 "Plants" for use of clean ground gypsum board as inorganic soil amendment.

D. Paint: Seal containers and store by type.

3.5 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged or recycled, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

3.6 ATTACHMENTS

A. Form CWM-1 for construction waste identification.

B. Form CWM-2 for demolition waste identification.

C. Form CWM-3 for construction waste reduction work plan.

D. Form CWM-5 for cost/revenue analysis of construction waste reduction work plan.

E. Form CWM-7 for construction waste reduction progress report.

F. Form CWM-8 for demolition waste reduction progress report.

END OF SECTION 017419

SECTION 071326 - SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The General Conditions, the Supplementary Conditions, the Instructions to Bidders and Division One General Requirements shall be read in conjunction with and govern this section.

B. The Specification shall be read as a whole by all parties concerned. Sectioning of the Specification is for convenience. Each Section may contain more or less than the complete work of any trade. The Contractor is solely responsible to make clear to the Subcontractors the extent of their work.

1.2 DESCRPTION

A. Supply labor, materials, plant, tools and equipment to complete the Work as shown on the Drawings and as specified herein including, but not limited to the following:
   1. Foundation Walls (by others),
   2. Primer & Self-Adhered SBS Modified Asphalt Waterproofing Membrane,
   3. Drain Board/Protection Board,
   4. Specified Backfill.

1.3 SUBMITALS

A. Product Data: For each type of product.

   1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
   2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.

B. Shop Drawings: Show locations and extent of waterproofing and details of substrate joints and cracks, expansion joints, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

C. Samples: For each exposed product and for each color and texture specified, including the following products:

   1. 8-by-8-inch square of waterproofing and flashing sheet.
   2. 4-by-4-inch square of drainage panel.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.

1. Do not apply waterproofing in snow, rain, fog, or mist.

B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.7 WARRANTY

A. Manufacturer's Warranty:

1. Waterproofing Warranty: Manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.
   a. Warranty Period: Three years from date of Substantial Completion.

B. Installer's Special Warranty: Specified form, on warranty form at end of this Section, signed by Installer, covering Work of this Section, for warranty period of two years.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Source limitations for Waterproofing System: Obtain waterproofing materials, protection course, and molded-sheet drainage panels from single source from single manufacturer.

2.2 MATERIALS

A. Modified Bituminous Sheet Waterproofing Basis of Design: Subject to compliance with requirements, provide Blueskin WP200 manufactured by Henry, or comparable product by another manufacturer, from list of acceptable manufacturers.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Carlisle Coatings & Waterproofing Inc.
   b. CETCO is a subsidiary of Minerals Technologies Inc.
   c. MAPEI Corporation.

B. Primer Basis of Design: Subject to compliance with requirements, provide Aquatac Primer manufactured by Henry, a polymer emulsion based adhesive, quick setting, having the following physical properties:
   1. Color: Aqua;
   2. Weight: 8.7 lbs/gal;
   3. Solids by weight: 53%;
   4. Water based, no solvent odours
   5. Drying time (initial set): 30 minutes at 50% RH and 70 degrees F;

   1. Or comparable product by another manufacturer, from list of acceptable manufacturers.
      a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
         1) Carlisle Coatings & Waterproofing Inc.
         2) CETCO is a subsidiary of Minerals Technologies Inc.
         3) MAPEI Corporation.

C. Liquid Membrane and Termination Sealant Basis of Design: HE925 BES Sealant manufactured by Henry; a moisture cure, medium modulus polymer modified sealing compound having the following physical properties:
   1. Compatible with sheet air barrier, roofing and waterproofing membranes and substrate,
      a. Complies with Fed. Spec. TT-S-00230C, Type II, Class A
      b. Complies with ASTM C 920, Type S, Grade NS, Class 25
      c. Elongation: 450 – 550%
      d. Remains flexible with aging
      e. Seals construction joints up to 1 inch wide

   2. Or comparable product by another manufacturer, from list of acceptable manufacturers.
      a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
         1) Carlisle Coatings & Waterproofing Inc.
         2) CETCO is a subsidiary of Minerals Technologies Inc.
         3) MAPEI Corporation.

D. Prefabricated Drain Boards Basis of Design: Two-part prefabricated geocomposite drain board consisting of a formed polystyrene or PVC core covered on one side with a woven or non-woven polypropylene filter fabric:
   1. Henry DB 200: For vertical and horizontal installations, shallower depths.
   2. Henry DB 500: For vertical installations requiring high compressive strength and high flow capacity.
   3. Henry DB 650: For horizontal applications requiring high compressive strength, high flow capacity & woven geotextile. Suitable for use under topping slab in split slab applications.
   4. Or comparable product by another manufacturer, from list of acceptable manufacturers.

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   4) Carlisle Coatings & Waterproofing Inc.
   5) CETCO is a subsidiary of Minerals Technologies Inc.
   6) MAPEI Corporation.

E. Prefabricated Drain Board Accessories:
   1. Securement Bars: Continuous 1/4 inch x 3/4 inch HDPE bar for screw attachment.
   2. Moulding Strip: Continuous 3 ½ inch wide 'Z' flashing strip to fit over exposed top edge of drain board.
   3. Drain Board Plugs & Nails: HDPE pre-moulded washer to fit dimples c/w high strength, corrosion resistant concrete nails, UCAN AFH 37 or equal.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Verify that surfaces and conditions are ready to accept the Work of this section. Commencement of the work or any parts thereof shall mean acceptance of the prepared substrate.

3.2 PREPARATION
A. All surfaces must be sound, dry, clean and free of oil, grease, dirt, excess mortar, frost or other contaminants. Fill spalled areas in substrate to provide an even plane.
B. New concrete should be cured for a minimum of 7 days and must be dry before waterproofing membranes are applied. Lightweight structural concrete must be cured a minimum of 14 days.
C. Use appropriate waterproofing membrane primer as recommended by manufacturer based on air and surface temperature at time of application.

3.3 PRIMER
A. Apply primer for self-adhered membrane by roller or spray at rate recommended by manufacturer.
B. Allow minimum 30 minute open time. Primed surfaces not covered by waterproofing membrane during the same working day must be re-primed.

3.4 FOOTING/FOUNDATION WALLS, JUNCTURES, CRACKS IN SLAB AND PROTRUSIONS
A. Coat penetrations, such as brackets, clips, braces, etc. that are set into the concrete with a 90 mil coating of liquid membrane to the height of the wearing course and around projections to ensure a complete seal prior to coating the entire area.
B. To all cracks and cold joints less than 1/16 inch, apply a coat of liquid membrane at a minimum thickness of 30 mils extending 3 inches on either side of joint, embed a 6 inch wide strip of primary self-adhered waterproofing membrane over.
C. To all cracks greater than 1/8 inch, fill void with non-shrink cementitious patching material and allow to cure dry. Prime area and install self-adhered waterproofing membrane, extend 3 inches on either side of crack. Overlap end joint of sheet a minimum 3 inches.
D. At monolithic and non-monolithic wall/slab junctures, prime area, trowel-in fillet bead of liquid membrane to inside corners and install self-adhered waterproofing membrane sheet to the required height on the wall and at least 4 inches on the slab. Lap primary

waterproofing membrane over a minimum of 2 inches.

E Horizontal to vertical inside corner transition areas are to be pre-treated with a liquid membrane fillet extending 3/4 inch vertically and horizontally from the corner. Apply a minimum 10 inch strip of self-adhered waterproofing membrane centred at the joint.

F. All outside corners are to be pre-treated with a minimum 10 inch strip of waterproofing membrane centred at the joint.

G. Where three or more planes come into contact reinforce with cut sections of waterproofing membrane reinforcing sheet as per manufacturer's instructions.

3.5 PROJECTIONS

A. Extend waterproofing membrane tight to projection and seal with liquid membrane extending 3 inches along projection and 3 inches onto waterproofing membrane.

3.6 WATERPROOFING MEMBRANE - VERTICAL APPLICATIONS

A. Apply waterproofing membrane to prepared substrate in lengths of 6 feet or less.

B. Provide 3 inch laps at both sides and ends. Position for alignment and remove protective film. Press firmly into place. Promptly roll all laps with a counter top roller to effect seal. If more than one length is required on a vertical surface, apply in a shingle fashion.

C. Terminate membrane using termination mastic or termination bar, reglet or counter flashing as indicated. Refer to manufacturers standard details.

D. All laps within 12 inches of a 90 degrees change in plane are to be sealed with termination sealant.

3.7 WATERPROOFING MEMBRANE - HORIZONTAL APPLICATIONS

A. Apply 2 plies of waterproofing membrane to prepared substrate in lengths of 6 feet or less.

B. Provide 3 inches laps at both sides and ends. Position for alignment and remove protective film. Press firmly into place. Promptly roll all laps with a counter top roller to effect seal. If more than one length is required on a vertical surface, apply in a shingle fashion.

C. Terminate membrane using termination mastic or termination bar, reglet or counter flashing as indicated. Refer to manufacturers standard details.

D. All laps within 12 inches of a 90 degrees change in plane are to be sealed with termination sealant.

3.8 Installation of Protection Board

A. Protection Boards shall be installed over the waterproofing membrane to prevent damage from materials used in backfilling.

B. Apply protection board adhesive in 1 inch wide strips spaced at 16 inches o/c to cure waterproofing membrane. Immediately embed protection board and press into adhesive to ensure full contact.

C. Do not backfill until adhesive has cure dried. Do not use excessive levels of adhesive.

3.9 Installation of Drainage Board (Vertical)

A. Align and hang drainage up to foundation wall. Position bottom edge of drainage board to be in moderate contact with weeping tile system.

B. Secure drainage board to foundation wall with nails and washers spaced 450 mm o/c horizontally. Install minimum of 2 rows staggered and spaced 6 inches apart and min 6 inches from top edge.

C. Align and install termination strip along top edge with nails spaced 12 inches o/c and

seal with termination sealant.

D. Align and install moulding strip over completed top edge detail.
E. Overlap end laps, pull back loose fabric to expose drain core and position core of second panel over the overlap flange of first panel.
F. Bend drain board to create inside corners and cut board to create outside corners, provide 4 inches of extra fabric to wrap corner.
G. Stagger or offset joints of drain board sheets.
H. Place all subsequent sheets in an overlapping single fashion.
I. Backfill bottom edge in conjunction with weeping tile system.

3.10 Installation of Drainage Board (Horizontal)

A. The edge of the core flange shall be at the higher edges of the substrate, away from drains.
B. Overlap in the direction of water flow. Pull back loose fabric to expose drain core and position core of second panel over the overlap flange of first panel.
C. Bend drain board to create inside corners and cut board to create outside corners, provide 3 inch of extra fabric to wrap corner.
D. Stagger or offset joints of drain board sheets.
E. Place all subsequent sheets in an overlapping single fashion.

3.11 CLEAN-UP

A. Promptly as the work proceeds and on completion clean up and remove from site all rubbish and surplus materials resulting from the foregoing work.

3.12 PROTECTION

A. Protect waterproofing membrane and drain board work from other trades during construction.
B. Backfill with specified materials, protect membrane from damage.

END OF SECTION 071326

SECTION 072500 – WEATHER BARRIERS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The General Conditions, Supplementary Conditions, Instructions to Bidders, and Division 01- General Requirements shall be read in conjunction with and govern this Section.

B. Read this Specification as a whole by all parties concerned. Each Section may contain more or less than the complete Work of any trade. The Contractor is solely responsible to make clear to the installing Subcontractor the extent of their Work.

1.2 SUMMARY

A. This Section includes requirements for supplying labor, materials, tools, and equipment to complete the Work as shown on the Drawings Architectural Division as specified herein including, but not limited to, the following:
   1. Adhesive/Primer
   2. Self-Adhered Water Resistive Air Barrier
   3. Sealant

1.3 REFERENCES

A. American Architectural Manufacturers Association (AAMA):
   1. AAMA 711-13 - Voluntary Specification for Self-Adhering Flashing Used for Installation of Exterior Wall Fenestration Products
   2. AAMA 2400-02 - Standard Practice for Installation of Windows with a Mounting Flange in Stud Frame Construction

B. American Society for Testing and Materials (ASTM):
   1. ASTM D882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting
   2. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds
   3. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
   4. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials
   5. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen
   6. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls by Uniform Static Air Pressure Difference

7. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
8. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials
9. ASTM E2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

C. National Fire and Protection Agency (NFPA):
1. NFPA 285 - Standard Fire Test Method for Evaluation Of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components

D. US Green Building Council (USGBC), Leadership in Energy and Environmental Design (LEED)

1.4 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation meetings:
1. When required, and with prior notice, an Air Barrier Manufacturer representative will meet with the necessary parties at the jobsite to review and discuss project conditions as it relates to the integrity of the assembly.

1.5 SUBMITTALS

A. Provide the following requested information in accordance with Section [project specific] Submittal Procedures.

B. Action Submittals:
1. Product Data:
   a. Air Barrier Manufacturer’s guide specification
   b. Air Barrier Manufacturer’s complete set of technical data sheets for assembly
   c. Air Barrier Manufacturer’s complete set of guide details for assembly
2. Certificates:
   a. Product certification confirming assembly components are supplied and warranted by a single source Air Barrier Manufacturer
   b. LEED HPD declaration
3. Tests and Evaluation Reports:
   a. NFPA 285 wall assembly compliance:
      1. Air Barrier Manufacturer statement that anticipated wall assembly complies with NFPA 285
4. Warranty:
   a. Sample warranty as specified

1.6 QUALITY ASSURANCE

A. Single Source Responsibility:
1. Obtain air barrier and auxiliary materials including adhesive/primer, air barrier, flashings, and sealants from a single Air Barrier Manufacturer

regularly engaged in the manufacturing and supply of the specified products.
2. Verify product compliance with federal, state, and local regulations.

B. Manufacturer Qualifications:
1. Air Barrier Manufacturer shall demonstrate qualifications to supply materials of this Section by certifying the following:
a. Air Barrier Manufacturer must not issue warranties for terms longer than they have been manufacturing and supplying specified products for similar scope of Work.

C. Installer Qualifications:
1. Perform Work in accordance with the Air Barrier Manufacturer's published literature and as specified in this Section.
2. Maintain one (1) copy of the Air Barrier Manufacturer's installation instructions on site.
3. At all times during the execution of the Work allow access to site by the Air Barrier Manufacturer representative.
4. If meeting with the Air Barrier Manufacturer during project construction, contact the Air Barrier Manufacturer a minimum of two weeks prior to schedule meeting.

1.7 MOCK-UPS

A. Mock-ups: Construct mock-ups to verify selections made under submittals and to set quality standards for materials and execution in accordance with Section [project specific] for mock-ups and as follows:
1. Where directed by [engineer] [architect] [consultant], construct typical exterior wall section, six and one-half (6.5) feet by six and one-half (6.5) feet, incorporating [project specific], substrate materials, and adjacent materials including flashing, door frame, window frame, attachment of insulation and [project specific]; showing air barrier application details.

B. Notify [engineer] [architect] [consultant] a minimum seven (7) days prior to mock-up construction.

C. Review and acceptance of mock-ups does not constitute approval of deviations from the Contract Documents contained in mock-ups unless [engineer] [architect] [consultant] specifically notes such deviations in writing.

D. Once reviewed by [engineer] [architect] [consultant], acceptable mock-up can form a permanent part of the Work, and will form the basis for acceptance for the remainder of the project.

E. Remove and replace materials found unacceptable at no additional cost to Owner.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials:

1. Deliver materials to the jobsite in undamaged and clearly marked containers indicating the name of the Air Barrier Manufacturer and product.

B. Storage of Materials:
1. Store materials as recommended by the Air Barrier Manufacturer and conform to applicable safety regulatory agencies. Refer to all applicable data including, but not limited to, Safety Data Sheet (SDS), Technical Data sheet (TDS), product labels, and specific instructions for personal protection.
2. Keep solvents away from open flame or excessive heat.
3. Store materials in original packaging.
4. Protect rolls from direct sunlight until ready for use.
5. Refer to Air Barrier Manufacturer’s product TDS.

C. Handling:
1. Refer to Air Barrier Manufacturer’s product TDS.

1.9 SITE CONDITIONS

A. Environmental Requirements:
1. Do not perform Work during rain or inclement weather.
2. Do not perform Work on frost covered substrates or surfaces that are wet to touch.

B. Protection:
1. It is the responsibility of the installing Subcontractor to protect all surfaces not included in scope of Work from overspray including, but not limited to, windows, doors, adjacent areas, and vehicles.
2. Cap and protect exposed back-up walls against wet weather conditions during and after application of air barrier assembly.

C. Complete preparation Work prior to installing air barrier.

D. Ground all equipment during operations.

1.10 WARRANTY

A. Manufacturer's Single Source Warranty; choose from the following:
1. Product Warranty:
a. Manufacturer must warrant the material against product defect for a period of one (1) year from date of purchase.
2. Assembly Warranty:
a. Manufacturer must warrant the assembly against product defect for a period of twelve (12) years from the date of substantial completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Air Barrier and auxiliary materials shall comply with the following system requirements:
   1. Obtain air barrier and auxiliary materials as a single-source from the Air Barrier Manufacturer to ensure total system compatibility and integrity.
   2. Air leakage:
      a. ASTM E2357: Pass
      b. CAN/ULC-S742-11: Classification A1
      c. CAN/ULC S741-08
   3. Water resistance:
      a. AATCC TM127: Pass
      b. ASTM E331: Pass
   4. Nail Sealability:
      a. AAMA 711-13, ASTM D1970: Pass

2.2 MATERIALS

A. Subject to compliance with requirements, provide basis of design products manufactured by Henry, or comparable product by another manufacturer, from list of acceptable manufacturers.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Carlisle Coatings & Waterproofing, Inc.
      b. Grace Construction Products; W.R. Grace & Co.
      c. Sto Corporation.
      d. Tremco.
      e. W.R. Meadows, Inc.

B. Primary Sheet-Applied, Vapor Permeable Water Resistive Air Barrier (Basis of Design):
   1. Self-adhered vapor permeable, water resistive air barrier consisting of a reinforced, modified polyolefin tri-laminate film surface and patented permeable adhesive technology with split-back poly-release film; having the following typical physical properties:
      a. Basis of design: Henry® Blueskin® VP160 Self-Adhered Water Resistive Air Barrier
      b. Color: Blue
      c. Thickness: 23 mils (0.58 mm)
      d. Water Vapor Permeance (ASTM E96): 29 perms
      e. Air Leakage of Air Barrier Assemblies (ASTM E2357): Pass
      f. Air Permeance (ASTM E2178): Pass
      g. Nail Sealability (ASTM D1970): Pass
      h. Dry Tensile Strength (ASTM D882):
         1. 41 lbf /182N MD
         2. 29 lbf /129N CD
      i. Surface Burning Characteristics (ASTM E84):
         1. Flame Spread: Class A
         2. Smoke Development: Class A

j. Low Application Temperature: 20 degrees F (-7 degrees C)

C. Assembly Auxiliary Materials:

1. Adhesives/Primers:
   a. Standard VOC adhesive:
      1. Synthetic rubber based quick setting adhesive; having the following typical physical properties:
         a. Basis of design: Henry® Blueskin® Adhesive
         b. Color: Blue
         c. Maximum VOC: 450 g/L
         d. Drying time (initial set): 30 minutes
         e. Low Application Temperature: 10 degrees F (-12 degrees C)
   b. Low VOC adhesive:
      1. Synthetic rubber based quick setting adhesive with low VOC content; having the following typical physical properties:
         a. Basis of design: Henry® Blueskin® LVC Adhesive
         b. Color: Blue
         c. Maximum VOC: <240 g/L
         d. Drying time (initial set): 30 minutes
         e. Low Application Temperature: 10 degrees F (-12 degrees C)
      2. Polymer emulsion water based quick setting adhesive with low VOC content; having the following typical physical properties:
         a. Basis of design: Henry® Aquatac™ Primer
         b. Color: Aqua
         c. Maximum VOC: 50 g/L
         d. Drying time (initial set): 30 minutes
         e. Low Application Temperature: 25 degrees F (-4 degrees C)

   c. Aerosol spray adhesive:
      1. Quick drying spray adhesive used to prepare construction surfaces for the application of flashings; having the following typical physical properties:
         a. Basis of design: Henry® Blueskin® Spray Prep Adhesive
         b. Color: Clear amber
         c. Solids by weight: 35%
         d. Drying time (initial set): 3 minutes
         e. Low Application Temperature: -10 degrees F (-23 degrees C)
   d. Quick setting primers:
      1. Synthetic rubber based quick setting adhesive with low VOC content; having the following typical physical properties:
         a. Basis of design: Henry® Blueskin® LVC Spray Primer
         b. Color: Blue
         c. Maximum VOC: 250 g/L
         d. Dry time: 1-3 minutes
         e. Low Application Temperature: 40 degrees F (4.4 degrees C)

2. Liquid-Applied Flashing:
   a. Moisture-curing single component elastomeric liquid-applied flashing using a highly advanced Silyl-Terminated Polyether (STPE) polymer

curing to a monolithic membrane; having the following typical physical properties:

1. Basis of design: Henry® Air-Bloc® LF Liquid-Applied Flashing
2. Color: Blue
3. Air Permeance (ASTM E2178): Pass
4. Water Vapor Permeance (ASTM E96): 21.8 perms @ 25 mils
5. Air Leakage of Air Barrier Assemblies (ASTM E2357): Pass
6. Water Resistance (AC212/ASTM D2247): Pass
7. Nail Sealability (AAMA 711): Pass
8. Surface Burning Characteristics (ASTM E84):
    a. Flame Spread: Class A
    b. Smoke Development: Class A
9. Elongation (D412): 264%
10. Low Application Temperature: 20 degrees F (-7 degrees C)

3. Self-Adhered Flashing:

    a. Non-Vapor Permeable Flashing:
        1. Non-vapor permeable, self-adhered water resistive air and vapor barrier consisting of a synthetic butyl compound integrally laminated to a white engineered polypropylene film surface; having the following typical physical properties:
            a. Basis of design: Henry® Blueskin® Butyl Flash
            b. Color: White
            c. Thickness: 14 mils (0.36 mm)
            d. Water Vapor Permeance (ASTM E96): 0.14 perms
            e. Nail Sealability (ASTM D1970): Pass
            f. Elongation (ASTM D412): 825% minimum
            g. Low Application Temperature: 25 degrees F (-4 degrees C)
        2. Non-vapor permeable, self-adhered water resistive air and vapor barrier consisting of an SBS rubberized asphalt compound integrally laminated to a high strength polyethylene with surface layer of metallic aluminum film; having the following typical physical properties:
            a. Basis of design: Henry® Metal Clad® Self-Adhered Water Resistive Air Barrier
            b. Color: Metallic Aluminum
            c. Thickness: 45 mils (1.14 mm)
            d. Water Vapor Permeance (ASTM E96): 0.014 perms
            e. Nail Sealability (ASTM D1970): Pass
            f. Elongation (ASTM D412): 85%
            g. Low Application Temperature: 20 degrees F (-7 degrees C)
        3. Non-vapor permeable, self-adhered water resistive air and vapor barrier consisting of an SBS rubberized asphalt compound integrally laminated to a blue engineered thermoplastic film surface; having the following typical physical properties:
            a. Basis of design: Henry® Blueskin® SA Self-Adhered Water Resistive Air Barrier
            b. Color: Blue
            c. Thickness: 40 mils (1 mm)

d. Water Vapor Permeance (ASTM E96): 0.86 perms
e. Nail Sealability (ASTM D1970): Pass
f. Elongation (ASTM D412-modified): 200% minimum
g. Low Application Temperature: 41 degrees F (5 degrees C)

4. Low temperature non-vapor permeable, self-adhered water resistive air and vapor barrier consisting of an SBS rubberized asphalt compound integrally laminated to a blue engineered thermoplastic film surface; having the following typical physical properties:
   a. Basis of Design: Henry® Blueskin® SALT Low Temp Self-Adhered Water Resistive Air Barrier
   b. Color: Blue
   c. Thickness: 40 mils (1 mm)
   d. Water Vapor Permeance (ASTM E96): 0.86 perms
   e. Nail Sealability (ASTM D1970): Pass
   f. Elongation (ASTM D412-modified): 200% minimum
   g. Low Application Temperature: 10 degrees F (-12 degrees C)

b. Vapor Permeable Flashing:
   1. Self-adhered water resistive vapor permeable air barrier consisting of a reinforced modified polyolefin tri-laminate film surface and patented adhesive technology with split-back poly-release film; having the following typical physical properties:
      a. Basis of design: Henry® Blueskin® VP160 Self-Adhered Water Resistive Air Barrier
      b. Color: Blue
      c. Thickness: 23 mils (0.58 mm)
      d. Water Vapor Permeance (ASTM E96): 29 perms
      e. Nail Sealability (ASTM D1970): Pass
      f. Low Application Temperature: 20 degrees F (-7 degrees C)

4. Sealants:
   a. Building Envelope Sealant:
      1. Moisture cure, medium modulus polymer modified sealing compound; having the following typical physical properties:
         a. Basis of design: Henry® 925 BES Sealant
         b. Color: Varies
         c. Elongation: 450 – 550%.
   b. Termination Sealant:
      1. One-part high performance synthetic rubber sealant; having the following typical physical properties:
         a. Basis of design: Henry® 212 All Purpose Crystal Clear Sealant
         b. Color: Clear
         c. Elongation: 200% minimum

PART 3 - EXECUTION

3.02. EXAMINATION

A. Verification of Conditions:

1. Verify substrates to receive Work and surrounding adjacent surfaces are in accordance with Air Barrier Manufacturer's installation guide and as specified in this Section prior to installation of self-adhered air barrier assembly.
2. Continuous substrate:
    a. Existing substrate must be continuous and secured prior to application of air barrier.
    b. Securely fasten sheathing panels and install flush to ensure a continuous substrate in accordance with Air Barrier Manufacturer's installation guide and as specified in this Section.
    c. Fastener penetrations must be set flush with sheathing and fastened into solid backing.
    d. Refer to Air Barrier Manufacturer's details.
3. Strike masonry joints flush.
4. Concrete surfaces shall be smooth and without large voids, spalled areas or sharp protrusions. Refer to Air Barrier Manufacturer's details for substrate gap limitations.
5. Remove concrete forms and allow new concrete to cure for a minimum of fourteen (14) days.
6. Curing compounds or release agents used in concrete construction must be resin based without oil, wax or pigments.
7. Do not install air barrier over substrates that are wet to touch.

B. Notify Contractor in writing of any conditions that are not acceptable.

C. The installing contractor shall examine and determine that surfaces and conditions are ready to accept the Work of this Section in accordance with the Air Barrier Manufacturer's installation guide and as specified in this Section. Commencement of Work or any parts thereof shall mean installer's acceptance of the substrate.

D. Do not apply air barrier until substrate and environmental conditions are in accordance with Air Barrier Manufacturer's installation guide and as specified in this Section.

3.03. PREPARATION

A. All surfaces must be sound, dry, clean, and free of oil, grease, dirt, excess mortar, frost, laitance, loose and flaking particles, or other contaminants.

B. Protect adjacent surfaces not included in scope of Work to prevent spillage and overspray.

C. Cap and protect exposed back-up walls against wet weather conditions during and after application of the air barrier assembly.

3.04. INSTALLATION

A. Ensure substrate is ready to receive air barrier in accordance with Air Barrier Manufacturer's installation guide and as specified in this Section.

B. Temperature limitation:
   1. Primary air barrier:
      a. Substrate temperature must be above 20 degrees F (-7 degrees C) and rising.
   2. Auxiliary products:
      a. Temperature limitations may vary. Refer to Air Barrier Manufacturer's product TDS for product specific temperature limitations.

C. Application of flashing:

   1. Self-adhered flashing:
      a. Where required install adhesive/primer recommended by Air Barrier Manufacturer continuously at rate recommended ensuring complete substrate coverage of anticipated flashing installation area.
         1. Allow adhesive/primer to cure to a tacky film prior to application of flashing.
         2. Primed areas not covered by end of day must be re-primed prior to installation of flashing.
      b. Measure and cut self-adhered flashing to ensure adequate length to achieve continuous coverage of desired installation.
      c. Peel protective film from self-adhered flashing and align top of membrane verifying proper positioning prior to complete film removal and flashing placement.
      d. Press self-adhered flashing firmly into place by applying hand pressure to the middle of the membrane and working the pressure to the edges; eliminating wrinkles and air bubbles.
      e. Install self-adhered flashings in shingle fashion to eliminate reverse laps.
      f. Where required, prime laps at rate recommended by Air Barrier Manufacturer to ensure complete coverage of anticipated lap installation.
      g. Lap adjoining edges a minimum of two (2) inches.
      h. Roll flashing and laps with countertop roller to obtain thorough adhesion.
      i. Seal reverse laps at self-adhered flashing with sealant. Sealant recommendations may vary due to product or sequence of construction. Refer to Air Barrier Manufacturer details for recommended sealant.
   2. Liquid-applied flashing:

a. Apply a uniform film of aerosol spray adhesive to raw edges of gypsum sheathing at rate recommended by Air Barrier Manufacturer completely encapsulating loose gypsum core at the cut edge of gypsum sheathing.
b. Allow adhesive to cure to a tacky film prior to application of liquid-applied flashing.
c. Apply flashing in accordance with and at rate recommended by Air Barrier Manufacturer.
d. Spread flashing to achieve a monolithic membrane over substrate requiring flashing.
e. Allow flashing to cure prior to subsequent installations.

D. Detailing/Flashing:
1. Complete detailing and flashing installations per Air Barrier Manufacturer's installation guide, details, and this specification.
2. Refer to Air Barrier Manufacturer details for further clarification and installation procedures including, but not limited to, the following:
a. Inside corners
b. Outside corners
c. Pipe penetrations
d. Shelf angles
e. Wall to foundation transitions
f. Reverse laps
g. Construction joints
h. Rough openings:
1. Install rough opening details per Window Manufacturer's installation guide details and in accordance with ASTM E2112.
2. Wall assemblies containing a vapor retarder on the interior wall assembly:
a. Extend flashing into rough opening to ensure sufficient membrane for connection with vapor retarder and provide a continuous air barrier assembly.
3. Transitions:
a. Contact Air Barrier Manufacturer to coordinate transition of self-adhered air barrier to adjacent areas including, but not limited to, the following:
1. Roof to air barrier
2. Air barrier to vertical or horizontal waterproofing
3. Fastener penetrations

E. Application of Primary Sheet-Applied Vapor Permeable Water Resistive Air Barrier:

1. Where required, install adhesive/primer recommended by Air Barrier Manufacturer continuously and at rate recommended by Air Barrier Manufacturer to ensure complete substrate coverage of anticipated flashing installation area.
    a. Allow adhesive/primer to cure to a tacky film prior to application of air barrier.
    b. Primed areas not covered by end of day must be re-primed prior to installation of air barrier.
2. Peel protective film from primary air barrier and align top of verifying proper positioning prior to complete film removal and placement.
3. Press primary air barrier firmly into place by applying hand pressure to the middle of the membrane and working the pressure to the edges; eliminating wrinkles and air bubbles.
4. Install primary air barrier in shingle fashion to eliminate reverse laps.
5. For lap adhesion enhancements, install standard or low VOC adhesive continuously and at rate recommended by Air Barrier Manufacturer to ensure substrate coverage of anticipated flashing installation area.
    a. Allow adhesive/primer to cure to a tacky film prior to subsequent primary air barrier installation.
6. Horizontal applications:
    a. Horizontal seams: two (2) inch minimum.
    b. Vertical seams: three (3) inch minimum.
7. Roll primary air barrier and laps with countertop roller to obtain thorough adhesion.
8. Seal permanent reverse laps of primary air barrier with termination sealant.

F. Special Considerations:
1. Contact Air Barrier Manufacturer to verify product and installation requirements.
2. Wall assemblies identified as special conditions and requiring supplemental detailing may include, but are not limited to, any of the following:
    a. Panelized wall assemblies.
    b. Sloped wall assemblies.
    c. Rainscreen cladding systems permitting permanent direct exposure to bulk water onto the primary air barrier within a completed wall assembly.
    d. Claddings impeding drainage and/or promoting hydrostatic pressure:
        1. Horizontal Z-girts or furring strips installed directly onto air barrier in a manner to encourage water collection.

G. Fastener Penetrations Through Primary Air Barrier:

1. It is the responsibility of the installer penetrating the air barrier assembly to install fasteners and components in accordance with the Air Barrier Manufacturer's installation guide and as specified in this Section.
2. Installation requirements:
    a. Drill fasteners and components with sufficient compression to maintain continuity in the air barrier assembly.
    b. Refer to "Self-tapping fasteners" and/or "Pre-drilled fasteners".
3. Supplemental sealant:
    a. Penetrations that do not meet installation requirements require the addition of termination sealant at point of insertion through the air barrier to maintain continuity in the air barrier assembly.
4. Self-tapping fasteners:
    a. Fastener head/assembly component must be larger in diameter than the fastener shank.
    b. Install fastener head/assembly component to provide a continuous compression firmly against the air barrier creating a gasketing seal without damaging the membrane.
    c. Do not install fastener components through the air barrier over unsupported areas of the substrate such as sheathing joints.
    d. Remove overdriven fasteners, improperly installed fasteners, defective/broken fasteners, or fasteners not properly fastened into the building structure beyond the air barrier membrane and seal the vacated hole with termination sealant prior to the installation of the exterior cladding.
5. Pre-drilled fastening assemblies:
    a. Fastening head/assembly component must be larger in diameter than predrilled hole.
    b. Install fastening head/assembly component to provide a continuous compression firmly against the air barrier creating a gasketing seal without damaging the membrane.
    c. Do not install fastening components through air barrier over unsupported areas of the substrate such as sheathing joints.
    d. Seal improperly drilled and/or vacated holes with termination sealant prior to the installation of the exterior cladding.

3.05. FIELD QUALITY CONTROL

A. Final Observation and Verification:
1. Owner's representative, General Contractor, or Air Barrier Manufacturer shall complete the final inspection of the air barrier assembly as required by warranty.
    a. Contact Air Barrier Manufacturer for warranty issuance requirements.

B. Install cladding as soon as practical after application. Air barrier assembly not designed for permanent UV exposure. Refer to Air Barrier Manufacturer's product TDS for product limitations.

3.06. CLEANING

A. As the Work proceeds, and upon completion, promptly clean up and remove from the premises all rubbish and surplus materials resulting from the foregoing Work.

B. Clean soiled surfaces, spatters, and damage caused by Work of this Section.

C. Check area to ensure cleanliness and remove debris, equipment, and excess material from the site.

END OF SECTION 072500

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware
2. Electronic access control system components

B. Section excludes:

1. Windows
2. Cabinets (casework), including locks in cabinets
3. Signage
4. Toilet accessories
5. Overhead doors

C. Related Sections:

1. Division 01 Section "Alternates" for alternates affecting this section.
2. Division 06 Section "Rough Carpentry"
3. Division 06 Section "Finish Carpentry"
4. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
5. Division 08 Sections:
   a. "Metal Doors and Frames"
   b. "Flush Wood Doors"
   c. "Stile and Rail Wood Doors"
   d. "Interior Aluminum Doors and Frames"
   e. "Aluminum-Framed Entrances and Storefronts"
   f. "Stainless Steel Doors and Frames"
   g. "Special Function Doors"
   h. "Entrances"
6. Division 26 "Electrical" sections for connections to electrical power system and for low-voltage wiring.
7. Division 28 "Electronic Safety and Security" sections for coordination with other components of electronic access control system and fire alarm system.

1.02 REFERENCES

A. UL LLC

1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies

3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Keying Systems and Nomenclature
4. Installation Guide for Doors and Hardware

C. NFPA – National Fire Protection Association

1. NFPA 70 – National Electric Code
2. NFPA 80 – 2016 Edition – Standard for Fire Doors and Other Opening Protectives
3. NFPA 101 – Life Safety Code
4. NFPA 105 – Smoke and Draft Control Door Assemblies
5. NFPA 252 – Fire Tests of Door Assemblies

D. ANSI - American National Standards Institute

1. ANSI A117.1 – 2017 Edition – Accessible and Usable Buildings and Facilities
2. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
3. ANSI/BHMA A156.28 - Recommended Practices for Keying Systems
4. ANSI/WDMA I.S. 1A - Interior Architectural Wood Flush Doors
5. ANSI/SDI A250.8 - Standard Steel Doors and Frames

1.03 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 Submittal Procedures.
2. Prior to forwarding submittal:
   a. Review drawings and Sections from related trades to verify compatibility with specified hardware.
   b. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

B. Action Submittals:

1. Product Data: Submit technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:
   a. Wiring Diagrams: For power, signal, and control wiring and including:

1) Details of interface of electrified door hardware and building safety and security systems.
2) Schematic diagram of systems that interface with electrified door hardware.
3) Point-to-point wiring.
4) Risers.

3. Samples for Verification: If requested by Architect, submit production sample of requested door hardware unit in finish indicated and tagged with full description for coordination with schedule.
   a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.

4. Door Hardware Schedule:
   a. Submit concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work critical in Project construction schedule.
   b. Submit under direct supervision of a Door Hardware Institute (DHI) certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule published by DHI.
   c. Indicate complete designations of each item required for each opening, include:
      1) Door Index: door number, heading number, and Architect's hardware set number.
      2) Quantity, type, style, function, size, and finish of each hardware item.
      3) Name and manufacturer of each item.
      4) Fastenings and other pertinent information.
      5) Location of each hardware set cross-referenced to indications on Drawings.
      6) Explanation of all abbreviations, symbols, and codes contained in schedule.
      7) Mounting locations for hardware.
      8) Door and frame sizes and materials.
      9) Degree of door swing and handing.
      10) Operational Description of openings with electrified hardware covering egress, ingress (access), and fire/smoke alarm connections.

5. Key Schedule:
   a. After Keying Conference, provide keying schedule that includes levels of keying, explanations of key system's function, key symbols used, and door numbers controlled.
   b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.

c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion. Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.

C. Informational Submittals:

1. Provide Qualification Data for Supplier, Installer and Architectural Hardware Consultant.
2. Provide Product Data:
   a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
   b. Include warranties for specified door hardware.

D. Closeout Submittals:

1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:
   a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
   b. Catalog pages for each product.
   c. Final approved hardware schedule edited to reflect conditions as installed.
   d. Final keying schedule
   e. Copy of warranties including appropriate reference numbers for manufacturers to identify project.
   f. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.

E. Inspection and Testing:

1. Submit written reports to the Owner and Authority Having Jurisdiction (AHJ) of the results of functional testing and inspection for:
   a. Fire door assemblies, in compliance with NFPA 80.
   b. Required egress door assemblies, in compliance with NFPA 101.

1.04 QUALITY ASSURANCE

A. Qualifications and Responsibilities:

1. Supplier: Recognized architectural hardware supplier with a minimum of 5 years documented experience supplying both mechanical and electromechanical door hardware similar in quantity, type, and quality to that indicated for this Project. Supplier to be recognized as a factory direct distributor by the manufacturer of the primary materials with a warehousing facility in the Project's vicinity. Supplier to have on staff, a certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
2. Installer: Qualified tradesperson skilled in the application of commercial grade hardware with experience installing door hardware similar in quantity, type, and quality as indicated for this Project.
3. Architectural Hardware Consultant: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:
    a. For door hardware: DHI certified AHC or DHC.
    b. Can provide installation and technical data to Architect and other related subcontractors.
    c. Can inspect and verify components are in working order upon completion of installation.
    d. Capable of producing wiring diagram and coordinating installation of electrified hardware with Architect and electrical engineers.

4. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

B. Certifications:

1. Fire-Rated Door Openings:
    a. Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction.
    b. Provide only items of door hardware that are listed products tested by UL LLC, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.

2. Smoke and Draft Control Door Assemblies:
    a. Provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105
    b. Comply with the maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.

3. Electrified Door Hardware
    a. Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.

4. Accessibility Requirements:

a. Comply with governing accessibility regulations cited in "REFERENCES" article 087100, 1.02.D3 herein for door hardware on doors in an accessible route. This project must comply with all Federal Americans with Disability Act regulations and all Local Accessibility Regulations.

C. Pre-Installation Meetings

1. Keying Conference
   a. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
      1) Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
      2) Preliminary key system schematic diagram.
      3) Requirements for key control system.
      4) Requirements for access control.
      5) Address for delivery of keys.

2. Pre-installation Conference
   a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   b. Inspect and discuss preparatory work performed by other trades.
   c. Inspect and discuss electrical roughing-in for electrified door hardware.
   d. Review sequence of operation for each type of electrified door hardware.
   e. Review required testing, inspecting, and certifying procedures.
   f. Review questions or concerns related to proper installation and adjustment of door hardware.

3. Electrified Hardware Coordination Conference:
   a. Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping.

B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package. Deliver each article of hardware in manufacturer's original packaging.

C. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.

D. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

E. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

F. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.06 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

1.07 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within published warranty period.

1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.
2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer's published listings.
    a. Mechanical Warranty
        1) Locks
            a) Schlage L Series: 3 years
            b) Schlage ND Series: 10 years
        2) Exit Devices
            a) Von Duprin: 3 years
        3) Closers
            a) LCN 4000 Series: 30 years
        4) Automatic Operators
            a) LCN: 2 years
    b. Electrical Warranty
        1) Exit Devices
            a) Von Duprin: 1 year

1.08 MAINTENANCE

A. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

B. Turn over unused materials to Owner for maintenance purposes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Approval of alternate manufacturers and/or products other than those listed as "Scheduled Manufacturer" or "Acceptable Manufacturers" in the individual article for the product category are only to be considered by official substitution request in accordance with section 01 25 00.

B. Approval of products from manufacturers indicated in "Acceptable Manufacturers" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.

C. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.02 MATERIALS

A. Fabrication

1. Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. provide screws according to manufacturer’s recognized installation standards for application intended.
2. Finish exposed screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
3. Provide concealed fasteners wherever possible for hardware units exposed when door is closed. Coordinate with “Metal Doors and Frames”, “Flush Wood Doors”, “Stile and Rail Wood Doors” to ensure proper reinforcements. Advise the Architect where visible fasteners, such as thru bolts, are required.

B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.

1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

C. Cable and Connectors:

1. Where scheduled in the hardware sets, provide each item of electrified hardware and wire harnesses with number and gage of wires enough to accommodate electric function of specified hardware.
2. Provide Molex connectors that plug directly into connectors from harnesses, electric locking and power transfer devices.
3. Provide through-door wire harness for each electrified locking device installed in a door and wire harness for each electrified hinge, electrified continuous hinge, electrified pivot, and electric power transfer for connection to power supplies.

2.03 HINGES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
   a. Ives 5BB series

2. Acceptable Manufacturers and Products:
   a. Hager BB1191/1279 series
   b. McKinney TB series
   c. Best FBB series

B. Requirements:

1. Provide hinges conforming to ANSI/BHMA A156.1.
2. Provide five knuckle, ball bearing hinges.
3. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
   a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
   b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high

4. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
   a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
   b. Interior: Heavy weight, steel, 5 inches (127 mm) high

5. 2 inches or thicker doors:
   a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
   b. Interior: Heavy weight, steel, 5 inches (127 mm) high

6. Adjust hinge width for door, frame, and wall conditions to allow proper degree of opening.
7. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
8. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
   a. Steel Hinges: Steel pins
   b. Non-Ferrous Hinges: Stainless steel pins
   c. Out-Swinging Exterior Doors: Non-removable pins
   d. Out-Swinging Interior Lockable Doors: Non-removable pins
   e. Interior Non-lockable Doors: Non-rising pins

9. Provide hinges with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component. Provide mortar guard for each electrified hinge specified.

2.04 CONTINUOUS HINGES

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Ives

2. Acceptable Manufacturers:
   a. Select
   b. Best
   c. Roton
   d. ABH
   e. Hager

B. Requirements:

1. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
2. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum.
3. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
4. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
5. On fire-rated doors, provide aluminum geared continuous hinges classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
6. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
7. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

2.05 ELECTRIC POWER TRANSFER

A. Manufacturers:

1. Scheduled Manufacturer and Product:
   a. Von Duprin EPT-10

2. Acceptable Manufacturers and Products:
   a. ABH PT1000

b. Securitron CEPT-10
c. Security Door Controls PTM
d. Precision EPT-12C

B. Requirements:

1. Provide power transfer with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
2. Locate electric power transfer per manufacturer's template and UL requirements, unless interference with operation of door or other hardware items.

2.06 FLUSH BOLTS

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Ives

2. Acceptable Manufacturers:
   a. Burns
   b. Rockwood
   c. DCI
   d. Trimco
   e. Don-Jo
   f. Hager

B. Requirements:

1. Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless-steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide dust-proof strikes at each bottom flush bolt.

2.07 COORDINATORS

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Ives

2. Acceptable Manufacturers:
   a. Burns
   b. Rockwood
   c. DCI
   d. Trimco

e. Don-Jo
f. Hager

B. Requirements:

1. Where pairs of doors are equipped with automatic flush bolts, an astragal, or other hardware that requires synchronized closing of the doors, provide bar-type coordinating device, surface applied to underside of stop at frame head.
2. Provide filler bar of correct length for unit to span entire width of opening, and appropriate brackets for parallel arm door closers, surface vertical rod exit device strikes, or other stop mounted hardware. Factory-prepared coordinators for vertical rod devices as specified.

2.08 CYLINDRICAL LOCKS – GRADE 1

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
   a. Schlage ND series

B. Requirements:

1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 1, and UL Listed for 3-hour fire doors.
2. Cylinders: Refer to "KEYING" article, herein.
3. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2-inch latch throw. Provide proper latch throw for UL listing at pairs.
4. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
5. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
7. Provide electrified options as scheduled in the hardware sets.
8. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.
   a. Lever Design: Rhodes

2.09 EXIT DEVICES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
   a. Von Duprin 98/35A series

B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
2. Cylinders: Refer to "KEYING" article, herein.
3. Provide smooth touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
4. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
5. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
6. Provide exit devices with weather resistant components that can withstand harsh conditions of various climates and corrosive cleaners used in outdoor pool environments.
7. Provide flush end caps for exit devices.
8. Provide exit devices with manufacturer's approved strikes.
9. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
10. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
11. Provide cylinder or hex-key dogging as specified at non fire-rated openings.
12. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
13. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
14. Provide electrified options as scheduled.
15. Top latch mounting: double- or single-tab mount for steel doors, face mount for aluminum doors eliminating requirement of tabs, and double tab mount for wood doors.
16. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.

2.10 CYLINDERS

A. Manufacturers:

1. Scheduled Manufacturer and Product:
   a. Match Existing Key System

2. Acceptable Manufacturers and Products:
   a. No Substitute

B. Requirements:

1. Provide cylinders/cores to match Owner’s existing key system, compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset, manufacturer’s series as indicated. Refer to “KEYING” article, herein.

2.11 KEYING

1. Existing factory registered system:
   a. Provide cylinders/cores keyed into Owner's existing factory registered keying system. Comply with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

B. Requirements:

1. Permanent Keying:
   a. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
      1) Master Keying system as directed by the Owner.
   b. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements will be cause for replacement of cylinders/cores involved at no additional cost to Owner.
   c. Provide keys with the following features:
      1) Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
      2) Patent Protection: Keys and blanks protected by one or more utility patent(s).
      3) Geographically Exclusive: Where High Security or Security cylinders/cores are indicated, provide nationwide, geographically exclusive key system complying with the following restrictions.
   d. Identification:
      1) Mark permanent cylinders/cores and keys with applicable blind code for identification. Do not provide blind code marks with actual key cuts.
      2) Identification stamping provisions must be approved by the Architect and Owner.
      3) Failure to comply with stamping requirements will be cause for replacement of keys involved at no additional cost to Owner.
      4) Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.
   e. Quantity: Furnish in the following quantities.
      1) Change (Day) Keys: 3 per cylinder/core.
      2) Permanent Control Keys: 3.
      3) Master Keys: 6.

2.12 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
   a. LCN 4040XP series

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.

2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2-inch (38 mm) diameter piston with 5/8-inch (16 mm) diameter double heat-treated pinion journal. QR code with a direct link to maintenance instructions.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards. Provide snap-on cover clip, with plastic covers, that secures cover to spring tube.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck. Provide graphically labelled instructions on the closer body adjacent to each adjustment valve. Provide positive stop on reg valve that prevents reg screw from being backed out.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.13 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Ives

2. Acceptable Manufacturers:
   a. Burns
   b. Trimco
   c. Rockwood

B. Requirements:

1. Provide protection plates with a minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes plates 2 inches (51 mm) less width of door on single doors, pairs of doors with a mullion, and doors with edge guards. Size plates 1 inch (25 mm) less width of door on pairs without a mullion or edge guards.
3. At fire rated doors, provide protection plates over 16 inches high with UL label.

2.14 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

1. Scheduled Manufacturers:
   a. Glynn-Johnson

2. Acceptable Manufacturers:
   a. Rixson
   b. Sargent
   c. ABH

B. Requirements:

1. Provide overhead stop at any door where conditions do not allow for a wall stop or floor stop presents tripping hazard.
2. Provide friction type at doors without closer and positive type at doors with closer.

2.15 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Ives

2. Acceptable Manufacturers:
   a. Trimco
   b. Burns
   c. Rockwood

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide concave type where lockset has a push button of thumbturn.
2. Where a wall stop cannot be used, provide universal floor stops.
3. Where wall or floor stop cannot be used, provide overhead stop.
4. Provide roller bumper where doors open into each other and overhead stop cannot be used.

2.16 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Zero International

2. Acceptable Manufacturers:

a. National Guard
b. Reese
c. Legacy
d. Pemko

B. Requirements:

1. Provide thresholds, weather-stripping, and gasketing systems as specified and per architectural details. Match finish of other items.
2. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.
4. Size thresholds 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width unless otherwise specified in the hardware sets or detailed in the drawings.

2.17 FINISHES

A. FINISH: BHMA 626/652 (US26D); EXCEPT:

1. Hinges at Exterior Doors: BHMA 630 (US32D)
2. Aluminum Geared Continuous Hinges: BHMA 628 (US28)
3. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
4. Protection Plates: BHMA 630 (US32D)
5. Overhead Stops and Holders: BHMA 630 (US32D)
6. Door Closers: Powder Coat to Match
7. Wall Stops: BHMA 630 (US32D)
8. Latch Protectors: BHMA 630 (US32D)
9. Weatherstripping: Clear Anodized Aluminum
10. Thresholds: Mill Finish Aluminum

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance. Verify doors, frames, and walls have been properly reinforced for hardware installation.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Submit a list of deficiencies in writing and proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Interior Architectural Wood Flush Doors: ANSI/WDMA I.S. 1A
4. Installation Guide for Doors and Hardware: DHI TDH-007-20

B. Install door hardware in accordance with NFPA 80, NFPA 101 and provide post-install inspection, testing as specified in section 1.03.E unless otherwise required to comply with governing regulations.

C. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.

D. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

E. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

F. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

G. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.

H. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated.

I. Lock Cylinders:

1. Install construction cores to secure building and areas during construction period.
2. Replace construction cores with permanent cores as indicated in keying section.
3. Furnish permanent cores to Owner for installation.

J. Wiring: Coordinate with Division 26, ELECTRICAL and Division 28 ELECTRONIC SAFETY AND SECURITY sections for:

1. Conduit, junction boxes and wire pulls.
2. Connections to and from power supplies to electrified hardware.
3. Connections to fire/smoke alarm system and smoke evacuation system.
4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.

5. Connections to panel interface modules, controllers, and gateways.
6. Testing and labeling wires with Architect's opening number.

K. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

L. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.

M. Closer/Holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.

N. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.

O. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

P. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.

Q. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

R. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

S. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

3.03 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Spring Hinges: Adjust to achieve positive latching when door can close freely from an open position of 30 degrees.
2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

3.04 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items per manufacturer's instructions to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.05 DOOR HARDWARE SCHEDULE

A. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.

B. Discrepancies, conflicting hardware, and missing items are to be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application.

C. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.

D. Hardware Sets:

Hardware Group No. 01

For use on Door #(s):

105	117	118	119	129	130
131	132	144			

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 (QTY, SIZE, WEIGHT, NRP AS REQ)	652	IVE
1	EA	PRIVACY LOCK	ND40S RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

Hardware Group No. 02

For use on Door #(s):

141	145

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	HINGE	5BB1 (QTY, SIZE, WEIGHT, NRP AS REQ)	652	IVE
1	EA	ENTRANCE LOCK	ND53LD RHO	626	SCH
1	EA	CYLINDER(S)	MATCH EXISTING KEY SYSTEM AS DIRECTED BY OWNER		
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

Hardware Group No. 02.1

For use on Door #(s):
110 148 149 151

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	HINGE	5BB1 (QTY, SIZE, WEIGHT, NRP AS REQ)	652	IVE
1	EA	ENTRANCE LOCK	ND53LD RHO	626	SCH
1	EA	CYLINDER(S)	MATCH EXISTING KEY SYSTEM AS DIRECTED BY OWNER		
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	MORTISED AUTO DOOR BOTTOM	369AA	AA	ZER

Hardware Group No. 03

For use on Door #(s):
101 121B

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	HINGE	5BB1 (QTY, SIZE, WEIGHT, NRP AS REQ)	652	IVE
1	EA	CLASSROOM LOCK	ND70LD RHO	626	SCH
1	EA	CYLINDER(S)	MATCH EXISTING KEY SYSTEM AS DIRECTED BY OWNER		
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

Hardware Group No. 03.1

For use on Door #(s):
150

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	HINGE	5BB1 (QTY, SIZE, WEIGHT, NRP AS REQ)	652	IVE
1	EA	CLASSROOM LOCK	ND70LD RHO	626	SCH
1	EA	CYLINDER(S)	MATCH EXISTING KEY SYSTEM AS DIRECTED BY OWNER		
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	MORTISED AUTO DOOR BOTTOM	369AA	AA	ZER

Hardware Group No. 04 - Not Used

Hardware Group No. 05

For use on Door #(s):
108A 110A 121C 142A

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	HINGE	5BB1 (QTY, SIZE, WEIGHT, NRP AS REQ)	652	IVE
1	EA	STOREROOM LOCK	ND80LD RHO	626	SCH
1	EA	CYLINDER(S)	MATCH EXISTING KEY SYSTEM AS DIRECTED BY OWNER		
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

Hardware Group No. 06

For use on Door #(s):
106 107 109 116 133

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	HINGE	5BB1 (QTY, SIZE, WEIGHT, NRP AS REQ)	652	IVE
1	EA	STOREROOM LOCK	ND80LD RHO	626	SCH
1	EA	CYLINDER(S)	MATCH EXISTING KEY SYSTEM AS DIRECTED BY OWNER		
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

Hardware Group No. 07

For use on Door #(s):
102 142B

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	EXTERIOR HINGE	5BB1 (SIZE, QTY, WEIGHT, NRP AS REQ)	630	IVE
1	SET	CONST LATCHING BOLT	FB51P / FB61P	630	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2 AS REQ	626	IVE
1	EA	STOREROOM LOCK	ND80LD RHO	626	SCH
1	EA	CYLINDER(S)	MATCH EXISTING KEY SYSTEM AS DIRECTED BY OWNER		
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	RAIN DRIP	142AA	AA	ZER
1	EA	TWO PIECE MEETING STILE	328AA-S	AA	ZER
1	SET	GASKETING SET	429AA-S	AA	ZER
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A - OR AS REQUIRED BY SILL DETAIL	A	ZER

Hardware Group No. 08

For use on Door #(s):
103 104

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	EXTERIOR HINGE	5BB1 (SIZE, QTY, WEIGHT, NRP AS REQ)	630	IVE
1	EA	STOREROOM LOCK	ND80LD RHO	626	SCH
1	EA	CYLINDER(S)	MATCH EXISTING KEY SYSTEM AS DIRECTED BY OWNER		
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	SET	GASKETING SET	429AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A - OR AS REQUIRED BY SILL DETAIL	A	ZER

Hardware Group No. 09

For use on Door #(s):
121A 135A

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	EXTERIOR HINGE	5BB1 (SIZE, QTY, WEIGHT, NRP AS REQ)		630	IVE
1	EA	POWER TRANSFER	EPT10	↯	689	VON
1	EA	DELAYED PANIC HARDWARE	CX98-NL-SNB 24 VDC	↯	626	VON
2	EA	CYLINDER(S)	MATCH EXISTING KEY SYSTEM AS DIRECTED BY OWNER			
1	EA	SURFACE CLOSER	4040XP SCUSH		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	RAIN DRIP	142AA		AA	ZER
1	SET	GASKETING SET	429AA-S		AA	ZER
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	655A - OR AS REQUIRED BY SILL DETAIL		A	ZER
1	EA	DOOR POSITION SWITCH	PROVIDED BY SECURITY CONTRACTOR			
	EA	LOW VOLTAGE POWER	PROVIDED BY SECURITY CONTRACTOR	↯		

Hardware Group No. AL-01

For use on Door #(s):
134A

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY/224XY EPT (AS REQ'D)		628	IVE
1	EA	POWER TRANSFER	EPT10	✓	689	VON
1	EA	DELAYED PANIC HARDWARE	CX98-L-06-SNB 24 VDC	✓	626	VON
2	EA	CYLINDER(S)	MATCH EXISTING KEY SYSTEM AS DIRECTED BY OWNER			
1	EA	SURFACE CLOSER	4040XP SCUSH		689	LCN
1	SET	SWEEPS	BY ALUM DOOR/FRAME MANUFACTURER			
1	SET	SEALS	BY ALUM DOOR/FRAME MANUFACTURER			
1	EA	DOOR POSITION SWITCH	PROVIDED BY SECURITY CONTRACTOR			
	EA	LOW VOLTAGE POWER	PROVIDED BY SECURITY CONTRACTOR	✓		

Hardware Group No. AL-01.1

For use on Door #(s):
122C

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY/224XY EPT (AS REQ'D)		628	IVE
1	EA	POWER TRANSFER	EPT10	↯	689	VON
1	EA	DELAYED PANIC HARDWARE	CX98-L-06-SNB 24 VDC	↯	626	VON
2	EA	CYLINDER(S)	MATCH EXISTING KEY SYSTEM AS DIRECTED BY OWNER			
1	EA	SURFACE CLOSER	4040XP SCUSH		689	LCN
1	SET	SWEEPS	BY ALUM DOOR/FRAME MANUFACTURER			
1	SET	SEALS	BY ALUM DOOR/FRAME MANUFACTURER			
1	EA	THRESHOLD	655A - OR AS REQUIRED BY SILL DETAIL		A	ZER
1	EA	DOOR POSITION SWITCH	PROVIDED BY SECURITY CONTRACTOR			
	EA	LOW VOLTAGE POWER	PROVIDED BY SECURITY CONTRACTOR	↯		

Hardware Group No. AL-02

For use on Door #(s):
108B 134B 147B 152B

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112XY/224XY (AS REQ'D)	628	IVE
1	EA	PANIC HARDWARE	35A-NL	626	VON
1	EA	CYLINDER(S)	MATCH EXISTING KEY SYSTEM AS DIRECTED BY OWNER		
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	SET	SWEEPS	BY ALUM DOOR/FRAME MANUFACTURER		
1	SET	SEALS	BY ALUM DOOR/FRAME MANUFACTURER		
1	EA	THRESHOLD	655A - OR AS REQUIRED BY SILL DETAIL	A	ZER

Hardware Group No. AL-02.1

For use on Door #(s):
134C

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112XY/224XY (AS REQ'D)	628	IVE
1	EA	PANIC HARDWARE	35A-L-06	626	VON
1	EA	CYLINDER(S)	MATCH EXISTING KEY SYSTEM AS DIRECTED BY OWNER		
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	SET	SWEEPS	BY ALUM DOOR/FRAME MANUFACTURER		
1	SET	SEALS	BY ALUM DOOR/FRAME MANUFACTURER		

Hardware Group No. AL-03

For use on Door #(s):
147A 152A

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112XY/224XY (AS REQ'D)	628	IVE
1	EA	DUMMY PUSH BAR & DOOR PULL	350-990DT	626	VON
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	689	LCN
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	SET	SWEEPS	BY ALUM DOOR/FRAME MANUFACTURER		
1	SET	SEALS	BY ALUM DOOR/FRAME MANUFACTURER		

Hardware Group No. MANUF

For use on Door #(s):
100A 100B 111 135B 140

Provide each RU door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR

ALL HARDWARE PROVIDED BY MANUFACTURER

END OF SECTION

SECTION 093013 - CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Porcelain tile.
2. Ceramic mosaic tile.
3. Glazed wall tile.
4. Tile backing panels.
5. Waterproof membranes.
6. Crack isolation membranes.
7. Setting material.
8. Grout materials.

1.2 DEFINITIONS

A. General: Definitions in ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. Face Size: Actual tile size, excluding spacer lugs.

C. Large Format Tile: Tile with at least one edge 15 inches or longer.

D. Module Size: Actual tile size plus joint width indicated.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Porcelain tile.
2. Ceramic mosaic tile.
3. Glazed wall tile.
4. Waterproof membranes.
5. Grout materials.

B. Samples for Initial Selection: For tile, grout, and accessories involving color selection or shade variation.

C. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.

2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches square , but not fewer than four tiles. Use grout of type and in color or colors approved for completed Work.
3. Full-size units of each type of trim and accessory for each color and finish required.
4. Metal flooring transitions 6-inch lengths.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of product, including product use classification.

B. Product Test Reports:

1. Tile-setting and -grouting products.
2. Certified porcelain tile.
3. Slip-resistance test reports from qualified independent testing agency.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Material: Furnish extra materials, from the same production run, to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.6 QUALITY ASSURANCE

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in "Referenced Standards" Article in the Evaluations and manufacturer's written instructions.

1.9 WARRANTY

A. System Warranty: Manufacturer's non-prorated comprehensive warranty that agrees to repair and replace defective installation areas, material, and labor that fail under normal usage within specified warranty period.

1. Warranty Period: 25 years from date of Product Purchase.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard Grade requirements unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

E. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.2 QUARRY TILE

2.3 PORCELAIN TILE

A. Porcelain Tile Type CT-1 : Unglazed .

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Crossville, Inc.
   b. Daltile; a brand of Dal-Tile Corporation.
   c. Florida Tile, Inc.
2. Certification: Tile certified by the Porcelain Tile Certification Agency.
3. Face Size: 12 by 24 inches .
4. Thickness: per manufacturer .
5. Product Use Classification: Interior, Wet (IW) .
6. Tile Color, Glaze, and Pattern: As indicated by manufacturer's designations As selected by Architect from manufacturer's full range .
7. Grout Color: As selected by Architect from manufacturer's full range .
8. Precoat with temporary protective coating.
9. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
   a. Base Cap: Surface bullnose, module size same as adjoining flat tile .
   b. Wainscot Cap: Surface bullnose, module size same as adjoining flat tile .
   c. Wainscot Cap for Flush Conditions: Regular flat tile for conditions where tile wainscot is shown flush with wall surface above it; same size as adjoining flat tile.
   d. External Corners: Surface bullnose, module size same as adjoining flat tile .
   e. Internal Corners: Field-butted square corners.
   f. Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finishes of different thickness, tapered to provide reduction in thickness from 1/2 to 1/4 inch across nominal 4-inch dimension.

2.4 CERAMIC MOSAIC TILE

A. Ceramic Mosaic Tile Type CT-2 : Glazed .

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Crossville, Inc.
   b. Daltile; a brand of Dal-Tile Corporation.
   c. Garden State Tile.
   d. Tilebar.
2. Module Size: 3 by 8 inches .
3. Thickness: per manufacturer.
4. Face: Pattern of design indicated, with cushion edges.
5. Product Use Classification: Interior, Wet (IW) .
6. Tile Color and Pattern: As selected by Architect from manufacturer's full range .
7. Grout Color: As selected by Architect from manufacturer's full range .
8. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable. Provide shapes as follows, selected from manufacturer's standard shapes:

a. Base Cove: Cove, module size match wall tile dimensions .
b. External Corners for Portland Cement Mortar Installations: Bead (bullnose), module size match wall tile dimensions .
c. External Corners for Thinset Mortar Installations: Surface bullnose, module size match wall tile dimensions .
d. Internal Corners:
    1) Cove, module size match wall tile dimensions .
    2) Field-butted square corners. For coved base and cap, use angle pieces designed to fit with stretcher shapes.
e. Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finishes of different thickness, tapered to provide reduction in thickness from 1/2 to 1/4 inch across nominal 4-inch dimension.

B. Ceramic Mosaic Tile Type CT-3 Unglazed

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Crossville, Inc.
    b. Daltile; a brand of Dal-Tile Corporation.
    c. Garden State Tile.
    d. Tilebar.
2. Module Size: 5 by 7 inches
3. Thickness: by manufacturer.
4. Face: Plain with cushion edges.
5. Surface: Smooth, without abrasive admixture.
6. Product Use Classification: Interior, Wet (IW)
7. Tile Color and Pattern: As selected by Architect from manufacturer's full range
8. Grout Color: As selected by Architect from manufacturer's full range

C. Ceramic Tile Type CT-4 unglazed

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Crossville, Inc.
    b. Daltile; a brand of Dal-Tile Corporation.
    c. Garden State Tile.
    d. Tilebar.
2. Module size: 6 by 12 inches
3. Thickness: by manufacturer
4. Face: plain with cushion edges
5. Surface: Smooth, without abrasive admixture
6. Product Use Classification: Interior, Wet (IW)
7. Tile Color and Pattern: As selected by Architect from manufacturer's full range
8. Grout Color: As selected by Architect from manufacturer's full range
9. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
    a. Base Cove: Cove, module size match wall tile dimensions

2.5 WATERPROOF MEMBRANES

A. General: Manufacturer's standard product , selected from the following, that complies with ANSI A118.10 and ANSI A118.12 and is recommended by manufacturer for application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Waterproof Membrane, Sheet: Polyethylene sheet faced on one or both sides with polyester fabric.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. MAPEI Corporation.
   b. Schluter Systems L.P.
   c. Schonox HPS North America, Inc.
2. Nominal Thickness: 0.02 inch .

C. Waterproof Membrane, Fluid Applied: Liquid-latex rubber or elastomeric polymer with continuous fabric reinforcement.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Bostik; Arkema.
   b. MAPEI Corporation.
   c. Sika Corporation.

2.6 GROUT MATERIALS

A. Sand-Portland Cement Grout: ANSI A108.10, consisting of white or gray cement and white or colored aggregate as required to produce color indicated.

B. Standard Cement Grout: ANSI A118.6.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. MAPEI Corporation.
   b. Sakrete; CRH Americas, Oldcastle APG.
   c. Sika Corporation.

C. High-Performance Tile Grout: ANSI A118.7.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. ARDEX Americas.
   b. Custom Building Products.
   c. H.B. Fuller Construction Products Inc. / TEC.

d. MAPEI Corporation.

2. Polymer Type:
   a. Dry, redispersible form, prepackaged with other dry ingredients.
   b. Liquid-latex form for addition to prepackaged dry-grout mix.

D. Water-Cleanable Epoxy Grout: ANSI A118.3 , with a VOC content of 65 g/L or less.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. MAPEI Corporation.
   b. Sika Corporation.
   c. Southern Grouts & Mortars, Inc.
2. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F, respectively, and certified by manufacturer for intended use.

E. Chemical-Resistant Furan Grout: ANSI A118.5, with carbon filler.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Atlas Minerals & Chemicals, Inc.
   b. Sauereisen.
   c. Summitville Tiles, Inc.

F. Grout for Pregrouted Tile Sheets: Same product used in factory to pregrout tile sheets.

2.7 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting and adhesive materials for installations indicated.

B. Vapor-Retarder Membrane: Polyethylene sheeting, ASTM D4397, 4.0 mils thick.

C. Metal Flooring Transitions: Profile designed specifically for flooring applications; height to match tile and setting-bed thickness.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Blanke Corporation.
   b. Profilitec Corp.
   c. Schluter Systems L.P.
2. Description: L-shaped Square .
3. Material and Finish: Metallic or combination of metal and PVC or neoprene base; polished chrome anodized aluminum polished nickel anodized aluminum color-coated aluminum exposed-edge material.
   a. Color: Architect selected from manufacturers range .

D. Metal Edge Trim: Profile designed for wall terminations and edge protection.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Dural USA, Inc.
   b. Profilitec Corp.
   c. Schluter Systems L.P.
2. Description: L-shaped Square Beveled .
3. Terminations: End caps Inside corners Outside corners matching edge-protection profile.
4. Material and Finish: Polished nickel anodized aluminum Color-coated aluminum exposed-edge material.
   a. Color: Architect selected from manufacturers range .

E. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

F. Grout Sealer: Grout manufacturer's standard product for sealing grout joints that does not change color or appearance of grout.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with adhesives bonded mortar bed or thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
   a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
   b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove coatings, including curing compounds or other coatings, that are incompatible with tile-setting materials.

B. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives or thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

C. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1 and is sloped 1/4 inch per foot toward drains.

D. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

E. Substrate Flatness:

1. For tile shorter than 15 inches, confirm that structure or substrate is limited to variation of 1/4 inch in 10 ft. from the required plane, and no more than 1/16 inch in 12 inches when measured from tile surface high points.
2. For large format tile, tile with at least one edge 15 inches or longer, confirm that structure or substrate is limited to 1/8 inch in 10 ft. from the required plane, and no more than 1/16 inch in 24 inches when measured from tile surface high points.

F. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 INSTALLATION OF CERAMIC TILE SYSTEM

A. Install tile backing panels and treat joints in accordance with ANSI A108.11 and manufacturer's written instructions for type of application indicated.

B. Install waterproof membrane to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.

1. Allow waterproof membrane to cure and verify by testing that it is watertight before installing tile or setting materials over it.

C. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.

1. Allow crack isolation membrane to cure before installing tile or setting materials over it.

D. Mix mortars and grouts to comply with "Referenced Standards" Article in the Evaluations and mortar and grout manufacturers' written instructions.

1. Add materials, water, and additives in accurate proportions.
2. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

E. Install tile in accordance with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of ANSI A108 series that are referenced in TCNA installation methods and specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
   a. Exterior tile floors and walls.
   b. Tile floors in wet areas.
   c. Tile swimming pool decks.
   d. Tile floors in laundries.
   e. Tile floors consisting of tiles 8 by 8 inches or larger.
   f. Tile floors consisting of rib-backed tiles.
2. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
3. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
4. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
5. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.
6. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
   a. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets, so joints between sheets are not apparent in finished Work.
   b. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
   c. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

7. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

F. Movement Joints: Provide movement joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated on Drawings. Form joints during installation of setting materials, mortar beds, and tile. Keep joints free of dirt, debris, and setting materials prior to filling with sealants. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

G. Metal Flooring Transitions: Install at locations indicated where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.

H. Metal Wall Trim: Install at locations indicated on Drawings.

I. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors in accordance with manufacturer's written instructions. As soon as sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 ADJUSTING AND CLEANING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile in accordance with tile and grout manufacturer's written instructions. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.5 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.6 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:

1. TCNA F111 : Method ANSI A108.1A ANSI A108.1B ANSI A108.1C. Cement mortar bed (thickset) installed over cleavage membrane.
   a. Ceramic Tile Type: All CT-1 .
   b. Bond Coat for Cured-Bed Method: Dry-set mortar.
   c. Grout: High-performance sanded cement grout.
   d. Joint Width: 1/8 inch .
   e. Movement Joints: Types located on Drawings.
2. TCNA F125-Full : Thinset mortar on crack isolation membrane.
   a. Ceramic Tile Type: CT-1 .
   b. Thinset Mortar: mortar.
   c. Grout: High-performance sanded cement grout.
   d. Crack Isolation Membrane: As recommended by setting material manufacturer .
   e. Joint Width: 1/8 inch .

B. Interior Wall Installations, Wood or Metal Studs or Furring:

1. TCNA W242 : Organic adhesive on gypsum board.
   a. Ceramic Tile Type: All .
   b. Grout: High-performance sanded cement grout.
   c. Joint Width: 1/8 inch .
   d. Movement Joints: Types located on Drawings.
2. TCNA W245 : Thinset mortar on glass-mat, water-resistant gypsum backer board over waterproof membrane.
   a. Ceramic Tile Type: All .
   b. Thinset Mortar: Dry-set mortar.
   c. Grout: High-performance sanded cement grout.
   d. Waterproof Membrane: As recommended by setting material manufacturer [**Fabric-reinforced, fluid-applied membrane**].
   e. Joint Width: 1/8 inch .
   f. Movement Joints: Types located on Drawings.

END OF SECTION 093013

SECTION 263213.13 - DIESEL-ENGINE-DRIVEN GENERATOR SETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Diesel engine.
2. Diesel fuel-oil system.
3. Control and monitoring.
4. Generator overcurrent and fault protection.
5. Generator, exciter, and voltage regulator.
6. Load bank.
7. Outdoor engine generator enclosure.
8. Remote radiator motors.
9. Vibration isolation devices.

B. Related Requirements:

1. Section 263600 "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine generators.

1.3 DEFINITIONS

A. EPS: Emergency power supply.

B. EPSS: Emergency power supply system.

C. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Tier 4 Emission verification
2. Buy American qualification or associated waiver for equivalent.

3. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
4. Include thermal damage curve for generator.
5. Include time-current characteristic curves for generator protective device.
6. Include fuel consumption in gallons per hour (liters per hour) at 0.8 power factor at 0.5, 0.75, and 1.0 times generator capacity.
7. Include generator efficiency at 0.8 power factor at 0.5, 0.75, and 1.0 times generator capacity.
8. Include airflow requirements for cooling and combustion air in cubic feet per minute (cubic meters per minute) at 0.8 power factor, with air-supply temperature of 95, 80, 70, and 50 deg F (35, 27, 21, and 10 deg C). Provide Drawings indicating requirements and limitations for location of air intake and exhausts.
9. Include generator characteristics, including, but not limited to, kilowatt rating, efficiency, reactances, and short-circuit current capability.

B. Shop Drawings:

1. Include plans and elevations for engine generator and other components specified. Indicate access requirements affected by height of subbase fuel tank.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Identify fluid drain ports and clearance requirements for proper fluid drain.
4. Design calculations for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
5. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include base weights.
6. Include diagrams for power, signal, and control wiring. Complete schematic, wiring, and interconnection diagrams showing terminal markings for engine generators and functional relationship between all electrical components.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For **Installer, manufacturer and testing agency**.

B. Seismic Qualification Data: Certificates, for engine generator, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: With engine and generator mounted on rails, identify center of gravity and total weight**, including full double walled fuel tank**, and each piece of equipment not integral to the engine generator, and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Source Quality-Control Reports: Including, but not limited to, the following:

1. Certified summary of prototype-unit test report.
2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
3. Certified Summary of Performance Tests: Certify compliance with specified requirement to meet performance criteria for sensitive loads.
4. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
5. Report of sound generation.
6. Report of exhaust emissions showing compliance with applicable regulations.
7. Certified Torsional Vibration Compatibility: Comply with NFPA 110.

D. Field quality-control reports.

E. Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

    a. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.
    b. Operating instructions laminated and mounted adjacent to generator location.
    c. Training plan.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: One for every 10 of each type and rating, but no fewer than one of each.
2. Indicator Lamps: Two for every six of each type used, but no fewer than two of each.
3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.
4. Tools: Each tool listed by part number in operations and maintenance manual.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

B. Testing Agency Qualifications: Accredited by NETA.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.9 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Kohler 150REOZJ4 with 4S12X Alternator

B. Source Limitations: Obtain packaged engine generators and auxiliary components from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Engine generator housing**,** engine generator, batteries, battery racks, silencers, sound attenuating equipment, accessories, and components shall withstand the effects of earthquake motions determined according to **ASCE/SEI 7**.

1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified **and the unit will be fully operational after the seismic event**."
2. Shake-table testing shall comply with ICC-ES AC156. Testing shall be performed with all fluids at worst-case normal levels. **Water shall be substituted for diesel fuel in fuel tank during test.**

For life-safety components required to function after an earthquake (such as fire-sprinkler systems, components that contain hazardous content, and storage racks in structures open to the public), the Component Importance Factor is 1.5. For other components, the Component Importance Factor is 1.0 unless the structure is in Seismic Use Group III and component is necessary for continued operation of facility or failure of component could impair continued operation of facility, in which case the Component Importance Factor is 1.5.

3. Component Importance Factor: **1.0**.

B. B11 Compliance: Comply with B11.19.

C. NFPA Compliance:

1. Comply with NFPA 37.

2. Comply with NFPA 70.
3. Comply with NFPA 99.

D. UL Compliance: Comply with UL 2200.

E. Engine Exhaust Emissions: Comply with EPA Tier **4** requirements and applicable state and local government requirements.

F. Noise Emission: Comply with **applicable state and local government requirements** for maximum noise level at **adjacent property boundaries** due to sound emitted by engine generator including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

G. Environmental Conditions: Engine generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: **5 to 104 deg F (Minus 15 to plus 40 deg C)**.
2. Relative Humidity: Zero to 95 percent.
3. Altitude: Sea level to **1000 feet (300 m)**

2.3 ENGINE GENERATOR ASSEMBLY DESCRIPTION

A. Factory-assembled and -tested, water-cooled engine, with brushless generator and accessories.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

C. Power Rating: **Standby**.

D. Overload Capacity: 110 percent of service load for 1 hour in 12 consecutive hours.

E. Service Load: 150 kVA.

F. Power Factor: **0.8** lagging.

G. Frequency: 60 Hz.

H. Voltage: **208** V ac.

I. Phase: Three-phase, **four** wire, **wye**

J. Induction Method: **Turbocharged**.

K. Governor: Adjustable isochronous, with speed sensing.

L. Mounting Frame: Structural steel framework to maintain alignment of mounted components without depending on concrete foundation. Provide lifting attachments sized and spaced to prevent deflection of base during lifting and moving.

1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and engine generator center of gravity.

M. Capacities and Characteristics:

1. Power Output Ratings: Nominal ratings as indicated at 0.8 power factor excluding power required for the continued and repeated operation of the unit and auxiliaries
2. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.

N. Engine Generator Performance:

1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
5. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
7. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.

2.4 DIESEL ENGINE

A. Fuel: ASTM D975, diesel fuel oil, Grade 2-D S15.

B. Rated Engine Speed: 1800 rpm.

C. Lubrication System: Engine or skid-mounted.

1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.

3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

D. Integral Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine generator set mounting frame and integral engine-driven coolant pump.

1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
3. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
4. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
5. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, UV-, and abrasion-resistant fabric.

    a. Rating: 50-psig (345-kPa) maximum working pressure with coolant at 180 deg F (82 deg C), and noncollapsible under vacuum.
    b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

E. Starting System: **24**-V electric, with negative ground.

1. Components: Sized so they are not damaged during a full engine-cranking cycle with ambient temperature at maximum specified in "Performance Requirements" Article.
2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
3. Cranking Cycle: **As required by NFPA 110 for system level specified**
4. Battery: **Lead acid** or **Nickel cadmium**, with capacity within ambient temperature range specified in "Performance Requirements" Article to provide specified cranking cycle at least **twice** without recharging.
5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater shall be arranged to maintain battery above 50 deg F (10 deg C) regardless of external ambient temperature within range specified in "Performance Requirements" Article. Include accessories required to support and fasten batteries in place. Provide ventilation to exhaust battery gases.
7. Battery Stand: Factory-fabricated, two-tier metal with acid-resistant finish designed to hold the quantity of battery cells required and to maintain the arrangement to minimize lengths of battery interconnections.
8. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
9. Battery Charger: Current-limiting, automatic-equalizing, and float-charging type designed for **lead-acid** or **nickel-cadmium** batteries. Unit shall comply with UL 1236 and include the following features:

a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 to 140 deg F (minus 40 to plus 60 deg C) to prevent overcharging at high temperatures and undercharging at low temperatures.
c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

2.5 DIESEL FUEL-OIL SYSTEM

A. Comply with NFPA 37.

B. Piping: Fuel-oil piping shall be Schedule 40 black steel, complying with requirements in Section 231113 "Facility Fuel-Oil Piping." Cast iron, aluminum, copper, and galvanized steel shall not be used in the fuel-oil system.

C. Main Fuel Pump: Mounted on engine to provide primary fuel flow under starting and load conditions.

D. Fuel Filtering: Remove water and contaminants larger than 1 micron.

E. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.

1. Fuel Tank Capacity: 24 hours.

2.6 CONTROL AND MONITORING

A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of engine generator. When mode-selector switch is switched to the on position, engine generator starts. The off position of same switch initiates engine generator shutdown. When engine generator is running, specified system or equipment failures or derangements automatically shut down engine generator and initiate alarms.

B. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts engine generator. The off position of same switch initiates engine generator shutdown. When engine generator is running, specified system or equipment failures or derangements automatically shut down engine generator and initiate alarms.

C. Provide minimum run time control set for **15** > minutes with override only by operation of a remote emergency-stop switch.

D. Comply with UL 508A.

E. Configuration:

1. Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the engine generator. Mounting method shall isolate the control panel from engine generator vibration. Panel shall be powered from the engine generator battery.
2. Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common wall-mounted control and monitoring panel. Panel shall be powered from the engine generator battery.
3. Operating and safety indications, protective devices, basic system controls, engine gages, instrument transformers, generator disconnect switch or circuit breaker, and other indicated components shall be grouped in a combination control and power panel. Control and monitoring section of panel shall be isolated from power sections by steel barriers. Panel shall be powered from the engine generator battery. Panel features shall include the following:

    a. Wall-Mounting Cabinet Construction: Rigid, self-supporting steel unit complying with NEMA ICS 6.
    b. Switchboard Construction: Freestanding unit complying with Section 262413 "Switchboards." Power bus shall be copper. Bus, bus supports, control wiring, and temperature rise shall comply with UL 891.
    c. Switchgear Construction: Freestanding unit complying with Section 262300 "Low-Voltage Switchgear."

F. Control and Monitoring Panel:

1. Digital engine generator controller with integrated LCD display, controls, and microprocessor, capable of local and remote control, monitoring, and programming, with battery backup.
2. Analog control panel with dedicated gages and indicator lights for the instruments and alarms indicated below.
3. Instruments: Located on the control and monitoring panel and viewable during operation.

    a. Engine-coolant temperature gage.
    b. DC voltmeter (alternator battery charging).
    c. Running-time meter.
    d. AC voltmeter, **for each phase**
    e. AC ammeter, **for each phase**
    f. AC frequency meter.

g. Generator-voltage adjusting rheostat.

4. Controls and Protective Devices: Controls, shutdown devices, and common alarm indication, including the following:

a. Cranking control equipment.
b. Run-Off-Auto switch.
c. Control switch not in automatic position alarm.
d. Overcrank alarm.
e. Overcrank shutdown device.
f. Low-water temperature alarm.
g. High engine temperature prealarm.
h. High engine temperature.
i. High engine temperature shutdown device.
j. Overspeed alarm.
k. Overspeed shutdown device.
l. Low fuel main tank.

1) Low-fuel-level alarm shall be initiated when the level falls below that required for operation for duration required

m. Coolant low-level alarm.
n. Coolant low-level shutdown device.
o. Coolant high-temperature prealarm.
p. Coolant high-temperature alarm.
q. Coolant low-temperature alarm.
r. Coolant high-temperature shutdown device.
s. EPS load indicator.
t. Battery high-voltage alarm.
u. Low cranking voltage alarm.
v. Battery-charger malfunction alarm.
w. Battery low-voltage alarm.
x. Lamp test.
y. Contacts for local and remote common alarm.
z. Low-starting air pressure alarm.
aa. Low-starting hydraulic pressure alarm.
bb. Remote manual stop shutdown device.
cc. Air shutdown damper alarm when used.
dd. Air shutdown damper shutdown device when used.
ee. Generator overcurrent-protective-device not-closed alarm.
ff. Hours of operation.
gg. Engine generator metering, including voltage, current, hertz, kilowatt, kilovolt ampere, and power factor.

G. Engine Generator Metering: Comply with **Section 260913 "Electrical Power Monitoring and Control" and Section 262713 "Electricity Metering."**

H. Connection to Datalink:

1. A separate terminal block, factory wired to Form C dry contacts, for each alarm and status indication.

I. Common Remote Panel with Common Audible Alarm: Include necessary contacts and terminals in control and monitoring panel. Remote panel shall be powered from the engine generator battery.

J. Remote Alarm Annunciator: An LED indicator light labeled with proper alarm conditions shall identify each alarm event, and a common audible signal shall sound for each alarm condition. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.

1. Overcrank alarm.
2. Low water-temperature alarm.
3. High engine temperature prealarm.
4. High engine temperature alarm.
5. Low lube oil pressure alarm.
6. Overspeed alarm.
7. Low fuel main tank alarm.
8. Low coolant level alarm.
9. Low cranking voltage alarm.
10. Contacts for local and remote common alarm.
11. Audible-alarm silencing switch.
12. Air shutdown damper when used.
13. Run-Off-Auto switch.
14. Control switch not in automatic position alarm.
15. Fuel tank derangement alarm.
16. Fuel tank high-level shutdown of fuel supply alarm.
17. Lamp test.
18. Low-cranking voltage alarm.
19. Generator overcurrent-protective-device not-closed alarm.

K. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator unless otherwise indicated.

L. Remote Emergency-Stop Switch: Flush; wall mounted unless otherwise indicated; and labeled. Push button shall be protected from accidental operation.

2.7 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Overcurrent protective devices shall be coordinated to optimize selective tripping when a short circuit occurs.

1. Overcurrent protective devices for the entire EPSS shall be coordinated to optimize selective tripping when a short circuit occurs. Coordination of protective devices shall consider both utility and EPSS as the voltage source.

2. Overcurrent protective devices for the EPSS shall be accessible only to authorized personnel.

B. Generator Overcurrent Protective Device:

1. Molded-case circuit breaker, thermal-magnetic type; 100 percent rated; complying with UL 489:

    a. Tripping Characteristic: Designed specifically for generator protection.
    b. Trip Rating: Matched to generator output rating.
    c. Shunt Trip: Connected to trip breaker when engine generator is shut down by other protective devices.
    d. Mounting: Adjacent to, or integrated with, control and monitoring panel.

2. Molded-case circuit breaker, electronic-trip type; 100 percent rated; complying with UL 489:

    a. Tripping Characteristics: Adjustable long-time and short-time delay and instantaneous.
    b. Trip Settings: Selected to coordinate with generator thermal damage curve.
    c. Shunt Trip: Connected to trip breaker when engine generator is shut down by other protective devices.
    d. Mounting: Adjacent to, or integrated with, control and monitoring panel.

3. Insulated-case circuit breaker, electronic-trip type; 100 percent rated; complying with UL 489:

    a. Tripping Characteristics: Adjustable long-time and short-time delay and instantaneous.
    b. Trip Settings: Selected to coordinate with generator thermal damage curve.
    c. Shunt Trip: Connected to trip breaker when engine generator is shut down by other protective devices.
    d. Mounting: Adjacent to, or integrated with, control and monitoring panel.

4. Molded-case type disconnect switch; 100 percent rated:

    a. Trip Rating: Matched to generator output rating.
    b. Shunt Trip: Connected to trip switch when signaled by generator protector or by other protective devices.

C. Generator Protector: Microprocessor-based unit shall continuously monitor current level in each phase of generator output, integrate generator heating effect over time, and predict when thermal damage of alternator will occur. When signaled by generator protector or other engine generator protective devices, a shunt-trip device in the generator disconnect switch shall open

the switch to disconnect the generator from load circuits. Protector performs the following functions:

1. Initiates a generator overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other engine generator malfunction alarms. Contacts shall be available for load shed functions.
2. Under single- or three-phase fault conditions, regulates generator to 300 percent of rated full-load current for up to 10 seconds.
3. As overcurrent heating effect on the generator approaches the thermal damage point of the unit, protector switches the excitation system off, opens the generator disconnect device, and shuts down the engine generator.
4. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.

D. Ground-Fault Indication: Comply with NFPA 70, "Emergency System" signals for ground fault.

1. Indicate ground fault with other engine generator alarm indications.
2. Trip generator protective device on ground fault.

2.8 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1.

B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

C. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required. Provide **12**-lead alternator.

D. Range: Provide **broad** range of output voltage by adjusting the excitation level.

E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

F. Enclosure: Dripproof.

G. Instrument Transformers: Mounted within generator enclosure.

H. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified **and as required by NFPA 110**.

1. Adjusting Rheostat on Control and Monitoring Panel: Provide plus or minus 5 percent adjustment of output-voltage operating band.
2. Maintain voltage within **20** percent on one step, full load.
3. Provide anti-hunt provision to stabilize voltage.
4. Maintain frequency within **5** percent and stabilize at rated frequency within **5** seconds.

I. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

K. Subtransient Reactance: **12** percent, maximum.

2.9 OUTDOOR ENGINE GENERATOR ENCLOSURE

A. Description:

1. Vandal-resistant, sound-attenuating, weatherproof steel housing; wind resistant up to 100 mph (160 km/h). Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments and control shall be mounted within enclosure.
2. Prefabricated or pre-engineered, galvanized-steel-clad, integral structural-steel-framed, walk-in enclosure; erected on concrete foundation.

B. Structural Design and Anchorage: Comply with ASCE/SEI 7 for wind loads up to 100 mph (160 km/h).

C. Seismic Design: Comply with seismic requirements in Section 260548.16 "Seismic Controls for Electrical Systems."

D. Hinged Doors: With padlocking provisions.

E. Space Heater: Thermostatically controlled and sized to prevent condensation.

F. Lighting: Provide weather-resistant **LED** lighting with **30 fc (330 lx)** average maintained.

G. Thermal Insulation: Manufacturer's standard materials and thickness selected in coordination with space heater to maintain winter interior temperature within operating limits required by engine generator components.

H. Engine-Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for two hours with ambient temperature at top of range specified in system service conditions.

1. Louvers: Fixed-engine, cooling-air inlet and discharge. Stormproof and drainable louvers prevent entry of rain and snow.
2. Automatic Dampers: At engine cooling-air inlet and discharge. Dampers shall be closed to reduce enclosure heat loss in cold weather when unit is not operating.
3. Ventilation: Provide temperature-controlled exhaust fan interlocked to prevent operation when engine is running.

I. Interior Lights with Switch: Factory-wired, vapor-proof luminaires within housing; arranged to illuminate controls and accessible interior. Arrange for external electrical connection.

1. AC lighting system and connection point for operation when remote source is available.
2. DC lighting system for operation when remote source and generator are both unavailable.

J. Convenience Outlets: Factory-wired, GFCI. Arrange for external electrical connection.

2.10 FINISHES

A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine generator performance.

B. Examine roughing-in for piping systems and electrical connections. Verify actual locations of connections before packaged engine generator installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify **Architect and Construction Manager** no fewer than **two** working days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without **Owner's** written permission.

3.3 INSTALLATION

A. Comply with NECA 1 and NECA 404.

B. Comply with packaged engine generator manufacturers' written installation and alignment instructions **and with NFPA 110**.

C. Equipment Mounting:

1. Install packaged engine generators on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
2. Install **packaged engine generator** with concrete base construction is specified in Section 260548.16 "Seismic Controls for Electrical Systems."
3. Remote Radiators:
4. Install isolating thimbles where exhaust piping penetrates combustible surfaces with a minimum of 9 inches (225 mm) of clearance from combustibles.

D. Fuel Piping:

1. Copper and galvanized steel shall not be used in the fuel-oil piping system.

E. Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.4 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping and specialties.

B. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine generator to allow space for service and maintenance.

C. Connect engine exhaust pipe to engine with flexible connector.

D. Connect fuel piping to engines with a gate valve and union and flexible connector.

E. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

F. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Provide a minimum of one 90-degree bend in flexible conduit routed to the engine generator from a stationary element.

G. Balance single-phase loads to obtain a maximum of 10 percent unbalance between any two phases.

3.5 IDENTIFICATION

A. Identify system components according to Section 230553 "Identification for HVAC Piping and Equipment" and Section 260553 "Identification for Electrical Systems."

B. Install a sign indicating the generator neutral is bonded to the main service neutral at the main service location.

3.6 FIELD QUALITY CONTROL

A. Testing Agency:

1. Owner will engage a qualified testing agency to perform tests and inspections.
2. Engage a qualified testing agency to perform tests and inspections.
3. Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
4. Perform tests and inspections

B. Tests and Inspections:

1. Perform tests recommended by manufacturer and each visual and mechanical inspection and electrical and mechanical test listed in first two subparagraphs below, as specified in NETA ATS. Certify compliance with test parameters.

    a. Visual and Mechanical Inspection:

        1) Compare equipment nameplate data with Drawings and the Specifications.
        2) Inspect physical and mechanical condition.
        3) Inspect anchorage, alignment, and grounding.
        4) Verify that the unit is clean.

    b. Electrical and Mechanical Tests:

        1) Perform insulation-resistance tests according to IEEE 43.

            a) Machines Larger Than 200 hp (150 kW): Test duration shall be 10 minutes. Calculate polarization index.
            b) Machines 200 hp (150 kW) or Less: Test duration shall be one minute. Calculate the dielectric-absorption ratio.

        2) Test protective relay devices.
        3) Verify phase rotation, phasing, and synchronized operation as required by the application.
        4) Functionally test engine shutdown for low oil pressure, overtemperature, overspeed, and other protection features as applicable.
        5) Perform vibration test for each main bearing cap.
        6) Verify correct functioning of the governor and regulator.

2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here, including, but not limited to, single-step full-load pickup test.
3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.

    a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.

b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
c. Verify acceptance of charge for each element of the battery after discharge.
d. Verify that measurements are within manufacturer's specifications.

4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.
6. Exhaust-System Back-Pressure Test: Use a manometer with a scale exceeding 40-inch wg (120 kPa). Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the engine.
7. Exhaust Emissions Test: Comply with applicable government test criteria.
8. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
9. Harmonic-Content Tests: Measure harmonic content of output voltage at 25 and 100 percent of rated linear load. Verify that harmonic content is within specified limits.

C. Coordinate tests with tests for transfer switches and run them concurrently.

D. Test instruments shall have been calibrated within the past 12 months, traceable to NIST Calibration Services, and adequate for making positive observation of test results. Make calibration records available for examination on request.

E. Leak Test: After installation, charge exhaust, coolant, and fuel systems and test for leaks. Repair leaks and retest until no leaks exist.

F. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation for generator and associated equipment.

G. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

H. Remove and replace malfunctioning units and **retest** as specified above.

I. Retest: Correct deficiencies identified by tests and observations, and retest until specified requirements are met.

J. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

K. Infrared Scanning: After Substantial Completion, but not more than 60 days after final acceptance, perform an infrared scan of each power wiring termination and each bus connection while running with maximum load. Remove all access panels so terminations and connections are accessible to portable scanner.

1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan 11 months after date of Substantial Completion.
2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
3. Record of Infrared Scanning: Prepare a certified report that identifies terminations and connections checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.7 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include **12** months' full maintenance by skilled employees of manufacturer's authorized service representative. Include quarterly preventive maintenance and exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Parts shall be manufacturer's authorized replacement parts and supplies.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.

END OF SECTION 263213.13