Portland International Jetport (PWM)

Portland, Maine

Terminal Enhancement
Project Manual Issued For Permit
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SPECIFICATIONS VOLUME 1

General Requirements Subgroup

Facility Construction Subgroup

SECTION 27 05 00 - COMMON WORK RESULTS FOR COMMUNICATIONS

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. Communications equipment coordination and installation.
2. Sleeves for pathways and cables.
3. Sleeve seals.
4. Grout.
5. Common communications installation requirements.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.4 SUBMITTALS

A. Product Data: For sleeve seals.

1.5 QUALITY ASSURANCE

A. The installation shall conform to all requirements of ANSI C2, NFPA 70, and the codes and standards specified in other Sections, all local codes and the requirements of OSHA, which would be applicable if PWM were a private corporation.

B. In case of conflict between provisions of codes, laws and ordinances, the more stringent requirement shall apply.

1.6 COORDINATION

A. Coordinate arrangement, mounting, and support of communications equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.

2. To provide for ease of disconnecting the equipment with minimum interference to other installations.

3. To allow right of way for piping and conduit installed at required slope.

4. So connecting pathways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for communications items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."."

PART 2 - PRODUCTS

2.1 SLEEVES FOR PATHWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).

b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and pathway or cable.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

   a. Advance Products & Systems, Inc.

   b. Calpico, Inc.

   c. Metraflex Co.

   d. Pipeline Seal and Insulator, Inc.

3. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of pathway or cable.

4. Pressure Plates: Stainless steel. Include two for each sealing element.

5. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR COMMUNICATIONS INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both communications equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR COMMUNICATIONS PENETRATIONS

A. Communications penetrations occur when pathways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 3 inches (50 mm) above finished floor level.

G. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pathway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pathway and cable penetrations. Install sleeves and seal pathway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

K. Roof-Penetration Sleeves: Seal penetration of individual pathways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between pathway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for pathway or cable material and size. Position pathway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pathway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for communications installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION

SECTION 27 11 00 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

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. The communications equipment room will be referred as MDF (Main Distribution Frame) or IDF (Intermediate Distribution Frame) in this document which are intended to house racks, cabinets and equipment necessary for the support of the communications cabling infrastructure.

B. Section Includes:

1. Telecommunications mounting elements.
2. Backboards.
3. Telecommunications equipment racks and cabinets.
4. Telecommunications service entrance pathways.
5. Grounding.

C. Related Sections:

1. Contract Documents
2. Division 00 – Procurement & contracting Requirements Group
3. Division 01 – General Requirements
4. Section 012500 – Substitution Procedures
5. Section 271300 – Communications Backbone Cabling
6. Division 26

1.3 REFERENCES

1. All work shall be performed in accordance with the following codes and industry standards, unless noted otherwise:

2. NFPA 70 – National Electrical Code, current version adopted by local or State AHJ.

3. TIA/EIA-568-B – Commercial Building Telecommunications Cabling Standard, current version.

4. TIA/EIA-569-B – Commercial Building Standard for Telecommunications Pathways and Spaces, current version.

5. TIA/EIA-606-A – Administration Standard for Commercial Telecommunications Infrastructure, current version.

6. J-STD-607-A – Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, current version.

7. TIA-310- D Cabinets, Rack, and Associated Equipment

1.4 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).

C. IDF: Intermediate Distribution Frame

D. LAN: Local area network.

E. MDF: Main Distribution Frame

F. RCDD: Registered Communications Distribution Designer.

1.5 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Floor-mounted cabinets and cable pathways shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event.

1.6 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections. Include full rack elevations.

3. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.

C. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

D. Seismic Qualification Certificates: For floor-mounted cabinets, 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: Identify center of gravity and locate and describe mounting and anchorage provisions. Base certification on the maximum number of components capable of being mounted in each rack type. Identify components on which certification is based.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of RCDD or Commercial Installer, Level 2.
2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician or Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.

3. Field Inspector: Currently registered by BICSI as RCDD or Commercial Installer, Level 2 to perform the on-site inspection.

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 application.

C. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.

D. Grounding: Comply with ANSI-J-STD-607-A.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install equipment frames and cable trays until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and work above ceilings is complete.

1.9 COORDINATION

A. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.

1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.

2. Record agreements reached in meetings and distribute them to other participants.

3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.

4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.

B. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate. Coordinate with the grounding of all telecommunication racks with the electrical contractor.

C. All power in each IDF and MDF room shall be supplied by an emergency power panel located in the room by the Electrical Contractor. Coordinate with the Electrical Contractor to ensure the proper circuits are delivered to each telecommunication rack and piece of equipment requiring power.

PART 2 - PRODUCTS

2.1 PATHWAYS

A. General Requirements: Comply with TIA/EIA-569-A.

B. Cable Support: NRTL labeled. Cable support brackets shall be designed to prevent degradation of cable performance and pinch points that could damage cable. Cable tie slots fasten cable ties to brackets.

1. Comply with NFPA 70 and UL 2043 for fire-resistant and low-smoke-producing characteristics.

2. Support brackets with cable tie slots for fastening cable ties to brackets.

3. Lacing bars, spools, J-hooks, and D-rings.

4. Straps and other devices.

C. Cable Trays:

Continuous, rigid, welded steel or stainless steel wire mesh cable management system.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Cablofil

b. Cooper B-Line, Inc.

c. PW Industries, Inc.

2. Cable Tray Materials: Metal, suitable for indoors and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472 inch (0.012 mm) thick.

a. Wire Mesh Cable Trays: 12 inches wide, 6” deep.

D. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems.” Flexible metal conduit shall not be used.

1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

2.2 BACKBOARDS

A. Backboards: Plywood, void-free, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm) with two (2) coats of fire retardant paint, typically white in color. Comply with requirements for plywood backing panels specified in Division 06 Section "Rough Carpentry."

2.3 EQUIPMENT FRAMES

A. Each IDF or MDF room contains a minimum of one telecom equipment rack for locating fiber termination panels, security interface electronics and other types of equipment.

B. Contractor shall provide the following type of equipment cabinets in these locations as indicated on the drawings, contractor shall only provide equipment cabinets where indicated, existing equipment cabinets shall be modified as indicated using the equipment indicated:

C. MDF and TSA Spaces: Provide the following equipment cabinets and associate hardware in remote telecom rooms as specified on the telecom equipment room detailed drawings. No substitutions.

1. APC Netshelter SX 48U 600mm Wide x 1070mm Deep Enclosure with Sides Black

    a. APC Manufacturer Part Number – AR3107

2. APC UPS Network Management Card w/ Environmental Monitoring

    a. APC Manufacturer Part Number – AP9619

3. APC Door Switch Kit

    a. APC Manufacturer Part Number – AP9513

4. APC Netshelter Grounding Kit

    a. APC Manufacturer Part Number – AR8390

5. APC Netshelter SX Roof Fan Tray 115 VAC

    a. APC Manufacturer Part Number – ACF501

6. APC Rack PDU, Switched, Zero U, 30A, 100/120V, (24) 5-20

    a. APC Manufacturer Part Number – AP7832

D. IDF Spaces: Provide the following equipment cabinets and associate hardware in remote telecom rooms as specified on the telecom equipment room detailed drawings. No substitutions.

1. APC Netshelter 2 Post Rack 45U

    a. APC Manufacturer Part Number – AR201

2. APC Netshelter Grounding Kit

    a. APC Manufacturer Part Number – AR8390

3. APC Rack PDU, Switched, Zero U, 20A, 100/120V, (24) 5-20

    a. APC Manufacturer Part Number – AP7930

E. Airline Tenant Office Spaces

1. APC Netshelter SX 24U 600mm Wide x 1070mm Deep Enclosure with Sides Black

    a. APC Manufacturer Part Number – AR3104

2.4 LABELING

A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.

B. Install underground, buried, aerial pathways complying with recommendations in TIA/EIA-569-A, "Entrance Facilities" Article.

3.2 Install underground, buried, aerial entrance pathway complying with Division 26 Section "Raceway and Boxes for Electrical Systems."INSTALLATION

A. Comply with NECA 1.

B. Comply with BICSI TDMM for layout and installation of communications equipment rooms.

C. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.

D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.3 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Penetration Firestopping."Comply with TIA/EIA-569-A, Annex A, "Firestopping."

B. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.4 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

B. See Division 27 Section "Communications Horizontal Cabling" for additional identification requirements. See Evaluations for discussion of TIA/EIA standard as it applies to this Section.Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 3 level of administration including optional identification requirements of this standard.

C. Labels shall be preprinted or computer-printed type.

END OF SECTION

SECTION 27 13 00 - COMMUNICATIONS BACKBONE AND HORIZONTAL CABLING

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. Pathways.
2. UTP backbone and horizontal cable.
3. 62.5/125-micrometer, optical fiber cabling.
4. Telecommunications outlet/connectors.
5. Cable management system.
6. Cable connecting hardware, patch panels, and cross-connects.
7. Cabling identification products.

1.3 DEFINITIONS

A. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.

B. BICSI: Building Industry Consulting Service International.

C. Channel Cable Tray: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel.

D. Consolidation Point: A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways.

E. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

F. EMI: Electromagnetic interference.

G. IDC: Insulation displacement connector.

H. LAN: Local area network.

I. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.

J. RCDD: Registered Communications Distribution Designer.

K. UTP: Unshielded twisted pair.

1.4 EXISTING SYSTEM DESCRIPTION

A. The existing airport Cabling System is a Structured Cabling System using unshielded twisted pair and both muitimode and single-mode fiber optic cable.

B. The Cabling System supports many of the airport communications systems, including but not limited to: telephone, security, flight information, building automation and several local area networks.

1.5 SUMMARY OF WORK

A. The Contractor shall provide all structured cabling to support the project. Expansion of the Cabling System shall be compatible with and shall not void warranties of the existing Cabling System.

B. The Cabling System shall support analog and digital voice applications, data, local area networks (LAN), video and low voltage devices for building controls and management on a common cabling platform.

C. Indoor cable shall be run above cabinets and racks via conduit and or cable trays as specified.

D. The Contractor shall provide all patching of fiber optic and copper cabling through airport telecommunication rooms as required by the project to provide a fully operational system whether illustrated on the Drawings or not.

1.6 PERFORMANCE REQUIREMENTS

A. General Performance: Backbone cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

1.7 SUBMITTALS

A. Product Data: For each type of product indicated provide manufacturer specifications.

B. Shop Drawings:

1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.

2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.

3. Cabling administration drawings and printouts.

4. Wiring diagrams to show typical wiring schematics including the following:

5. Cross-connects.

6. Patch panels.

7. Patch cords.

8. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.

9. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:

10. Vertical and horizontal offsets and transitions.

11. Clearances for access above and to side of cable trays.

12. Vertical elevation of cable trays above the floor or bottom of ceiling structure.

13. Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.

C. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

D. Source quality-control reports.

E. Field quality-control reports.

F. Maintenance Data: For splices and connectors to include in maintenance manuals.

G. 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.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings and Cabling Administration Drawings, and field testing program development by an RCDD.

2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician or Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.

3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

B. Testing Agency Qualifications: An NRTL.

1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

C. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.

2. Smoke-Developed Index: 50 or less.

D. 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.

E. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.

F. Grounding: Comply with ANSI-J-STD-607-A.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test optical fiber cable to determine the continuity of the strand end to end. Use optical fiber flashlight or optical loss test set.

2. Test optical fiber cable while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector, including the loss value of each. Retain test data and include the record in maintenance data.

3. Test each pair of UTP cable for open and short circuits.

1.10 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.11 PROJECT SCHEDULES AND REPORTS

A. Early installation and testing of the Cabling System is vital to scheduling of other airport systems. Schedule completion of Cabling System installation to provide a one hundred and twenty day testing period for other airport systems prior to scheduled opening of facility.

1.12 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

B. Provide coordination of the Work with that of all other Contractors. The coordination of work between the Contractor and other contractors(s) is indicated on the Drawings and related sections of the specifications. All work shall be coordinated extensively with the Contractors. Absolutely no connections or modifications to the existing airport Cabling System shall be made by the Contractor without prior coordination and review with the Owner’s IT personnel. All installation of work under this section shall be reviewed by the Owner or their designated representative prior to commencement of same.

C. The contractor shall:

1. Provide a coordinated schedule with the owner in scheduling the work in specific areas to provide timely access and working and storage space for the performance of the Contractor's work.

2. Ensure that the Project Conditions and completion of the Contractor's work as specified in related sections of the specifications is completed and acceptable to the owner.

D. No changes or modifications of any existing airport cabling system equipment or operation may take place without authorization from the designated owner's representative. The contractor is responsible to keep the airport's telecommunication system operational during all phases of construction and associated demolition.

E. PWM requires a minimum of two (2) week’s notice prior to the start of cabling system changes. During this period, PWM will advise when work can proceed and of any special actions which must take place. Coordination with PWM is required for every step of the addition/removal process.

F. A coordination meeting between the cabling contractor and PWM shall be required prior to the start of shop drawings in order to ensure a complete understanding of the project requirements.

G. All work to the existing cabling system requiring a temporary shutdown of airport systems shall be performed between the hours of midnight and 5:00am or as directed by PWM. The contractor shall notify PWM a minimum of 72 hours in advance prior to the need to shut down any elements of the existing cabling system. All work to the existing cabling system shall take place in the presence of a representative of PWM.

H. All shop drawings shall be approved by both PWM and the project engineer before the start of construction. The contractor shall provide for added reviewal time on any shop drawing submittals requiring TSA approval.

I. The contractor shall coordinate with the TSA for all telecommunications work being performed in TSA operated spaces. All telecommunication rack locations shall be coordinated and approved by the TSA prior to final installation. All horizontal TSA cabling shall terminate back at a designated TSA patch panel in a TSA rack provided by this project. The contractor shall be responsible for all passive cabling requirements by the TSA. The contractor is not responsible for furnishing any switch or network equipment for the TSA.

J. The contractor shall coordinate with PWM and each airline in the airline tenant spaces in order to properly locate airline telecommunication racks purchased by this project. Only after approval by the airline may the associated telecommunication cabinet be installed within the ATO.

K. The contractor shall coordinate with the electrical contractor to ensure that proper power is supplied at all telecommunication rooms as required. Areas requiring coordination with the electrical contractor include, but are not limited to:

1. IDF #l2

2. MDF

3. IDF #l4

L. The contractor shall be required to coordinate all outlet locations for flight information displays (FIDS) with the FIDS contractor. Final outlet locations shall be approved by PWM and the fids contractor prior to installation.

M. It may be required at times for the contractor to coordinate with Fairpoint Communications' as cabling services get extended from the existing building to the new structure being installed by this project.

N. The cabling system being installed for this project serves as the communication backbone for several airport systems and services being provided under this project. In order to allow for proper testing time of these various systems, the contractor shall schedule all telecommunication work to be finished no less than 120 days from the project completion date. This shall include all testing and system acceptance work.

1.13 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning with Opening Date, provide software support for two years.

B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.14 EXTRA MATERIALS

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

1. Patch-Panel Units: Five of each type.

2. Connecting Blocks: Five of each type.

1.15 WARRANTY

A. Twenty (20)/Twenty-Five (25) Year Extended Product Warranty

1. The 20/25 Year Extended Product Warranty shall ensure against product defects, that all approved cabling components exceed the specifications of TIA/EIA 568A and ISO/IEC IS 11801, exceed the attenuation and NEXT requirements of TIA/EIA TSB 67 and ISO/IEC IS 11801 for cabling links/channels, that the installation will exceed the loss bandwidth requirements of TIA/EIA TSB 67 and ICO/IEC 11801 for fiber links/channels, for a twenty (20)/twenty-five (25) year period. The end-to-end passive product shall be capable of delivering 1GBPS half-duplex mode/2GBPS full-duplex mode to the workstation. The warranty shall apply to all passive Cabling System components.

2. The Twenty (20)/ Twenty-Five (25) Year Extended Product Warranty shall cover the replacement or repair of defective product(s) and labor for the replacement or repair of such defective product(s) for a twenty (20)/ twenty-five (25) year period.

B. Twenty (20) Year Application Assurance

1. The Twenty (20)/Twenty-Five (25) Year Application Assurance shall cover the failure of the wiring system to support the application which it was designed to support, a well as additional applications(s) introduced in the future, up to 1Gbps parallel transmission schemes, by recognized standards or user forums that use the TIA/EIA or ISO/IEC IS 11801 component and link/channel specifications for cabling, for a twenty (20)/twenty-five (25) year period.

C. System Certification

1. Upon successful completion of the installation and subsequent inspection, the customer shall be provided with a numbered certificate, from the manufacturing company, registering the installation.

PART 2 - PRODUCTS

2.1 PATHWAYS

A. General Requirements: Comply with TIA/EIA-569-A.

B. Cable Support: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

1. Support brackets with cable tie slots for fastening cable ties to brackets.

2. Lacing bars, spools, J-hooks, and D-rings.

3. Straps and other devices.

C. Cable Trays:

Continuous, rigid, welded steel or stainless steel wire mesh cable management system.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Cablofil

3. Cooper B-Line, Inc.

4. PW Industries, Inc.

5. Cable Tray Materials: Metal, suitable for indoors and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472 inch (0.012 mm) thick.

6. Wire Mesh Cable Trays: 12 inches wide, 6” deep.

D. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems.” Flexible metal conduit shall not be used.

1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

2. Manufacturer’s

a. Metal Conduit and Tubing:

1) Allied Tube and Conduit Corp.

2) Triangle PWC, Inc.

3) Wheatland Tube Company

4) Thomas & Betts Corp.

b. Conduit Bodies and Fittings

1) Appleton Electric Company

2) Crouse-Hinds Comapny

3) O-Z/Gedney Company

c. Boxes, Enclosures

1) Hoffman Engineering Co.

2) Hubbell, Inc.

3. Metal Conduit and Tubing

a. Rigid Metal Conduit

1) Description: UL 6; ANSI C80.1; Hot-dip zinc galvanized and chromated steel.

2) Fittings: ANSI/NEMA FB-1; Threaded insulating type; steel or mallable iron. Bushings 1-1/4 inch and larger shall be grounding type.

b. Electrical Metallic Tubing (EMT)

1) Description: ANSI C80.3, Hot galvanized and chromated steel with clear polymer coating.

2) Fittings: ANSI/NEMA FB-1; Gland and ring compression type; steel or malleable iron with insulated throats; rain an concrete tight. Bushings shall be grounding type for conduits 1-1/4 inch and larger. Bushings for conduits 1 inch and smaller may be PVC type.

c. Flexible Metal Conduit

1) Description: UL 360; Formed from continuous length of spirally wound, interlocked hot galvanized sheet steel.

2) Fittings: UL 360; Threadless hinged clamp type, steel or mallable iron. Straight terminal connectors shall have one piece body, female end with clamp and deep slotted machine screw for securing conduit

and male threaded end with locknut. Angle terminal connectors shall have two piece body with removable upper section.

2.2 SYSTIMAX/BERK-TEK COMPLIANT

A. All products and components of the Cabling System shall be by Systimax or Ortronics/Berk-Tek Netclear approved and comply with requirements for the Systimax 20-year certification of Berk-Tek/Ortonics Netclear 25-year certification.

2.3 BACKBONE UTP CABLE

A. 25, 50, 100, 200, 300, or 400-pair Category 3 cable as indicated in project Drawings

B. 24 AWG solid bare copper conductor

C. 100-ohm impedance

D. Thermoplastic jacket

E. Comply with:

1. ICEA S-90-661 for mechanical properties.

2. TIA/EIA-568-B.1 for performance specifications.

3. TIA/EIA-568-B.2

4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:

a. Communications, Plenum Rated: Type CMP, complying with NFPA 262.

b. Communications, Riser Rated: Type CMR, complying with UL 1666.

2.4 HORIZONTAL UTP CABLE

A. 4-pair UTP Category 6 cable

B. 23 AWG bare copper conductor

C. 100-ohm impedance

D. Thermoplastic jacket

E. Comply with:

1. ICEA S-90-661 for mechanical properties.

2. TIA/EIA-568-B.1 for performance specifications.

3. TIA/EIA-568-B.2-1 Category 6

4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:

   a. Communications, Plenum Rated: Type CMP, complying with NFPA 262.

   b. Communications, Riser Rated: Type CMR, complying with UL 1666.

2.5 UTP CABLE HARDWARE

A. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

B. Connecting Blocks: 110-style IDC for Category 5e, 110-style IDC for Category 6. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.

C. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.

   1. Number of Terminals per Field: One for each conductor in assigned cables.

   2. All cross-connect blocks for phones shall be rack mountable in a standard 19” rack.

D. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables. All patch panels shall be 48-port with an attached 2U cable management solution.

E. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.

   1. Outlets in fire rated walls shall be covered in fire rated material in order to maintain the fire rating on the wall.

F. Patch Cords: Factory-made, 4-pair cables in terminated with 8-position modular plug at each end. See lengths below:

   1. Category 6 modular patch cords

      a. Factory terminated double ended, 8-position to 8-position, modular, stranded conductors, Category 6, 4 pair, color blue.

   2. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.

   3. Patch cords shall have color-coded boots for circuit identification.

2.6 OPTICAL FIBER CABLE

A. General:

1. All new fiber cabling shall be installed in Innerduct as indicated in the project Drawings.

2. Fiber optic cable segments shall be comprised of individual multimode and singlemode fiber optic cables. Composite cables with multimode and singlemode in a common sheath shall not be used.

3. Cables shall be UL Listed as Optical Fiber Non Conductive Riser (OFNR).

4. Cables shall be marked as required by national and local electrical codes.

5. Individual fibers shall be color coded for identification. The color-coding shall be in accordance with EIA/TIA-598 Color Coding of fiber Optic Cables.

6. Fiber optic cabling shall be provided between facilities and furnished with the quantity of fibers as designated on the contract drawings. All fibers in a cable run shall be from the same manufacturer and shall be the same type. A mix of fibers from different manufacturers shall not be used.

7. Outside sheath on multimode cable shall be different in color than outside sheath on singlemode cable.

B. Fiber Optic Cable (Singlemode)

1. Single-mode fiber optic cable shall have a nominal core diameter of 8.3um and a cladding diameter of 125um.

2. All fibers shall be color coded to facilitate individual fiber identification.

3. Fiber will have D-LUX coating or approved equivalent to ensure color retention, minimize micro-bending losses and improve handling. The coating shall be mechanically strippable.

4. Fiber must comply with EIA/TIA 455 and IEC 793 test methods for required attributes.

5. Single-mode fiber shall have the following minimum transmission characteristics:

Fiber Attribute:	Depressed Cladding/Matched Cladding (Berk-Tek/Ortronics)
Cladding Diameter:	125.0 ± 1.0 μm
Cladding Non-Circularity:	≤ 1.0%
Colored Fiber Diameter:	250 ± 10 μm
Core Diameter:	8.3 μm (nominal)
Index of Refraction:	0.37%
Core/Cladding Concentricity:	≤0.5 μm
Mode Field Diameter:	8.8 ± 0.5 μm @ 1310 NM

Minimum Proof Strength:	100,000 psi (0.70GPa)
Maximum Uncabled Attenuation:	.35 dB/km @ 1310 NM .25 dB/km @ 1550 NM
Maximum Dispersion:	2.8 ps/NM-km 1285 to 1330 NM
Fiber Cutoff Wavelength:	≥1130 NM. ≥1300 NM
Fiber Macro-bend (100 turns @ 75 mm diameter):	≥0.05 dB @ 1310 NM ≥0.10 dB @ 1550 NM
Coating Strip Force:	1.3 N ≤ F ≤ 8.9 N

C. Fiber Optic Cable (Multimode)

1. Fiber shall be multimode, graded index, dual window, optical waveguide with nominal 62.5/125• m core/cladding material.

2. Multimode fiber shall have a numerical aperture of 0.275 plus or minus 0.015.

3. Fibers shall comply with EIA/TIA 492 specifications and IS 11801 standards.

4. Fibers will have dual wavelength capability, transmitting at 850 and 1300nm ranges.

5. All fibers shall be color coded to facilitate individual fiber identification.

6. Fiber will have D-LUX coating or approved equivalent to ensure color retention, minimize micro-bending losses and improve handling. The coating shall be mechanically strippable.

7. Multimode fiber shall have the following minimum transmission characteristics:

Core:	62.5 • m ± 2.5 • m
Core Non-Circularity:	<6%
Core/Cladding Concentricity Error:	<1.5 • m
Numerical Aperture:	0.275 ± 0.015
Cladding diameter:	125 • m ± 1• m
Cladding Non-Circularity	<2.0%
Colored Fiber Diameter:	254 • m ± 7 • m
Buffering Diameter:	890 mm ± 50 mm
Minimum Tensile Strength:	100,000 psi
Fiber Minimum Bending Radius:	.75 in. (1.91 cm)

Cable Minimum Bending Radius: During Installation: After Installation:	20 times cable diameter 10 time cable diameter
Operating Temp. Range:	32°F to 122°F (0°C to 50°C)
Storage Temp. Range:	-40°F to 149°F (-40°C to 65°C)
Maximum Fiber Loss:	3.4 dB/km at 850 NM (typical range 2.8 to 3.4 dB/km) 1.0 dB/km at 1300 NM (typical range 0.5 to 1.0 dB/km)
Minimum Bandwidth:	200MHz at 850 NM 500MHz at 1300 NM

D. Sheath Construction:

1. Design Selection – Inside Building

   a. Riser
   SYSTIMAX 5300 *xxx*A MR*xx* (multimode)
   SYSTIMAX 5300 *xxx*A ZR*xx* (singlemode)
   Or
   Berk-Tek PDR12B*xxx*-I/O-CB3510/25 (multimode)
   Berk-Tek PDR12B*xxx*-I/O-AB0707 (singlemode)

   b. Plenum
   SYSTIMAX 5300 xxxA MPxx (multimode)
   SYSTIMAX 5300 xxxA ZPxx (singlemode)
   Or
   Berk-Tek PDR12Bxxx-HE-CB3510/25 (multimode)
   Berk-Tek PDR12Bxxx-HE-AB0707 (singlemode)

2. Fan-out Kits: All loosetube, filled cables shall be provided with fan-out kits at each termination point.

2.7 OPTICAL FIBER CABLE HARDWARE

A. Singlemode Terminations

1. Terminate fiber optic cable with ST compatible connectors in compliance with manufacturers recommended installation procedures.

2. Provide ST compatible connectors with following minimum specifications:

a. Be field installable.

b. Ceramic ferrule construction

c. Be capable of mounting on either 0.9 mm buffered fiber or on 3.0-mm cordage.

d. Utilize a PC polishing on the tip to provide high yield during installation.

e. Have a locking feature to the coupler and assure non-optical disconnect.

f. Maximum attenuation of 0.5 dB typical.

g. Minimum durability of 500 insertions with less than 0.2 dB change at both windows.

h. Minimum tensile strength of 20 lb. with less than 0.2 dB change.

3. Approved Products:
Avaya P3070A-Z-125 single mode ST II+* connector approved
Systimax P3020A-Z-125 ST II connector
Or
Approved Berk-Tek/Ortronics equal.

B. Multimode Terminations

1. Terminate fiber optic cable with ST compatible connectors in compliance with manufacturers recommended installation procedures.

2. Provide ST compatible connectors with following minimum specifications:

a. Ceramic ferrule construction.

b. Be field installable.

c. Capable of mounting on either 0.9 mm buffered fiber or on 3.0 mm cordage.

d. Utilize a PC polishing on the tip to provide high yield during installation.

e. Have a locking feature to the coupler and assure non-optical disconnect.

f. Attenuation per mated pair shall be 0.5db.

g. Maximum attenuation per mated pair shall be 0.5db.

h. Minimum durability of 1000 insertions with less than 0.2 dB changes.

i. Minimum tensile strength of 22-lb. load (without adhesive) with less than 0.2 dB change.

3. Approved Products
Avaya P2070A-Z-125 multimode ST II + ® connector
Systimax P2020C-C-125 ST II connector
Or
Approved Berk-Tek/Ortronics equal

C. Patch Panels:

1. Either 72 port or high density 144 port as designation on Drawings

2. No fiber patch panel shall exceed 4U rack units

D. Patch Cords:

1. Contractor shall supply all required fiber optic patch cords.

2. Specifications for fiber optic patch cords shall meet or exceed specifications stated for fiber backbone cable and connectors.

3. Fiber optic patch cables shall all be factory made.

2.8 GROUNDING

A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems." for grounding conductors and connectors.

B. Comply with ANSI-J-STD-607-A.

2.9 IDENTIFICATION PRODUCTS

A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.10 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test cables on reels according to TIA/EIA-568-B.1.

C. Factory test UTP cables according to TIA/EIA-568-B.2.

D. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-B.3.

E. Cable will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 GENERAL

A. Install all equipment and components in accordance with manufacturer's written instructions with sound engineering practices as established by EIA/TIA and in compliance with NEC and recognized industry practices, to ensure that all items comply with specifications and serve intended purposes.

B. The Cabling System shall support analog and digital voice applications, data, local area networks (LAN), video and low voltage devices for building controls and management on a common cabling platform.

3.2 WIRING METHODS

A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.

2. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical Systems."

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.3 INSTALLATION OF PATHWAYS

A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A.

B. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Division 27 Section "Communications Equipment Room Fittings." Drawings indicate general arrangement of pathways and fittings.

C. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.

D. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.

E. Install manufactured conduit sweeps and long-radius elbows whenever possible.

F. Pathway Installation in Communications Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.

2. Install cable trays to route cables if conduits cannot be located in these positions.

3. Secure conduits to backboard when entering room from overhead.

4. Extend conduits 3 inches (76 mm) above finished floor.

5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

G. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

3.4 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.

2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."

3. Install 110-style IDC termination hardware unless otherwise indicated.

4. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.

5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

6. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.

7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.

8. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.

10. In the communications equipment room, install a 10-foot long service loop on each end of cable.

11. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.

2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

D. Optical Fiber Cable Installation:

1. Comply with TIA/EIA-568-B.3.

2. Cable may be terminated on connecting hardware that is rack or cabinet mounted.

E. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.

2. Suspend UTP cable not in a wireway or pathway, a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1524 mm) apart.

3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

F. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.

2. Install cabling after the flooring system has been installed in raised floor areas.

3. Coil cable 6 feet (1800 mm) long not less than 12 inches (300 mm) in diameter below each feed point.

G. Group connecting hardware for cables into separate logical fields.

H. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.

2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).

    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).

    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).

    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).

    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: No requirement.

    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).

    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).

6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.5 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Penetration Firestopping."Comply with TIA/EIA-569-A, Annex A, "Firestopping."

B. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.6 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI-J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.7 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

1. Administration Class: 3.

2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.

B. Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

C. See Division 27 Section "Communications Horizontal Cabling" for additional identification requirements. See Evaluations for discussion about TIA/EIA standard as it applies to this Section. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 3 level of administration including optional identification requirements of this standard.

D. Comply with requirements in Division 27 Section "Communications Horizontal Cabling" for cable and asset management software.

E. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

F. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

G. Cable and Wire Identification:

1. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.

2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.

3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m).

4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

a. Individually number wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device with name and number of particular device as shown.

b. Label each unit and field within distribution racks and frames.

5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

H. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA 606-A, for the following:

1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.8 TESTING PROCEDURES

A. All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA/EIA-568-B. All pairs of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.

B. All cables shall be tested in accordance with this document, the ANSI/TIA/EIA standards, the manufacturers procedures and best industry practice. If any of these are in conflict, the Contractor shall bring any discrepancies to the attention of the project team for clarification and resolution.

C. Cables, jacks, connecting blocks, and patch panels shall be in their final position with the building energized.

D. All Unshielded Twisted Pair cables shall be tested as follows:

1. All twisted-pair copper cable links shall be tested for continuity, pair reversals, shorts, opens and performance as indicated below. Additional testing is required to

verify Category performance. Horizontal cabling shall be tested using an approved manufacturer recommended certification tester (Fluke or Agilent) for category 6a, category 6, and category 5e performance compliance as specified in ANSI/TIA/EIA-568-B.2-1. Note: Cat 6a shall conform to current draft (current version) TIA/EIA -568-B-2.10 for augmented Cat 6 to 500 MHz.

2. Follow the Standards requirements established in ANSI/TIA/EIA-568-B .1, B.2-1.

3. Testing shall be accomplished with an approved manufacturer recommended certification tester (Fluke or Agilent)

4. The basic tests required are:

   a. Wire Map

   b. Length (feet)

   c. Insertion Loss (dB) (Formerly Attenuation)

   d. NEXT (Near end crosstalk) (dB)

   e. Return Loss (dB)

   f. ELFEXT (dB)

   g. Propagation Delay (ns)

   h. Delay skew (ns)

   i. PSNEXT (Power sum near-end crosstalk loss) (dB)

   j. PSELFEXT (Power sum equal level far-end crosstalk loss) (dB)

   Note: Cat 6a Ortronics NetClear GTX shall be tested to a Cat 6a auto test to 500 MHz
   Cat 6 Ortronics NetClear GT3 and GTS shall be tested to a Cat 6 auto test to 250 MHz.
   Cat 5e Ortronics NetClear GT shall be tested to a Cat5e auto test to 100 MHz.

5. All test results shall be provided in the approved certification testers original software format on a CD, with the following minimum information per cable:

   a. Circuit ID

   b. All information from 3.8D.4 above.

   c. Test result, “Pass” or “Fail”

   d. Date and Time of test

   e. Project Name

f. NVP

g. Version of software

Note: No asterisk * will be accepted by Ortronics. These results shall be retested and submitted after a PASS is received.

6. A software copy of the test results, in the original tester software format, shall be provided to the Owner and Ortronics.

7. Contractor shall provide a fully functional version of the tester software for use by the Owner in reviewing the test results.

8. Any failed test results that cannot be remedied through re-termination (as in the case of reversed or split pairs), must be reported in writing to the Owner immediately, along with a copy of the test results.

E. All Fiber Optic cables shall be tested as follows:

1. Testing procedures shall be in accordance with the following:

a. ANSI/TIA/EIA-568-A

b. ANSI/TIA/EIA-568-B.1

c. ANSI/TIA/EIA-526-7, Method B

d. ANSI/TIA/EIA-526-14, Method (Current Draft)

e. Proposed TSB-140 Tier one Fiber Certification, C

2. On the Reel Testing

1) In order to minimize rework that may be required due to factory fiber-optic cable defects, or damage in shipment, the Contractor shall perform fiber optic cable reel testing prior to placement.

2) One hundred percent (100%) of the cable’s fiber strands shall be tested with an approved Optical Time Domain Reflectometer (OTDR), a stabilized light source and optical power meter, or equivalent test equipment. Test results will be recorded on an approved form and a soft copy generated by commercially available off-the-shelf software associated with the OTDR test equipment. Completed test forms on each reel shall be handed over to Owner, including evidence of the OTDR's last calibration date.

3) A three-meter section of cable shall be removed from each reel of cable after verification of cable quality and provided to Owner with a copy of the test results.

4) Once approved by the Contractor and the Owner, the responsibility for replacement of damaged fiber will be the sole responsibility of the Contractor.

5) The Contractor shall supply all tools, test equipment, consumable items, and incidentals necessary to perform quality testing.

6) All cable ends shall be sealed upon completion of testing.

3. Cable Test Equipment

1) The Contractor shall provide a list of test equipment required for in process testing during installation and to demonstrate the performance capability of the installed cable plant. This list shall support the design criteria and performance specifications specified with this document. The Contractor shall be required to provide all testing results as part of his deliverable.

4. Post Installation Testing

1) In addition, all fiber optic cable strands will be tested after installation and termination to assure that attenuation and continuity are within acceptable limits. These tests will be performed with an OTDR and magnetic and hard copy of the trace and numeric boundaries of these tests will be provided to the Owner. Any fiber strands failing the continuity or attenuation measurement tests will be repaired or replaced by the Contractor at no additional cost to the Owner.

5. Passive Link Segments

1) Attenuation testing should be performed on each passive link segment of the cabling system. A link segment consists of the cable, connectors, couplings, and splices between two fiber optic termination units (patch panels, information outlets, etc.). Each terminated fiber within a link segment should be tested. The link segment attenuation measurement includes the representative attenuation of connectors at the termination unit interface on both ends of the link, but does not include the attenuation associated with the active equipment interface.

2) There are three basic types of link segments described in this document: Horizontal, Backbone, and Composite. A Horizontal Link Segment normally begins at the telecommunications outlet and ends at the horizontal cross-connect. The telecommunications outlet may be a multi-user outlet placed in an open office area. The Horizontal Link Segment may also include a consolidation point interconnection or a transition point splice. A riser Backbone Link Segment usually begins at the main cross-connect and ends at the horizontal cross-connect. For the purpose of this document a tie cable (placed between two horizontal cross-connects) and a campus cable (typically placed between two main cross-connects) are both considered Backbone Link Segments. Single Point Administration architecture (i.e. Centralized Cabling) eliminates the horizontal cross-connect, and as a result, horizontal and backbone cabling are combined into a Composite Link Segment. In this case, the horizontal closet may contain a splice, interconnect, or pulled-through cable.

6. General Testing Guidelines

1) Multimode Horizontal Link Segments should be tested in one direction at the 850-nm or 1300-nm wavelength.

2) Multimode Backbone and Composite Link Segments should be tested in either one or both directions depending on manufacturers testing specifications at both 850-nm and 1300-nm wavelengths.

3) Singlemode Horizontal Link Segments should be tested in either one or both directions depending on manufacturers testing specifications at the 1310-nm or 1550-nm wavelength.

4) Singlemode Backbone and Composite Link Segments should be tested in either one or both directions depending on manufacturers testing specifications at both 1310-nm and 1550-nm wavelengths.

5) The minor attenuation differences due to test direction are on par with the accuracy and repeatability of the test method. Therefore, testing in only one direction is warranted. Horizontal Link Segments are limited to 90 meters. Therefore, attenuation differences caused by wavelength are insignificant, and as a result, single wavelength testing is sufficient (AVAYA/Systimax only).

6) SYSTIMAX/Netclear requires multimode field tests to be performed with a launch condition as defined in TIA-455 part 50B (FOTB 50B). Defining a particular launch condition reduces measurement error and variability. This particular launch will produce field measurements that correlate well with component specifications. This launch condition can be closely and easily approximated in the field by using a Category 1 Coupled Power Ratio (CPR) source with a specific mandrel wrap on the launch test jumper.

7) In compliance with TIA/EIA-526-14A “Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant” and TIA/EIA-526-7 “Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant”, the following information should be recorded during the test procedure:

   a) Names of personnel conducting the test

   b) Type of test equipment used (manufacturer, model, and serial number)

   c) Date test is being performed

   d) Optical source wavelength, spectral width, and CPR (for Multimode tests only)

   e) Fiber identification

   f) End point locations

   g) Test direction

h) Reference power measurement (when not using a power meter with a Relative Power Measurement Mode).

i) Measured attenuation of the link segment.

j) Acceptable link attenuation. Note: Horizontal Link Segments are limited to 90 meters; therefore, the acceptable link attenuation can be based on the longest installed link without introducing a significant error.

7. Acceptable Attenuation Values

1) The general attenuation equation for any link segment is as follows:

2) Acceptable Link Attn. = Cable Attn. + Connection Attn. + Splice Attn.

3) Note: A connection is defined as the joint made by mating two fibers terminated with rematerable connectors (e.g. ST, SC, LC).

8. 62.5 mm Multimode Attenuation Coefficients

1) Cable Attn. = Cable Length (km) (3.40 dB/km@850nm or 1.00 dB/km@1300nm)

2) Connection Attn. (ST connectors) = (Connections 0.39 dB) + 0.42 dB (AVAYA/Systimax)

3) Max Connection Attn. (ST Connectors) = 0.75 dB/pair (Berk-Tek/Ortronics)

4) Splice Attn. (CSL or Fusion) = Splices 0.30 dB

9. Singlemode Attenuation Coefficients

1) Cable Attn. = Cable Length (km) (0.50 dB/km@1310nm or 0.50 dB/km@1550nm)

2) Connection Attn. (ST connectors) = (Connections 0.44 dB) + 0.42 dB (AVAYA/Systimax)

3) Max Connection Attn. (ST Connectors) = 0.75 dB/pair (Berk-Tek/Ortronics)

4) Splice Attn. (CSL or Fusion) = Splices 0.30 dB

10. Link Segment Testing

1) SYSTIMAX/Netclear requires all multimode link segment tests to be performed with a launch condition as defined in TIA-455 part 50B (FOTB 50B). This launch condition can be closely approximated in the field by using a Category 1 CPR source with a mandrel wrap of a specific type on the launch test jumper.

2) In order to include all connections in the measurement, the One Reference Jumper Method B specified in TIA/EIA-526-14A and TIA/EIA-526-7 shall be used to test each link segment.

11. Verification and Acceptance

1) Verification that all of the components are as specified and meet the installation criteria specified by respective component Contractor will be the responsibility of the installation Contractor. Testing and data recording should be accomplished and the results provided to Owner during the acceptance period.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Visually inspect UTP and optical fiber jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.

2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

3. Test UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.

a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

4. Optical Fiber Cable Tests:

a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

b. Link End-to-End Attenuation Tests:

1) Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in 1 direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.

2) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.

D. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

E. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

F. End-to-end cabling will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

1. UTP Performance Tests:

a. Test for each outlet. Perform the following tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.2:

1) Wire map.

2) Length (physical vs. electrical, and length requirements).

3) Insertion loss.

4) Near-end crosstalk (NEXT) loss.

5) Power sum near-end crosstalk (PSNEXT) loss.

6) Equal-level far-end crosstalk (ELFEXT).

7) Power sum equal-level far-end crosstalk (PSELFEXT).

8) Return loss.

9) Propagation delay.

10) Delay skew.

2. Optical Fiber Cable Performance Tests: Perform optical fiber end-to-end link tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.3.

3. Coaxial Cable Tests: Conduct tests according to Division 27 Section "Master Antenna Television System."

4. Final Verification Tests: Perform verification tests for UTP and optical fiber systems after the complete communications cabling and workstation outlet/connectors are installed.

a. Voice Tests: These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-

hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and digital subscription line telephone call.

b. Data Tests: These tests assume the Information Technology Staff has a network installed and is available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.

H. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

I. End-to-end cabling will be considered defective if it does not pass tests and inspections.

J. Prepare test and inspection reports.

END OF SECTION

SECTION 27 42 16 – MULTI USER FLIGHT INFORMATION DISPLAY SYSTEMS (MUFIDS)

PART 1 - GENERAL REQUIREMENTS

1.1 SYSTEM OVERVIEW

A. The project is for Portland International Jetport (PWM), referred to herein as the Airport.

B. The Contractor shall provide a fully operative integrated airport system, referred to herein as the Airport Information Management System (AIMS) that meets all of the equipment, functional, operational, performance, and redundancy requirements in the project plans and specifications.

C. The Contractor shall obtain written approval from the designated Authority representative(s), referred to herein as the Project Representative, prior to implementing any aspects of the AIMS. Designated Authority representatives will be identified in writing to the Contractor.

D. An integrated aspect of the AIMS shall be an Airport Operational Database (AODB), also referred to herein as AIMS Database. As such the AIMS shall provide integrated data resources/event triggers and middleware between subsystems as required to meet functionality described in this, and related documents. The AIMS shall support the real-time data warehousing and retrieval of data and provide the mechanism for the integration of systems at ACY.

E. The AIMS shall be provisioned to include the following subsystems:

1. Revenue Management and Billing Module (Revenue Manager) – A new AIMS module to be provisioned as part of this project scope of work.

2. Multi-User Flight Information Display System (MUFIDS) - A new AIMS subsystem to be provisioned as part of this project scope of work. The MUFIDS will provide for all dynamic display requirements including flight information, baggage information, visual paging, video, weather, advertising and other dynamic display information. Besides the core MUFIDS the following sub-modules shall be provided:

   a. Visual Paging Module

   b. Screen Designer Module

   c. Video Advertising Module

3. The AIMS system must be capable of allowing future subsystems to integrate. The AIMs subsystems that could be used for the future are the following:

   a. Resource Management

   b. CUPPS – Common Use passenger processing

   c. Revenue and Billing

   d. Gate Management

4. Common Use Self Service kiosks (CUSS) – A new subsystem of AIMS with partial hardware installation and future deployment of hardware associated with this system. Additionally, a CUSS Kiosk Management Module shall be provided.

F. Contractor shall provide ongoing service and maintenance for the AIMS based on selected Service Level Agreement.

1.2 RELATED DOCUMENTS

A. Drawings, Standard Contract Requirements, Special and General Provisions and all applicable Specification Sections, apply to this Section.

B. Contractor shall review in detail the Telecom project drawings and specifications, construction material and methods, and other issues requiring coordination. Architectural millwork, power, and data will all be performed by others outside of this bid item.

1.3 EQUIPMENT AND SERVICES BY SYSTEMS INTEGRATOR

A. The Contractor (Systems Integrator) shall perform all work, systems integration, engineering design, and testing, and shall provide all products required in order to ensure fully operative systems that fully meet the hardware, functional, operational, redundancy, and performance requirements defined herein. System operability and proper installation shall be verified via successful completion of the acceptance testing.

B. Hardware as specified for the AIMS (refer to hardware specifications) and hardware that is specific to the Contractor's solution necessary for a fully compliant system.

C. Final connection of hardware to power, phone, data circuits, and cabling infrastructure (patch cords connecting the AIMS equipment to the data outlets or network equipment). The Contractor shall provide all patch cabling, connectors, adapters, and terminating equipment necessary to interconnect all system equipment.

D. AIMS software and any other software that may be required to make the system fully operational as specified.

E. Implementation design work for the AIMS such that the implemented system meets the hardware, functional, operational, performance, and redundancy requirements specified herein.

F. Installation and setup of the AIMS system (hardware and software).

G. Provide all data level integration and interfaces as identified.

H. Coordination of airline host system interface and WAN/LAN terminations in the core (MDF) computer room and for testing.

I. Coordination of non-hosted airline interface requirements.

J. Hardware, software, and contract submittals as specified.

K. System warranty as specified.

L. Integrated Systems service level agreement on a per year basis for one (1) years.

M. Training as specified.

N. System test plans and testing as specified.

O. Provide all calculations and/or analysis to support design and engineering decisions as specified in Submittals.

P. Provide and pay for all labor, materials, and equipment. Pay required sales, gross receipts, and other taxes.

Q. Secure and pay for plan check fees, permits, fees, and licenses necessary for execution of work as applicable for the project.

R. Give required notices to Project Representative.

S. Comply with all codes, ordinances, regulations, and other legal requirements of public authorities which bear on performance and execution of work.

T. Mounting of all LCD screens and associated Mounts and Hardware.

U. Interfacing existing PWM core switch with new Switch in MDF and all associated Conduit and Fiber interconnections.

1.4 PROJECT COMPLIANCE

A. References

1. The publications listed form a part of this Specification. Reference publications for project adherence include those listed below and those included in supporting sections.

2. If conflicts exist between referenced requirements, then comply with the one establishing the more stringent requirements. If conflicts exist between referenced requirements and Contract documents, then comply with the one establishing the more stringent requirements.

3. The Regulations, Codes, and Standards listed shall be followed in execution of this project. Additionally, the Contractor shall adhere to local codes and regulations. The latest version of all documents shall be utilized.

4. General documents

a. ISO 9001, 9002, 9003, 9004; Quality Assurance

b. National Electrical Manufacturers Association (NEMA)

c. NFPA 70 National Electrical Code (NEC)

5. Common Use

a. International Air Transport Association (IATA) RP 1797; Common Use Passenger Processing Systems (CUPPS) and associated CUPPS Technical Requirements and Technical Specification (For Future use).

b. Due to transitional phase of this industry recommend practice and its planned replacement of CUTE, Contractor shall identify any deviations from current version (whether draft or final) of RP 1797 and CUPPS-TR and CUPPS-TS (For Future Use)

c. IATA Resolution 792; Bar Coded Boarding Pass

d. IATA RP 1706c; Common Use Self-Service (CUSS)

e. IATA RP 1706e; Paper Specifications for Documents to be Printed by a General Purpose Printer in a CUSS Kiosk

B. Federal, State & Local Codes

1. Comply with applicable laws and regulations in accordance with the Project Documents

2. Conform to applicable Federal, State and Local Building Codes and latest National Electrical Code adopted by local jurisdiction.

3. Pay for all permits, licenses, services and inspections required for successful completion of the work.

4. Deliver a copy of all permits and licenses required for the work to the PWM Representative.

5. At the completion of the work, secure and deliver to PWM all certificates of compliance of local authorities.

6. During construction, the Contractor shall be responsible for providing all his employees with working conditions as prescribed in the “Safety and Health Regulations for Construction” of the Occupational Safety and Health Administration of the U.S. Department of Labor.

7. Work shall conform to the Authority’s practices and standards.

C. Industry Practices

1. Common use Self Service implementation shall adhere to IATA Simplifying the Business (StB) initiative practices.

2. The AIMS database(s) shall comply with Open Database Connectivity (ODBC) interface practices.

3. Software used for this project shall have been developed using revision numbering and tracking procedures.

4. Software development shall be completed and document by certified developers using internationally recognized computer languages and techniques.

5. Proprietary development tools shall be identified in the proposal.

1.5 LAWS AND REGULATIONS

A. Comply with applicable laws and regulations in accordance with the General Conditions and Supplementary Conditions..

1.6 PROJECT/SITE CONDITIONS

Install work in locations as described or shown on drawings and schedules.

A. The Contractor is not required to visit the entire site prior to preparing and submitting the project Bid Response. Pre-bid questions if needed shall include:

1. Name and contact information for Contractor submitting questions

2. Questions shall be submitted in “softcopy” media such as Microsoft Word

3. Questions shall provide reference to specific drawings sheets and /or Specification part/page wherever possible.

4. Itemize questions to include a single topic per question.

1.7 OVERVIEW OF PROJECT SCOPE

A. The work defined in this Section and related drawings consist of upgrade New MUFIDS system and CUSS Kiosks at PWM. A general description of the work includes but is not limited to:

1. Provide installation of the new system defined herein throughout the Contract period. Contractor shall include all costs associated for support of Contractor tasks required for the long term phasing plans of this project, including multiple mobilization and demobilization, and coordination with and support of PWM.

2. Intergrators must have a minimum of FIVE airport MUFIDS and CUSS installations. Approved Integrators include:

a. SITA

b. AIRINC

c. Intersystems

d. ULTRA electronics

e. AIRIT

f. Comnet

g. Infax

h. Or approved equals

3. The provisioning and installation of new, fully integrated dynamic signage, BIDS, FIDS, and video display equipment as noted in project schedules and drawings.

4. The provisioning, programming and installation of new PC Digital Video Controllers (DVC’s) and video extension equipment where necessary.

5. Coordination and compliance with PWM’s representative(s) for signal distribution including review and provision of acceptable protocols and IP address establishment over the Owner’s Local Area Network (LAN) using assigned Virtual LAN’s (VLAN’s).

6. Provide operations and maintenance training for PWM staff.

7. Include multiple phases of system testing, retesting, and documentation of test results and submittal of test documentation.

8. Provide and install a new Visual Paging system hardware and equipment as indicated in the contract documents.

9. Provide and install a new Core and Distribution switching equipment as indicated in the contract documents.

1.8 WORK SEQUENCE AND SCHEDULING

A. Installation of the work shall accommodate Airport's operational requirements throughout the construction period. The Contractor shall develop and submit for PWM approval, a Phasing Schedule that details existing displays, use of temporary displays, processors and user interface demolition/removal, and installation, testing and activation of new equipment.

B. Phased cutover and shutdown of existing system(s) shall follow the suggested Phasing Schedule. Contractor may submit a revised phasing schedule for PWM review and approval, and if revised schedule is not approved then the suggested schedule will be used.

C. Work shall be planned and coordinated to ensure an absolute minimum impact to:

1. PWM operations.

2. The traveling public.

3. Airlines.

4. Other Airport Tenants.

D. The cost of any anticipated overtime and after-hours work shall be included in the Contractor's bid item. Requests for additional compensation for "overtime" or "after-hours" work after award of contract will be refused.

E. Coordinate systems cutover, phasing, work schedule and operations with PWM representative(s), and other trades working on site.

F. The Existing Airport will remain in operation throughout this project, therefore the existing system and or the new system shall be operational, accurate and fully functionnal for use by the public and airport users.

G. Contract must coordinate with Base contract work associated with General Contracting, Power, and Data.

1.9 TERMS AND ACRONYMS

A. The following list includes some of the terms and acronyms used throughout this specification section:

1. AIMS – Airport Information Management System

2. AODB – Airport operational database. An enterprise level database designed to allow a variety of airport information types to be accessed by multiple users.

3. API – Application Programming Interfaces

4. CUSS – Common Use Self Service

5. CUPPS – Coomon Use Passenger Processesing

6. C.U.T.E. – Common use terminal equipment, a system designed to allow shared use of facilities (such as gates and ticket counters) by multiple airlines.

7. DVC – Digital Video Controller – for this project the term DVC shall apply to a PC type processor that interfaces display video screens with the system.
8. MUFIDS – Multi User Flight Information Display System (commonly used to define a system used by a Multiple airlines)
9. GMS – Gate Management System. A scheduling tool used to optimize use of facilities and provide calculated solutions and models for degraded operational scenarios.
10. HTML – Hypertext Markup Language
11. IP – Internet Protocol
12. IVR – Interactive voice response system
13. LAN – Local area network
14. FIDS – Flight information display system
15. ODBC - Open Database Connectivity
16. OLE DB - Object Linking and Embedding
17. PC – Personal computer – for this project the term PC shall apply to user workstations
18. PWM – Portland Westbrook Municipal
19. SQL – Structured Query Language
20. TCP - Transmission Control Protocol
21. VLAN – Virtual Local Area Network
22. VPN – Virtual Private Network
23. XML – Extensible Markup Language
24. XSL – Extensible Style sheet Language

PART 2 - SUBMITTALS

2.1 PROJECT SUBMITTAL REQUIREMENTS

A. General

1. The Contractor shall submit for review and evaluation by Project Representative, copies of each major product or item. The Contractor shall not purchase or install any item prior to receipt of written approval from the Project Representative.
2. Submitted items that have be reviewed and evaluated by Project Representative and have been found unsuitable, rejected or returned for revision shall be reworked by the Contractor and resubmitted until an approved review has been issued by Project Representative.

3. All submittals are subject to Project Representative approval. Contract submittals will be submitted for a minimum of one round of review and comment by PWM. The Contractor shall be responsible for incorporating all comments and resubmitting as directed by the Project Representative. The Contractor shall assume all Project Representative review costs for submittals rejected twice and requiring a third or more reviews by the Project Representative.

4. The delivery dates of submittals will be negotiated unless specified herein. The Contractor shall supply any submittal within thirty (30) days if requested by the Authority.

5. Major Items required for submittal include, but are not limited to those identified in the following sections.

2.2 PRODUCT AND SHOP DRAWING SUBMITTALS

A. List of product items and types expected to be submitted for PWM review.

1. Within 15 days after date of notice to proceed, submit a list of major product items proposed for use. The list shall be compiled in a table format and saved on a common software spreadsheet tool such as Microsoft Excel or Word. The list shall include table fields identifying individual line items as indicated in the following sample: **Note: the initial version of this submittal list will include blank fields intended for future use.*

						REVIEW STATUS						
Item #	Spec or dwg ref.	Sub. #	Product or Drawing Title	Date Submitted	Date Returned							Review Comments
1	16781.4.3	001	MUFIDS 40-inch LCDs									
2	16781.4.6	002	MUFIDS 40-inch LCD's									

2.3 TABLE 1.0 – SAMPLE SUBMITTAL LIST

A. Requirements for Product Submittals:

1. Provide Product submittals for each type of equipment and/or material intended to be incorporated into the work.

2. Do not purchase or install products that have not been approved through the PWM submittal review and approval process.

3. Identify project specification section/subsection or drawing sheet numbers products are intended to comply with.

4. Name and contact information of product manufacturer

5. Proposed item trade name, model number, specific options and accessories for of each product.

6. If multiple products/part numbers/ options/ and or accessories are listed on product submittal cutsheets, the Contractor shall markup and notate exactly which items are intended for installation on the project.

B. Requirements for Shop Drawing Submittals:

1. Provide Shop Drawing submittals for the following:

a. System flow diagrams.

b. Equipment Rack/Cabinet Elevations.

c. Display equipment dimensioned detail drawings.

d. Integrated wiring diagram for each specified display bank for data, video and power.

2. Do not purchase or install items defined in shop drawings that have not been approved through the PWM submittal review and approval process.

3. Identify project specification section/subsection or drawing sheet numbers Shop Drawings are intended to comply with.

4. Name and contact information of product manufacturer, Engineer and Contractor

5. Include engineered calculations and configurations. Provide valid P.E stamps on applicable drawings.

6. If multiple configurations and or options are illustrated on drawings, the Contractor shall markup and notate exactly which items are intended for installation on the project

C. Contractor Initiated Request for Substitution:

1. When a substitution is proposed, the Contractor shall submit product cutsheets and shop drawings of both the specified and proposed items.

2. The request for substitution shall include a typewritten technical analysis outlining the qualities, benefit to PWM and cost savings of proposed items versus the specified item or previously submitted items.

3. Samples of both items shall be submitted upon request from PWM's representative(s).

4. PWM reserves the right to accept or reject product substitutions based upon benefit to the airport.

2.4 SCHEDULES- SUBMITTAL

A. CONSTRUCTION SCHEDULES

1. The Contractor shall create and maintain a project construction schedule. This schedule shall be maintained with accuracy to within current two-week status and available for inspection by PWM and its representatives throughout construction.

2. Two week look ahead schedules of planned activities and tasks shall be created, maintained and submitted for review throughout the project duration.

3. Provide project construction schedules based upon the Project Phasing Schedule including, but not limited to the detailed identification of processor tasks, planned start and stop dates, task durations, milestones and related information.

4. General Contractor is responsible for preparation and maintaining of overall construction schedule. Electrical Contractor shall coordinate work with General Contractor, as is the General Contractor will also coordinate work with the Electrical Contractor.

B. PHASING SCHEDULES

1. This Project requires the Contractor to follow a sequenced phasing plan, which mandates that each predecessor or current phase is completed and accepted by PWM, prior to initiation of follow on phases, unless written exception is issued by PWM. Refer to Base drawings for Phasing Plan.

C. Integrated Systems Deliverables

1. Systems Design Document: Provide a complete system design document for the AIMS integrated system and related subsystems a minimum of seventy (70) days prior to functionality testing. The documents shall include description and drawings for:

a. Design details of AIMS

b. Design detail of individual subsystems

c. Design detail of core system configuration including servers, services, applications, connectivity

d. Interface Control Document defining each systems interface.

2. AIMS Database Structure Document: The Contractor shall develop and submit an AIMS Database Structure Document a minimum of fifty-six (56) days prior to functionality testing. Primary topics to be detailed in the document include, but are not limited to:

a. Database modeling concept and methodology

b. Define database schema including field type, field length, table dependencies, etc.

c. Define applications and other database interfaces to the AIMS database

d. Database backup and archiving methods

D. Software

1. Software submittals shall include manufacturers / developer's documentation for each type of software used in the project. Documentation shall include:

a. Complete description of software features and functionality.

b. Software version & revision identification

c. Software manufacturer's contact information for technical support, including address, telephone numbers, fax numbers and e-mail /Web URL's

E. Hardware

1. Hardware submittals shall include manufacturers documentation for each type of hardware used in the project.

2. Documentation for hardware shall include:

a. Complete description of hardware features, proposed options and functionality.

b. Manufacturer's contact information for technical support, including address, telephone numbers, fax numbers and e-mail /Web URL's

F. As-Built Documentation and Maintenance Documents

1. The Contractor shall provide the Authority with detailed as-built documentation defining the AIMS, subsystems furnished with AIMS, database structure, and interface methods, procedures, configurations and related information. Compiled and updated versions of previously approved submittals may be included to meet this requirement.

2. The level of detail defined in these As-built documents shall be suitable to allow the Service and Maintenance Staff to support AIMS maintenance as well as future integration and expansion of the AIMS at the Airport.

3. Each of these As-Built Manuals shall be submitted in the following quantities and media types:

a. CD Media: 8 CD Copies with identical contents to the following hardcopy binders.

b. Hardcopy Binders: 8 Copies including the following format:

1) Manuals shall be bound or 3-ring binders with the Airport logo; project title, manual titles and date of contract close out printed on cover.

2) Table of contents

3) Cover page shall include system provider's telephone number, physical address and Internet address.

4) Subject matter shall be indexed in tabbed sections

4. System Administration Documentation: The Contractor shall supply System Administrator documentation that details the operation of each of the provided systems and integration pieces. This documentation shall provide complete information on the operation, maintenance, and trouble-shooting of the AIMS. The manuals are to be bound in three ring or spiral binders with a table of contents and a tab for each section or division. The information included in this documentation shall be covered during system training provided by the Contractor.

5. User Documentation: The Contractor shall supply User documentation that shall explain how each of the AIMS subsystems operates from an end user perspective (if applicable). This documentation shall be in accordance with and contain at least as much information as that included within the online help system. The manuals are to be bound in three ring or spiral binders with a table of contents and a tab for each section or division. The information included in this documentation shall be covered during system training provided by the Contractor.

6. Software Documentation and Utilities: All software shall be delivered with full documentation. Documentation shall include software error messages, description, and troubleshooting guide. The documentation shall include textual explanations and instructions and be supported by appropriate graphs, flowcharts and/or block diagrams. Adequacy of the flowcharts and the block diagrams shall be at the discretion of the Project Representative.

7. Maintenance Manuals: Manuals including maintenance instructions and other descriptive material as received from the manufacturers shall be provided that will enable Authority personnel to maintain equipment and test equipment. The Contractor shall make reasonable effort to obtain specified maintenance documentation for all third party equipment. This documentation shall include descriptions, specifications, theory of operation (where applicable), layout drawings (showing component types and positions), and back-panel and assembly wiring diagrams.

8. Preventative Maintenance: Instructions shall be provided for preventive maintenance procedures that include examinations, tests, adjustments, and periodic cleaning. The manuals shall provide guidelines for isolating the causes of hardware malfunctions and for localizing faults. The manuals shall provide thorough instructions on the use of any specialized test equipment needed for hardware maintenance.

9. Parts Lists: Complete parts lists and breakdowns that identify each hardware component (to the lowest repairable unit) as well as ordering information for these parts shall be provided. Recommended spare parts lists shall be included in the maintenance manuals.

10. Software Backup Copy: A backup copy of all the configured system software shall be provided on DVD-ROM media. All original distribution software shall be delivered with an installable backup. The backup copy shall be appropriately labeled.

G. Other Project Deliverables

1. Test Plan: The Contractor shall supply system test plans for each phase of testing (i.e., factory acceptance, performance testing, and endurance testing) as well as all related test results and reports. Each test shall include a purpose/goal, detailed procedure, and clear pass or fail criteria. Each specification requirement shall be tested and referenced. A summary cross-reference between each test and the specification shall be provided and sorted in the order of the specification requirements.
2. Training Plan: Training plan and course materials as specified.

2.5 QUALITY ASSURANCE

A. Equipment and materials shall be standard products of a manufacturer regularly engaged in the manufacture of each of the integrated system's equipment and shall be the manufacturer's latest standard design.

B. Provided products shall meet the following requirements:

1. Electrically powered equipment shall be UL approved.
2. Items of the same classification shall be identical. This requirement includes equipment, modules, assemblies, parts, and components.
3. All similar types of devices (e.g., LCDs) shall be of the same manufacturer.

2.6 SOFTWARE LICENSING

A. General

1. Submit executed license(s) for each type of software installed in the work.
2. Licenses shall have no expiration date for use at PWM.
3. Commercial software packages shall have all registration and licensing documentation filed indicating PWM as the owner of the software. Costs for commercial off-the-shelf software licenses shall be included.
4. Software developed for this proposal shall be licensed to PWM. This license shall include all executable, library, object, and source code required to maintain and modify the delivered product. Where possible this information will be delivered on DVD-ROM. All compilers, case tools, utilities, etc. that are needed to create the executable code shall be included.
5. The Contractor shall provide site licenses. Licenses shall be valid for the projected quantity of PWM Users and processors installed in work. If a site licenses is not available, a minimum of 100 user licenses for each type of software used in the AIMS shall be provided. The Contractor may propose an alternative licensing scheme in addition to the base proposal.
6. Licenses shall be valid for the projected quantity of PWM Users and processors installed in work.
7. The Contractor shall provide original and duplicate notarized copies of software licenses for each type of software installed at the Airport including but not limited to:

    a. Middleware and other specialized software

b. Application Software

c. Operating System Software

d. Database Software

e. Device drivers software

B. Software Source Code

1. All software shall be delivered with standard documentation. Additionally, all custom and special purpose software shall be delivered with well-commented source code in addition to the executable version. Source code shall be delivered in both hard copy and machine readable formats on a media acceptable to the Project Representative. All compilers, case tools, utilities, etc. that are needed to create the executable code shall be included.

2. The Systems Integrator may propose a non-disclosure agreement.

C. Escrow

1. For any of the above software products where source code is not directly delivered to the Authority, the source code shall be placed in an escrow account. As an add alternate, the Systems Integrator shall propose to provide the escrow account. The source code in the escrow account shall be the same version and revision of code that is in use at the Airport. If any of the following conditions are met, PWM shall be allowed to obtain the source code from the escrow account at no charge:

a. The software supplier (i.e., Systems Integrator or subcontractor) becomes insolvent

b. The software supplier becomes non-responsive to PWM's needs

c. The software supplier has a demonstrated lack of willingness to continue to support PWM in a reasonable manner.

2. PWM shall have permission to use the source code as necessary to support operations at the Airport once obtained from the Contractor or escrow account.

3. If the Systems Integrator makes any changes to the software which relates to its use for this project, then the copy of the software held in escrow shall be updated accordingly. This update shall take place within 30 days of the released software change.

2.7 WARRANTY

A. General

1. The Contractor shall provide a joint written warranty of the manufacturer(s) and the installer(s), on a single document. The warranty shall warrant complete installation of the equipment, system, and software, labor, and components furnished in accordance with the project specifications, schedules and Contract Drawings to be free from defects in materials and workmanship for a period of no less than twelve (12) months.

2. Warranties shall be executed in the name of the Owner**.**

3. The starting point for the warranty shall be from final system acceptance from the openening date of the head end system.

4. Draft of warranty shall be submitted to Engineer and Owner for review prior to execution. Warranty shall also be cosigned by the Electrical Contractor prior to submission and acceptance of warranty by the Owner.

B. Hardware Warranty

1. All hardware supplied as a part of this Specification shall have a minimum of a three (3) years warranty. Acceptance by the Owner. For LCD/Plasma screens, warranties shall include image retention caused by twenty-four (24) hour operation of the unit.

2. The Contractor shall warrant the system will conform to its description and any applicable specifications, and shall be of good quality for the known purpose for which it is intended. This warranty shall be in addition to any standard warranty or service guarantee given by the Contractor to PWM.

3. The warranty shall allow for replacement or repair of failed items at the discretion of PWM.

4. Warranty hardware replacement for items not included in spare parts shall be delivered to the Airport within 48 hours. Warranty hardware replacement for items included in spare stores shall be delivered to the Airport within ten (10) working days.

5. Warranty hardware replacement shall be delivered fully configured.

6. The equipment manufacturer shall be responsible for removing faulty equipment (including power & data disconnections), crating, packaging, shipping, handling, acceptance, re-installation of new equipment and associated connection, terminations (power & data), etc. as required for a complete and fully functioning system.

C. Software Warranty

1. All software supplied as a part of this Specification shall have a minimum of a one (1) year warranty. The warranty shall allow for replacement or repair at the discretion of PWM.

2. All software necessary to compile, modify, and maintain software developed for this Specification shall be included in this warranty.

3. Software upgrades shall be provided and installed at no additional cost during the warranty period.

D. Service Response Times

1. Warranty response times for system failures during the warranty period shall be governed by selected SLA.

2. If a SLA is not selected, then warranty period response time shall be 8 hours for emergency failure and 36 hours for critical failure.

E. Warranty Extension

1. Annual fixed pricing shall be provided for four (4) one (1) year extension periods for hardware and software warranty extension.

2. Hardware and software warranty during the extension period shall include the same aspects (software upgrades, etc.) as the regular warranty period.

F. Other Requirements

1. Spare Components and Parts Replacement: The Contractor shall provide, at the outset of the onsite testing a store of consumables and spare parts as required. Those consumables and spare parts shall be available to the Contractor for use during the equipment demonstration test, warranty periods, and extended support period in order to maintain system response time criteria as detailed below. The Contractor shall replenish the store as it is used, so that at the end of the test and warranty periods, the store shall be equal to that initially provided. Based upon the maintenance experience of the warranty period, the Contractor shall recommend, at the end of the warranty period, any changes in spare component and small part stores that may prove to be appropriate. The Contractor shall maintain the spare component store during any extended support period.

2. Special Equipment: The Contractor shall supply a list of special tools, test equipment, and outside inventory required for this project. The Contractor may recommend specific items to facilitate long-term support of the system.

2.8 SERVICE LEVEL AGREEMENT (SLA)

A. General

1. This project includes the requirements for the Contractor to provide service to the Airport and airline tenants throughout phasing and construction for all systems, which are brought online with software furnished under this project's scope of work.

2. The scope of work requires the Contractor to maintain any & all software systems furnished and activated by the Contractor throughout the project duration.

B. SLA Alternatives (Included in this BID ITEM)

1. SLA shall include hardware and software support via:

a. 24/7 phone support

b. 1 hour onsite response for emergency failure

c. 8 hour onsite response for critical failure

d. 36 onsite response for operational failure

e. Preventative maintenance services

C. Failure Definitions

1. Inoperative: A device shall be considered inoperative when the device does not perform its intended function(s) within defined performance criteria. Response services shall include inspections and necessary tests to determine the causes of equipment or software malfunction or failure. The failure services shall include the furnishing and installation of components, parts or software changes required to replace malfunctioning system elements.
2. Operational Failure – Defined as a networked end device (MUFIDS DVC, CUSS Kiosk etc.) that is inoperative.
3. Critical Failure – Defined as a redundant network or server component that is inoperative or when a system failure results in more than two (2) simultaneous operational failures, but less than fifteen percent (15%) of entire system.
4. Emergency Failure – Defined as a network or server failure that results in more than fifteen percent (15%) of the networked end devices being inoperative. A formal report shall be submitted to the Authority on the cause and resolution of the problem. Resolution shall not be considered complete until written approval is provided by the Authority.

D. Other Service Requirements

1. Support Availability: The Contractor shall commit to make available support for the AIMS for ten (10) years after final system acceptance.
2. Support Personnel: The Contractor shall commit approved support personnel for the duration of the service level agreement. Technicians performing installation and maintenance on the proposed system shall meet the following requirements:
   a. Manufacturer certified on all hardware/software applications with at least 2 years post-certification work experience.
   b. Be approved by the Project Representative.
   c. Shall attend a one (1) week manufacturer training class each year.

2.9 CONSTRUCTION SCHEDULING

A. The Contractor shall create and maintain a project construction schedule utilizing Critical Path (CPM) software specified by Construction Manager. This schedule shall be maintained with accuracy to within current two-week status and available for inspection by the Project Representative throughout construction.

B. Provide project construction schedules listing the following milestones

a. Construction NTP

b. Pre Construction Conference and Walk-Through

c. Any required Permits

d. Contractor Request for Information (RFI)

e. Shop Drawings, product and equipment submittals

f. Functional Testing

g. Construction Activities

h. Performance Testing

i. Training

j. Request for Substantial Completion Inspection

k. Endurance Testing and punch list development/resolution

l. System Commissioning

m. Project Close-out

n. Provide detailed schedule for critical path items furnished under the scope of work for this project, and items provided under a separate project or "by Others". This schedule shall be used to coordinate with the Authority, the Project Representative, related projects and airline tenants.

o. Provide bimonthly construction look-ahead schedules upon Project Representative request.

2.10 TEST PLANS AND PROCEDURES - SUBMITTAL

A. Provide test plans and procedure documentation for system, within 60 days following notice to proceed. Include a typed check-off list for each test, with a column for Engineer's witness initials for each test and date of each test.

B. Provide system test plans and procedures including test plan narrative, step-by-step procedure instructions, list test equipment used, and expected results.

C. Display equipment test plans shall include:

1. Manufacturer's startup and test procedures for display equipment.

D. Submit test plans and procedures for each of the following testing phases:

1. Performance Testing (PT)

2. Substantial Completion Inspection (SCI)

3. 30-day Test and Punch list Period

2.11 TRAINING SUBMITTALS

A. Contractor shall provide on-site training for PWM personnel with regards to operation and maintenance of the system software/hardware. Training shall provided on each of three (3) shifts (or as required) for no less than eight (8) hours each shift. This may be divided into four (4) hour intervals at the approval of the PWM. Provide bound copies of all training materials, O&M manuals, etc. for each person to be trained.

B. Submit proposed training course outlines for:

1. Operations & Maintenance

C. Submit proposed training manuals for:

1. Operations & Maintenance

D. Training manuals as well as Instructor manual shall be provided in an editable format (MS-WORD format) and reproducible by PWM for additional training of personnel. This cost is to be included in the bid. Training to be provided out of the normal work areas to prevent distraction and interruption to the instruction being given.

2.12 AS-BUILT DOCUMENTATION- SUBMITTAL

A. At the completion of the work, and prior to final acceptance and payment, the Contractor shall provide the PWM with a complete set of As-Built Documentation including:

1. As-Built Drawings hard copy bound sets and in electronic file format AutoCAD (latest version). The As-built drawing set shall consist of the updated and expanded project construction drawings including but not limited to:

a. Floor plan / device location sheets.

b. Enlarged plans, elevations and detail sheets.

c. All telecommunications horizontal cabling and data location sheets and/or schedules.

2. As-built schedules:

a. Updated FIDS device schedules

PART 3 - PRODUCTS

3.1 CONDITIONS:

A. General:

1. All products shall be new, undamaged and covered by the original manufacturer’s warranty and licensed as applicable to meet project intent.

2. Products shall be shipped, handled and stored as recommended by the manufacture.

3. The Contractor shall furnish and install products in accordance with manufacturer’s recommendations and as illustrated in the project drawings.

4. Should discrepancies be noted regarding quantities in schedules, specifications and/or on Project drawings, the Contractor shall provide the greater number of units.

5. Contractor shall coordinate product delivery and movement of equipment to installation locations with the PWM, and expect restrictions of delivery to off-hour periods, for the purpose of minimizing impacts to PWM operations.

3.2 SPARE EQUIPMENT

A. Furnish equipment operational spares that are new in condition, covered fully in warranty by the manufacturer and stored in manufacturer's shipping containers.

B. Spares equipment shall be exact same product (manufacturer and model) as units installed in the work.

C. Provide a minimum of five (5%) percent (or a minimum of one (1) each, whichever is greater) of equipment as spare parts (i.e. each type/size of the following: mounts, screens, monitors, DVCs, CUSS Kiosk Equipment, etc. – this list is not all inclusive).

3.3 VIDEO DISPLAY EQUIPMENT –GENERAL

A. Video Display Equipment shall be furnished and installed to provide the public, PWM staff and other users with flight, baggage, visual paging and other information. Refer to the drawings and schedules for video display quantities and sizes for specific locations.

B. All LCD video products provided for this project shall be manufactured using only "Grade A" rated LCD glass.

C. LCD video screens shall be provisioned at locations indicated in the project drawings, primarily for public viewing. Note: Some display locations have space constraints and millwork support which limit the over dimensions of acceptable screen models. The Contractor shall coordinate and verify display dimensions and attachment requirements for each prior to submittal or ordering any products.

D. All LCD products shall be designed to support mounting of the screen in portrait and landscape orientations with equal field of view and maintain manufacturer's performance and operational requirements. Refer to drawing MF 12.20 for further information.

E. Each video display shall be furnished with a power cord. The Contractor shall determine and provide power cords of the appropriate length for each display listed in the project schedules and indicated in the project drawings.

F. Furnish video display handheld remote controls for each type of video display listed in the project schedules and indicated in the project drawings. As a minimal requirement provide at least 1 remote control unit for each 10 units of identical model and manufacture video display equipment type. For video display type listed in the project documentation and drawings with quantities of less than 10 units, provide at least one remote control per video display unit.

G. All video display front screen bezels shall be black in color. No manufacturer's names, lettering or logos shall be visible on the display front, glass or bezels.

H. The contractor shall furnish and install all adapters and cabling required to support signaling between the PC/DVC's (MAC Mini's) and the display screens. For locations indicated in the project schedules where one DVC is planned to provide video contents to two screens, the Contractor shall provide all adapters and cabling to extend video between the two displays. Note the locations planned with a single DVC supporting two video screens are intended to post identical video content on each screen.

3.4 40 TO 50-INCH LCD FLATSCREENS

A. 40 to 43-inch LCD video screens shall meet or exceed the following minimal requirements:

1. 1920 x 1080 pixel resolution or greater.
2. Brightness: 700 cd/m2 or better.
3. Contrast: 2000:1 or better.
4. Viewing angle: 178° (H) and 178° (V) or better.
5. Response Time: 16 milliseconds or faster.
6. VESA 200 standard hole pattern for wall mounting bracket and adjustable mounting arms.
7. 15 pin VGA type and DVI signal input ports.
8. NTSC and S-Video signal input ports.
9. 15 pin VGA type signal output ports to support loop thru of signal.
10. NTSC Video signal output ports to support loop thru of signal.
11. VESA DDC2B & DDC-CI Compliant Plug & Play.
12. Internal power supply.
13. Diagonal screen dimension: 40” to 43” (approximate size).
14. Operating Environmental Ranges: 41° to 104° F and 0 to 85% humidity or better ranges.
15. Multimedia type wherever required.

B. Control Interface Requirements:

1. VESA DPMS compliant power saving “sleep mode” upon loss of video signal.
2. User selectable disable/enable lockout of local display control buttons.
3. RS-232 and / or DDC-CI control via 15-pin VGA control ports supporting remote selection of:
   a. Power On & Power Off
   b. Input ports and signal type displayed
   c. Screen brightness and color adjustments

C. Design selection of manufacturers for 40 to 43-inch LCD video screens include, but is not limited to:

1. NEC
2. SAMSUNG
3. Or approved equal

3.5 DISPLAY ATTACHEMENT HARDWARE & ACCESSORIES

A. Video displays shall be provisioned with video screen manufacturer’s approved attachment hardware and accessories as defined in this and related specifications

Sections and as indicated on the Contract Drawings and schedules.

B. Furnish and install various attachment hardware and accessories including, but not limited to:

1. VESA standard flatscreen attachment plates and platform support with safety straps for CRT's.
2. Wall mounting brackets supporting display tilt range of -5° thru +15° or greater.
3. Ceiling mounting brackets supporting display tilt range of -5° thru +15° or greater.
4. Environmental mounting brackets supporting display tilt range of -5° thru +15° or greater.
5. Structural attachment hardware as required for each specific location to provide a complete installation.
6. Tamper resistant bolts, screws and fasteners.
7. Video screen control button/ connector panel concealment hardware and cable concealment sleeve material Tech-Flex or equal product
8. Display hardware material and finishes shall be; commercial grade steel and/or aluminum construction with powdercoat enamel finish. Finish color shall be black unless specific other color selections are defined in the project schedules, drawings or related Sections.
9. Display attachment hardware and accessories shall be designed and installed to exceed the expected loading and meet applicable building codes for the PWM site. Display attachments requiring structural support shop drawings shall be submitted with a valid State of Maine P.E. Seal (Stamp).

C. Design selection of suitable display hardware and accessories shall be as manufactured by Peerless Industries, Inc.

D. Contractor shall hire services of a Professional Structural Engineer, licensed in the State of Maine, to evaluate, document and design supplemental structural supports for the mounting of new monitors/screens as required in areas where new monitors/screens are to be installed from ceiling or wall structure (i.e. concrete precast tee structure, composite deck structure, drywall walls, baggage makeup carousels etc.) as required. Supplemental structural supports are defined as any type of additional framing structure or supports required due to existing structure constraints in order to attach new monitors/screens and associated mounting brackets. These supplemental structural mounting supports are in addition to the standard mounting hardware as specified either on the drawings or in the project specification manual. These supplemental supports may need to be anchored to the structural framing components of the building structure, depending on the existing building construction. Contractor shall submit detailed shop drawings (signed and sealed by a Professional Structural Engineer licensed in the State of Maine) to the Engineer regarding supplemental structural framing as required for new monitor/screen installation. Supports shall be anchored securely to the existing building structure and painted to match existing adjacent finish (color) as required. Primer coat of paint shall be applied to all steel used for supports along with two (2) finish coats. Refer to Painting and Metal Fabrication specification sections.

3.6 DIGITAL VIDEO CONTROLLERS (DVC'S)

A. DVC's provisioned for this project shall be commercially available units configured to support public video display systems and meet requirements listed herein.

B. DVC's shall be provisioned in quantities required to provide video signaling to display's defined in project schedules and drawings. Each video display provided in this project shall support system software operations, performance, and quality requirements.

C. DVC's shall be provisioned to support video display signaling in both portrait and landscape display orientations.

D. DVC's shall be furnished to provide one or two video outputs as defined for specific locations. Refer to the project drawing MF 12.20 and schedules for defining video port quantity requirements.

E. DVC Configuration Requirements: DVC's shall be installed in following physical configuration to support placement of units local to displays as follows:

F. DVC's shall meet or exceed the follow minimal requirements for components and performance:

1. DVC's shall be Dell Product or LINUX OS or approved equal with 2.0 GHz or greater Intel Core Solo processor. The DVC should be solid State with no moving Parts.
2. Memory: 1 GB RAM or greater
3. USB 2.0 ports-minimum of 2
4. Mouse: Dell or approved equal
5. Keyboard: Dell or approved equal
6. Network Interface Card (built-in): Ethernet IEEE 802.3, 10/100/1000 BaseT Gigabit Ethernet (RJ45 connector)
7. DVI to VGA video adapter(If required)
8. Video: Intel GMA950 graphics processor with 64MB of DDR2 SDRAM shared with main memory
9. Disk drives: 60GB solid state
10. Optical Drive: Slot-loading Combo drive (DVD-ROM/CD-RW)
11. OS software: latest version MS or Linux
12. Five (5) year protection plan to be provided.
13. Furnish video cabling required to extend video signal from DVC to video display input. The Contractor shall determine and provide video cables of the appropriate length for each display listed in the project schedules and indicated in the project drawings. (DVI Cabling required)

3.7 DEAD ON ARRIVAL OR FAILED EQUIPMENT

A. Dead on Arrival Equipment – Contractor shall immediately (within 24 hours) open up a trouble ticket and take all necessary steps to obtain a replacement and have

delivered on site within five (5) business days. Contractor shall provide all information to PWM as to the failed equipment, including but not limited to names, dates, times of contact, actions and action plans, contact numbers, trouble ticket numbers, and return authorization numbers.

B. Failed Equipment Prior to Completion of the Project– Contractor shall immediately (within 24 hours) open up a trouble ticket and take all necessary steps to obtain a replacement and have delivered on site within five (5) business days. Contractor shall provide all information to PWM as to the failed equipment, including but not limited to names, dates, times of contact, actions and action plans, contact numbers, trouble ticket numbers, and return authorization numbers.

PART 4 - AIMS REQUIREMENTS

4.1 GENERAL

A. The AIMS shall comprise the totality of the AIMS core services, the integrated subsystems provided as part of this project, and the defined systems interfaces with existing systems.

B. The AIMS subsystem functionality is defined in separate sections. The AIMS subsystems include:

1. MUFIDS
2. CUSS

C. The AIMS interfaces abilitywith existing systems shall include:

1. Fire Alarm System (FAS)
2. Baggage Belt Motor Control Panel (MCP)
3. Airport Website
4. Third party flight message service
5. IED Paging Interface (future upgrade capability only)
6. HVAC System Interface (future upgrade capability only)

D. The AIMS shall provide upgrade capability for remote operations (e.g., Hotel) including:

1. Remote CUSS Kiosk implementation
2. Remote bag handling operations including bag tracking mechanism
3. Remote MUFIDS

E. The AIMS shall support the following airlines and provide the required airline interfaces for each of the subsystems:

1. USAirways
2. Delta Connection
3. Continental Airlines
4. Jet Blue Airlines

5. Delta Airlines
6. Untied Airlines
7. All existing carriers presently at PWM. Contractor to include in Bid Current airlines.
8. A minimum of three (3) non-hosted charter airlines
9. Future airlines to support, but connectivity not required at this time include: JetBlue, Allegiant, Air Tran, Spirit, and Skybus.

F. Refer to the AIMS Systems Diagram and AIMS Data Flow Diagram for high level system configuration.

4.2 AIMS CORE SERVICES

A. General

1. The AIMS core services is comprised of the AIMS application and middleware, and its intrinsic AIMS Database (also referred to as the Airport Operational Database - AODB). The AIMS core services shall comprise the information hub for the AIMS subsystems.
2. The MUFIDS and RMS application tiers shall be fully integrated with the AIMS Database tier.
3. Other systems shall interface with the AIMS Database via middleware and data sharing including:

   a. CUPPS (only for future use) CUSS
   LDCS (only for future use) Revenue Manager (only for future use) Gate management (only for future use)

4. The AIMS core services shall accommodate the integration of a new components including the creation of tables and storage space for the new data, and the creation of interfaces to insert and retrieve the data from the AIMS Database.
5. The AIMS core services shall be the application or set of applications controlling data and security management functions. The AIMS shall have interactive interfaces for entering data and specifying how it should be retrieved and displayed.
6. The AIMS core services shall be the controlling entity for the user authentication, data dictionary, data distribution, data storage, data security, data integrity and data synchronization. The AIMS shall be the controlling entity for distribution of data updates to recipient systems and servers.
7. The AIMS core services shall include the necessary forms, reports, and interfaces to manage the data for the AIMS subsystems. The ability to sort on any field, combination of fields, or partial fields shall be provided. The user shall be able to specify either ascending or descending order. The default, if not specified, shall be ascending order. The system shall have the flexibility to customize the user interface without programming changes. The customization shall be accomplished with simple toggle switches or pop-up menus.

B. AIMS Database

1. The AIMS Database shall be the consolidated data repository for AIMS subsystems. The AIMS Database will serve as an information exchange mechanism. The principle role of the AIMS Database is to be the primary holder of data that relates to operational activity, flight information, facility data, common use self service, and visual paging.

2. In addition to requirements in this section, the AIMS Database shall meet all requirements in the Database Standards section.

3. The AIMS Database shall perform real-time data warehousing functions for Flight Information data, current and historical. The AIMS Database shall be the common relational database utilized by the AIMS subsystems. The AIMS Database shall house data generated as a result of custom and proprietary applications.

4. The AIMS Database shall accommodate central storage of airport operational data. The database shall be designed to permit real time backup of live data and a database restoration protocol shall be addressed to assist in disaster recovery.

5. The Contractor shall propose the AIMS Database engine solution for Project Representative approval. The AIMS database shall be an industry standard, open database platform such as Microsoft SQL or Oracle. The database platform shall be the latest version available at the time of project award.

6. The Contractor shall specify a hardware and software recommendation for supporting recommended backup procedures and disaster recovery.

7. The Contractor shall provide functional hardware and software interfaces for the AIMS Database so that:

   a. Airport personnel will be capable of obtaining information from the AIMS Database. Any information needed shall be available based on and according to specific user authorizations via administrative workstations in accordance with security requirements.

   b. The database tables shall be capable of accepting configuration changes on-line while having minimal impact on the operation to the overall AIMS Database.

   c. Database maintenance personnel shall be capable of making a backup copy for purposes of restoring to the AIMS Database.

8. The AIMS database shall provide the following functions:

   a. Hold the Airport Master Tables and act as a data validation point

   b. Include the ability to receive data both digitally from other systems and manually by data entry

   c. Automatically send data either initiated by a digital transaction or by a time trigger

d. Collate all data pertaining to a flight record from the time that the record becomes an active flight record until the total completion of the planned activity

e. Alerts users to irregular operations that are either flight or facility related

f. Provide individual subsystem data interfaces

g. Provide for data record retrieval

h. Perform data record archiving

i. Provide alarm notification and logging

j. Provide and support information dissemination to other airport systems and applications.

9. The AIMS Database shall be capable of holding numerous flight and operational related fields including, but not limited to:

a. Origins

b. Destinations

c. Airline data

d. Aircraft dimensional data

e. Registration (tail) number

f. Code share information

g. Start and stop times of aircraft rotational activity (for future use)

h. Start and stop times of aircraft parking activity (for future use)

i. Resource elements such as bag drop, ticket counter, and gate counter (for future use)

j. Device and workstation use data

k. Revenue and billing data (for future use)

10. The design of the AIMS Database shall permit the inclusion of additional fields and tables on an as-needed basis. The amount of additional fields and tables to be supported shall be no less than a minimum of two times the amount of initially populated database structure.

11. The database tables listed below shall be provided with the AIMS. The tables that make up the AIMS dataset shall consist of the following (as a minimum):

a. Master Flight Schedule Table

b. Active Flight Schedule Table

c. Historical Flight Schedule Table

d. End Device Table

e. Visual Paging Table

f. Ticket Counter Resource Table (for future use)

g. Gate Counter Resource Table (for future use)

h. Airline Table

12. Data Entry:

a. The AIMS Database shall maintain Master Tables, in order to ensure a uniform set of Master Table data across all integrated systems. The information shall be distributed to the subsystems. Subsequent updates and distribution of data shall occur as and when new or amended entries are made into the AIMS Database Master Tables.

b. All manual entry of data into the AIMS Database shall be via a graphical user interface and not directly input into data tables. All manual updates shall be verified as being valid records prior to any updates being implemented.

c. Interfaces to other systems to automatically input data into the AIMS Database shall be defined as part of the development of the Interface Control Document (ICD). Electronic data transfer shall be validated by the AIMS Database prior to the record being automatically updated.

d. At the initial set up of the AIMS Database and for the regular operations, it is required that data entered either manually or automatically shall conform to defined rules. Via these rules the AIMS Database shall verify that the data being sent is not only correct in structure but also content is valid.

e. All transactions occurring within the AIMS Database shall be logged to provide audit and tracking capabilities. The system shall also support the creation of a tracking report detailing all database transactions within a specific, user definable, time period.

13. Archiving System

a. The AIMS Database shall provide the archival system for all process information. The AIMS Database shall provide an archive capability, within another partition of the same database. The data held within the “operational” portion of the database shall be current month plus last month only. The purpose is to prevent historical records from having impact on the operational data and thereby impacting the transaction and response time of the graphical user interface.

b. Information shall be collected from all process databases and applications on a periodic basis and moved to archival tables to ensure performance criteria are met. Data in archived tables shall be accessible via the standard AIMS reporting and database tools with only minor performance degradation.

c. The AIMS Database archival system shall provide the ability to import or export data in any common database/spreadsheet format.

C. AIMS Integration Requirements

1. The AIMS core services shall interface with defined subsystems providing information exchange and archiving.

2. The Contractor shall be responsible for performing all data level systems integration and interfaces for the MUFIDS, CUSSVisual Paging, and advertising. Refer to AIMS Data Flow Diagram for high level interface requirements. The Contractor is responsible for coordinating with PWM stakeholders to finalize specific data exchange requirements.

3. The Systems Integrator shall fully document interface requirements for each subsystem.

4.3 SYSTEMS STANDARDS

A. General

1. The standards in the following sections apply to the entire AIMS and subsystems unless noted otherwise. Each individual system and application provided now or in the future shall meet these standards as a minimum.

2. The AIMS shall facilitate integration of other applications.

B. Software

1. Software provided shall be 64-bit based applications. In instances where 32-bit applications are provided Contractor shall submit for written approval. Software shall be built around a compliant operating system as defined in this Specification.

2. The Contractor shall deliver all required system and application software for a fully functioning AIMS. Each shall be identified by the generic, off-the-shelf name. The software provided by the Contractor to operate the systems shall be delivered in a ready-to-run form, including all necessary utility programs and documentation.

3. The systems shall use industry standard components. The systems shall not contain any proprietary interfaces or components. The system shall use industry standard application development software.

4. All new inter-relationships between the application, database, and operating system shall be the responsibility of the Contractor.

C. User Interface

1. Software modules shall have a Graphical User Interface (GUI). User interfaces shall provide a common look and feel for AIMS applications. Via the user interface, authorized users have the ability to select authorized application(s) to execute (e.g., CUSS application, MUFIDS application).

2. The systems shall provide context sensitive, on-line help capabilities. The online help system shall contain enough information to inform the user of the nature of the current form/window, and provide a reference for the user to gather further information. The Contractor shall populate the on-line help messages prior to Functionality Testing and provide a facility a mechanism for updating online help.

D. Operating System

1. Server O/S: The Contractor shall select a standardized 64-bit Operating System to use across all servers. The proposal shall specify the server operating system along with any exceptions.

2. Client O/S: Client and desktop devices shall use a Microsoft 64-bit operating system.

3. Operating systems shall support TCP/IP network protocol.

4. Contractor shall implement latest version and service pack of the operating system at time of project notice to proceed.

E. System Architecture

1. The systems shall adhere to a Client / Server model (or Peer to Peer model). The end devices shall be the clients to the primary/secondary servers. All information shall be communicated between the server(s) and the clients via the Local Area Network (LAN) assigned VLANs.

2. Network communications shall utilize TCP/IP network communications protocol. Servers and system administrator workstations shall be gigabit Ethernet. End devices shall be fast Ethernet.

3. End device addressing shall be coordinated with PWM.

4. Sufficient resiliency / redundancy and logic shall be provided to assure that the availability objectives can be met without manual intervention. All major system hardware components shall be designed so that there is not any single point of failure that can cause operations to be disrupted.

5. Adjacent end devices shall be interweaved to edge network switches where two more are available.

6. The system shall synchronize the date and time on all devices. The system servers shall receive a synchronization signal from the network.

F. Security

1. Authorized users shall log into the system using a unique user name and password. Depending on assigned user access privileges, the user shall be either granted or denied access to individual applications.

2. The System Administrator shall be able to add, delete, set, and change user privileges and access authorization via a GUI built into the general operations of the application. All system security parameters shall be configurable by the System Administrator.

3. The system shall have a "inactivity timeout period" such that if any workstation is determined to be inactive by having no input/output performed at that workstation for the defined timeout period, that workstation shall be automatically logged out of the application. The System Administrator shall be able to configure and disable the timeout period.

4. The occurrence of an inactivity timeout occurring as described above shall be recorded in the fault log, showing date, time, workstation identifier, and the user name of the user who was logged in at the time when the inactivity timeout occurred.

5. The system shall have the ability to prevent a user name from being logged in more than one time concurrently.

6. The system shall provide an audit trail of all transactions. The audit trail shall track on a per user basis. The audit trail file shall indicate any changes that occurred to applications configuration, data structure, or database fields/records, and shall contain the date and time of the change, the user identification of the user who made the change, and the details of the change.

7. The system shall provide automated tracking of the audit trail database, and shall alert the system administrator when this file has exceeded pre-determined size restrictions. The operator shall then have the ability to archive this database, along with the ability to restore it for reporting purposes. The system shall also include the option of a “rolling window”. In this case, the audit trail database shall use a rolling window with a system administrator configurable window (i.e., after defined period of time oldest records are automatically dumped).

G. Database Standards

1. These general database requirements shall be applied to the AIMS and subsystems.

2. The provided database(s) shall be SQL based and capable of supporting real time data warehousing. The database(s) shall use a common relational database to store all data. The database(s) shall be based on accepted and recognized industry standards.

3. Database Architecture: The database(s) shall meet the following requirements:

   a. Provide read consistency (data seen by a statement is consistent with respect to a single point-in-time)

   b. Provide creation of a read-consistent set of data when a table is being queried (read) and simultaneously updated (written)

   c. Provide original data values upon query when updated transaction remains uncommitted

   d. Utilize rollback methodology for uncommitted transactions

e. Utilize record locking mechanisms to prevent simultaneous updates to the same record. Only the record(s) being updated shall be locked.

f. Provide support for both distributed processing and distributed multiple databases along with standard DML operations, including queries, inserts, updates, and deletes of remote table data

g. Provide support for automatic recovery from system or network failures (i.e., automatically commits or rolls back any in-doubt distributed transactions consistently on all involved nodes when a failure occurs)

h. Provide referential integrity for all data such that modifications to current data does not affect historical data

i. Provide capability of online "live" backup of all database objects

j. Provide capability of "point of failure" recovery of all database objects within one hour of the failure (i.e., dump transaction logs hourly) with a native utility package.

4. Database Security: Third-party database and reporting tools shall support database security functions. Database security shall include the following items as a minimum:

a. Encryption capability for defined data fields within database objects such as tables or views

b. Prevention of unauthorized database access

c. Prevention of unauthorized access to schema objects

d. Control of system resource usage (such as CPU time)

e. Auditing of user actions and database transactions

f. Assignment of valid username/password combinations

g. Assignment and control of resource limits for a user including hardware, database and application resources

h. Control of user access rights including database, table, record and field level authority

i. Control of which system functions a user can perform.

5. The Contractor shall submit all database schema(s) for review and approval. The Contractor shall coordinate with PWM and Current airlines to identify unique database requirements. The Contractor shall add needed fields as requested by the Authority. The database(s) shall be designed such that the addition of fields and/or tables is easily accommodated. The database schema shall be provided in a chart format showing all tables, key fields, and hierarchical relationships.

6. SQL: The utilized native structured programming language shall be storable in the database. The database shall employ a native structured programming language that can utilize standard Structured Query Language (SQL) which includes the following:
    a. Data Definition Language (DDL) statements
    b. Data Manipulation Language (DML) statements
    c. Transaction control statements
    d. Session control statements
    e. System control statements
    f. Embedded SQL statements
7. Database Maintenance: The database maintenance system shall be capable of maintaining configuration control (i.e., keep track of changes and compare versions of the database). Database maintenance software shall be provided to allow modification of designated database fields. Database documentation shall be provided to enable the updating or regeneration of the database tables when inputs are changed and added, and as programs are modified or added.
8. Reporting:
    a. The database shall have reporting capabilities. This shall be in the form of a Crystal Reports or other PWM approved reporting tools. The reporting tool shall allow the user to create "ad hoc" reports from the database, and print "canned" reports. The reporting tool shall be capable of building reports from any fields in the database and on any subset of records where PWM allows.
    b. For any and all reports, including both canned reports and ad hoc reports generated via the reporting tool, only authorized users shall have access to the reporting features.
    c. For any and all reports, including both canned reports and ad hoc reports generated via the reporting tool, only the System Administrator, or users with a sufficient level of security access authorization shall be able to generate the reports.
    d. Airline or other tenant users shall be limited to reporting data from their company only or standard reports created by Authority for tenant’s use.
    e. The Contractor shall conduct a workshop(s) to determine report requirements and report design elements.

H. Performance Requirements
1. General:

a. Capacity - The AIMS shall be designed to support the operational, functional, and performance requirements, specified herein, for a minimum of 50 flight operations per hour and 12 different airlines with a total of 120 users simultaneously conducting 30 user operations per minute.

b. The system shall be capable of supporting all end devices as specified in this document within the performance requirements as outlined herein.

c. The performance requirements in this section are for system design and testing and not service response.

2. System Availability: At any given time, the overall AIMS shall be considered unavailable if 15 percent or more of the end devices are non-operational, not fully functional, or do not meet response time criteria for any given tenant. Software and system devices shall execute, without degradation, at the scheduled periods and response times for the systems to be considered available. The systems shall operate as specified twenty-four (24) hours per day, seven 7 days per week. Availability of the overall AIMS shall be at least 99.99 percent (not more than 52 minutes per year of downtime).

3. Device Availability: A system server and workstation shall be considered available only if all components are operating and fully functional. A peripheral device shall be considered unavailable if it cannot be placed on-line and perform its intended function(s). Besides scheduled downtime, as identified below, individual device availability shall exceed 99.8 percent (not more than 17.5 hours per year of downtime).

4. Scheduled Downtime: Downtime to update the computer operating system or repair a component shall be acceptable reasons for downtime, but at no time shall more than 15 percent of the system be non-operational. The following reasons are acceptable causes of down time:

a. If the operating system of the servers require maintenance or updates, or if the servers require system maintenance, each server shall be brought down individually to be updated/maintained, such that at no time is more than one server down at the same time.

b. If the operating system of the end device computer requires maintenance or updates, or if the end device computers require system maintenance, the end device that requires the maintenance shall be brought down during non-peak hours of operation.

c. It shall be acceptable to perform maintenance/updates on an end device computer system during other than non-peak hours if the particular end device is non-functional without having the maintenance or updates performed.

5. Response Time: Response time criteria shall be met under maximum capacity conditions as defined above.

a. Peripheral(CUSS Only): For 95 percent of peripheral commands, there shall be no more than a 3.0 second delay between the time that a user selects an action and the associated peripheral responds to the request. The remaining 5 percent of command responses shall not exceed 10.0 seconds.

b. Database Transactions: For 95% of all transactions, there shall be no more than a 0.5 second delay between the time that a user presses a key or makes a mouse click and the system responds in some way that the input has been received. The remaining 5% of transactions shall not exceed 1.0 seconds.

c. MUFIDS Display: For 95 percent of dynamic display device changes, there shall be no more than a 20.0 second delay between the time that a user inputs a database change and the affected display devices reflect the change. The remaining 5 percent of transactions shall not exceed 45.0 seconds.

I. System Management

1. All devices connected to the network shall have SNMP management capability.

2. System failures, including workstation failures, shall be viewable at a central control point (i.e., the system administrator's workstation). A failure shall initiate an alarm and add a failure record to the failure database table. Additionally, the system administrator shall receive a warning message on the system administrator workstation, notifying him of the failure. The system shall also be capable of providing pager notification. Server failure shall include any hardware or software based failure.

3. Network devices shall have remote administration and monitoring capabilities. This capability shall allow the specific machine to be remotely configured and to provide a status report to the management system. Data included in the reporting capabilities shall include: data pertaining to the machine's memory, storage devices, network connections, and general health of the machine.

4. In the event that a workstation or end device goes out of service, the central control log shall be updated. Therefore, where practical, a positive relationship (e.g., system heart beat) shall exist between all components of the systems at all time.

4.4 HARDWARE PLATFORM REQUIREMENTS

A. General Hardware Requirements

1. Refer to AIMS Hardware specification for specific hardware requirements.

2. The AIMS shall include all configured hardware necessary for a fully functional system. The Contractor shall supply all cabling, connectors, adapters, and termination equipment necessary to interconnect all system hardware. All hardware and materials shall be new.

3. Hardware requirements given are the minimum requirements. The Contractor's product shall meet or exceed these requirements. The hardware selected shall meet the operational, functional, performance, and redundancy requirements specified herein.

4. Coordinate with electrical power trades to ensure proper power provisions are available to support the AIMS equipment, including coordination of outlet locations and power requirements.

5. All servers, workstations and end devices shall be installed with power and data line surge protection devices.

B. General Server Requirements

1. The Contractor shall recommend and provide the server configuration that best serves the Contractor's overall design solution. Servers shall be from a reputable manufacturer capable of a high level of maintenance and service.

2. The various server requirements stated herein are not intended to limit the AIMS. The Contractor may submit alternative solutions to any of the server configuration requirements. A brief explanation of equivalency or benefits shall accompany alternative solutions.

3. The servers shall be fault tolerant via mirroring or other vendor technology. The design should allow a server to be powered down and replaced without disruption to the network, applications, or operations. Multiple load sharing application servers or other configurations shall be considered viable alternatives to redundant application server pairs if equivalent or better system redundancy and resiliency can be demonstrated.

4. Servers shall be standard 19-inch rack mountable where specified in MDF or IDF cabinets.

5. Servers shall be capable of upgrading the number of processor units by simply adding another processor or processor card.

6. Servers shall be "dual-homed" to the LAN core switches via server grade Gigabit Ethernet NICs. Final requirements and configuration shall be coordinated with the Authority.

7. Total useable disk capacity shall be at least 4 times the estimated storage requirements of the application. RAID shall be implemented as best suits the application. RAID 5 shall be provided unless justification for alternative configuration is provided. RAID shall not be implemented in the operating system, but by a hardware controller. Disk arrays shall have open frames to allow the capacity to be increased by addition of RAID drives without system shutdown.

C. Expansion and Spares

1. Contractor shall clearly state the limitations of the base system proposed in terms of adding additional servers and end devices. Particular attention should be given to the number of additional end devices that can be added without requiring additional processing power, memory, and/or disk storage.

2. At the time of final system acceptance, all hardware shall have a minimum of 50 percent reserve capacity, with the capability to double the capacity with no change to the system design. Hard disk, CD-ROMs, and tape unit capacities shall be based on formatted capacity. System reserve capacity shall be based on the maximum continual working load.

3. The Contractor shall provide a recommended spare parts inventory. The Contractor shall furnish an inventory of spare parts (type, model number, and quantity) to be required during the warranty period. The Contractor shall also furnish a bill of materials, catalogue numbers, unit prices, and a list of local distribution sources for replacement parts. Required spares shall be on-site at the time of final system acceptance. The parts are to be inventoried at the beginning of the project and accounted for at the end of the warranty and service period. Any spare parts unused at the end of the warranty and service period shall become the property of Authority. As a minimum the following spare parts shall be provided:

   a. Five percent (5%) spare parts inventory shall be maintained for end devices.

   b. An on-site configured spare for any hardware component that is identified as a single point of failure or that affects the reliability of more than 15 percent of the network

   c. All components that have a manufacturer identified Mean Time Between Failure (MTBF) of 9,000 hours or less shall have a spare on-site.

PART 5 - MULTI-USER FLIGHT INFORMATION SYSTEM

5.1 MUFIDS SUBSYSTEM GENERAL

A. The contractor shall provide a Multi-User Flight Information Display System (MUFIDS). The work shall include the provision, installation, programming, testing, and startup of the MUFIDS, which is a subsystem and an integrated component of the AIMS.

B. Information refresh on the displays shall meet the performance criteria as specified. Refresh shall be on a per field basis verses a full screen refresh. Except for the changed data, refresh shall be imperceptible (e.g., screen shall not flicker) by viewers.

C. The MUFIDS shall utilize the AIMS Database and MUFIDS applications software to operate flight information display equipment, servers, and workstations.

D. The MUFIDS shall use the AIMS to integrate with the Resource Management System (RMS) to allow the RMS to define resource use assignments.

E. Load flight schedules for each airline operating at the airport to provide a minimum of 30 days of operations, prior to Performance Testing.

F. Network failure shall leave the last updated information displayed on each affected display.

G. Contractor shall provide twenty (20) unique screen layouts as requested by the

PWM Representative including arrivals, departures, gate backdrop, ticket back wall, ticket overheadbaggage makeup operations. Screen layouts shall be submitted as Draft, Revised, and Final via an PWM review, comment, and approval process.

5.2 MUFIDS MANAGEMENT SOFTWARE

A. Provide and program MUFIDS management software to monitor and control the MUFIDS equipment utilizing Simple Network Management Protocol (SNMP). The MUFIDS Management Software shall include the following:

1. Provide dedicated management program loaded on MUFIDS administration workstations.
2. The MUFIDS management software shall provide real time alarm reports, GUI screens indicating MUFIDS equipment status, and current display contents for any display selected.
3. Provide monitor and control of AIMS servers and MUFIDS workstations assigned to PWM and airlines.
4. Provide monitor and control of dynamic signage and video display equipment
5. Provide interface to the network time source to interfaces to provide accurate display of local time on video monitors, dynamic signs, system servers and workstations.
6. Provide real time MUFIDS equipment operational status for each MUFIDS system device.

5.3 MUFIDS PERFORMANCE AND OPERATIONS

A. Video and dynamic signage shall display flight information schedules derived from the latest information residing in the system database. The displays shall be fully synchronized with network timing protocols, the airline schedules and external flight data feed (Contractor to provide) to display actual arrival and departure times and latest edits / remarks. All Flight information Banks will be mounted in a portrait configuration.

B. MUFIDS Database shall use indexing to allow display and reports based on time, date, and specific carrier or groups of carriers, city names (alphabetic), scheduled and actual arrival/departure, gate use, and airline code sharing.

C. Multiple levels of password security for servers and workstation PCs to prevent unauthorized users from accessing databases and schedules. Specifically, airlines shall not be allowed to access schedules for any airline except their own.

D. The MUFIDS system provided shall allow for operation and maintenance of the system to be performed by the local airport staff.

E. The system shall allow PWM and present / future airlines to input their flight information into the database as monthly master schedules and add, delete, or edit schedules at any time to reflect actual up to the minute schedules or conditions.

F. Airline users and PWM shall receive alert notification of flight schedules that are listed to expire. This notification shall be a pop-up alert that appears on user workstation screens 5-days prior to schedule expiration.

G. Displays planned to post flight arrival and or departures shall have an automated feature to reduce "window" time upon failure of a digital video controller (DVC) or LCD screen within the bank of video displays and redistribute contents among active displays. "Window" time is defined as the period of flight records to be displayed (e.g., 2 hr window with 5 minutes after departure to 1:55 minutes before departure). All parameters of the display time window shall be fully configurable from the MUFIDS Admin Workstation for each type of flight data and display bank.

H. The system shall allow PWM to post flight schedules (arrival & departures) at any of the video display banks in either Alphabetic order based on City names or Chronological order based on time of arrival or departure.

I. Display contents shall be posted for the amount of time scheduled by display rules development and be fully editable by PWM authorized user selection of roll on roll off rules and schedules by user triggered activities such as log on at common use workstation.

J. The system shall include remote maintenance access via Virtual Private Network (VPN) as the primary access method will secondary access via dial up modems which may be physically disconnected during normal operations.

K. The system will be configured and programmed to import, process, and display information from PWM selected sources such as: Weather video and FAA in-route flight status. Feeds shall be provided via TCP/IP interface or web service.

L. The system shall accept feeds from various video sources including TV feed, analog camera feed using video input encoding to IP.

M. The most current copy of a flight record and/or facility assignment will be posted for public and airline viewing.

N. All MUFIDS information will be passed through the systems servers and compiled into indexed database fields. The Database shall process schedule data in a two tier structure using "Master" or long term schedules as templates for "real time" / daily schedules used to post information.

5.4 USER INTERFACES

A. Airline Host Interfaces

1. The current PWM MUFIDS in the existing terminal, Intersystems provides airline data via PWM's gateway.

2. Contractor shall coordinate with non-hosted airlines to determine flight input method including, but limited to: electronic file, manual input, batch download.

B. MUFIDS Workstations

1. User workstation provided for this project shall be provisioned to support PWM administration, APWM maintenance and airline operational tasks. One workstation shall be provided in the airport OPS center, in each ATO space, and for the Director.

2. MUFIDS Administration Workstation features shall include:

a. Addition or deletion of airlines operating at PWM

b. Creation of new displays and locations such as ticket counters, gates and baggage claims.

c. Assigns passwords for PWM and Airline groups

d. Review all airline schedules

e. Create and maintain schedules for Airlines and Charters not provided with workstations.

f. Create, edit, and maintain schedules for airlines that have problems with their workstations (technical or operator error).

g. Create and print out various reports

h. Monitor and control of MUFIDS management software.

i. Full access to system database with ability to monitor and control audit trail and history log for tracking user activities.

j. Create, send and receive network messages to select user stations and / or all.

3. The Airline and Airport Operational authorization level at workstations shall support the following tasks and operations:

a. Create daily, monthly and seasonal flight schedules

b. Edit, add, delete, move, and change flight schedules to reflect up to the minute operational status.

c. Create, send and receive e-mail messages to select and / or all system workstation users.

d. Receive “must acknowledge” alerts for operation critical events such as “current flight schedule will expire in 5-days”, and “automated schedule feed from airline host is currently not sending”.

e. Enter remarks (only for authorized display fields or devices)

f. View and modify airline host created schedules.

g. Select graphics, canned messages and enter free form text into display fields that the airline and user are authorized to control.

h. Create, edit and print out custom reports

4. MUFIDS operator levels shall be used to enter visual paging information and edit airline schedules as needed. PWM shall have the ability to update and override airline flight and display data.

5. Baggage Input Consoles (BICs) shall be programmed to notify AIMS and public displays which airline and flight is using the outbound carousels 1 through 4 and provide associated information.

5.5 VIDEO DISPLAY RULES

A. General Display Rules and Sequence of Operations

1. MUFIDS display equipment furnished by the Contractor shall be fully integrated with the MUFIDS software and databases to allow display of edits, updates, remarks, flight changes, flight schedule information and other information to be displayed according to adjustable rules triggered by user definable sequences of operations.

2. Display rules and sample formats defined herein are provided to assist the Contractor in evaluation of the scope of work and minimal programming requirements. The Contractor shall include in the proposal response costs the programming time required to modify display rules and display formats as directed by PWM during programming of the system.

3. The Contractor shall provide software tools for creation of each types of display format defined for the project. Software tools shall allow simple assignment of text fields, graphics and video contents to select individual displays and /or types (groups) of displays. The software tool shall provide direct dynamic links to the system database.

4. Video Banks (Clusters) Primarily displaying flight and baggage information:

   a. Video Bank Types: The contents of these video display clusters shall be software-controlled, and be capable of operation as individual units and as an integrated cluster. For the initial configuration, each video display cluster shall be configured to function as an integrated or clustered unit, with the automated reconfiguration feature to provide complete listings of schedules in the event of single screen failure. All content for these banks including advertising must be created in portrait mode.

   b. Video bank clusters are used in the following locations (typical; refer to drawings for specific locations):

      1) Terminal Arrival/Departure

      2) Gate areas

5. General flight information video display cluster attributes and features:

   a. Video banks shall be provisioned with DVCs that are configured to support text, graphics, and motion video.

   b. Left, right, and centered justification of each video text field and long-line remarks.

   c. Screen-saving attribute allowing power down for off hours.

d. Attributes that are triggered by an event or entry in the remarks field such as selection and insertion of a canned message "Delayed" into the remarks field of a flight will trigger display of a flashing "delayed" in red colored font on video screens.

e. System software shall allow posting of any screen contents (video page) on any screen and automatically adjust time windows dynamically from 1 to 12 hours to support complete display of A to Z city names.

f. Video display bank screen fonts and character sizes, types, text fields and colors shall be keyboard (software) selectable and adjustable from the system administrator's workstation.

B. Initial Video Display Settings (Flight Information Displays)

1. Screen Headers: Screen headers shall be one line consisting of column headers for each text field. Characters shall be a minimum of 5/8 inch in height, Arial font type. Font color and header background color shall be keyboard selectable for each type of video display. Initial programming shall set header font and header background colors as follows:

a. Arrival video screen headers: Font color shall be light gray. Background color shall be medium green.

b. Departure video screen headers: Font color shall be light gray. Background color shall be medium red.

c. Visual Paging and Graphics display screens shall have no headers.

2. Screen Footers: Footers shall have one line consisting of two text fields with text background colors to match display type headers:

a. Calendar date

b. Hour/minutes.

c. Footer text shall be dynamically linked to AIMS and the system clock to post time and date that are accurate to within 30 seconds of local airport time and date.

3. Characters shall be a minimum of 5/8 inch in height, Arial font type. Font color and footer background color shall be keyboard selectable for each type of video display.

4. Multilingual – The system shall be capable of support multilingual text display including Spanish and French as a minimum. Multilingual information shall be displayed either at same time or by fade in and out between languages.

C. Arrival & Baggage Makeup Schedules - Video Display Contents and Rules

1. Alphabetic City Name Sort: Arrival flight lines shall be displayed on video screens from top to bottom in alphabetical order based upon city names. Multiple flights arriving from the same origination city shall be sorted and posted based upon arrival times with the earliest arriving flight posting first in the top to bottom screen order. Should two or more flights arrive from the same origination, at the same time, the flight with the lowest numerical flight number will post first in the top to bottom screen order.

2. Chronological Sort Display Order: Arrival flight lines shall be displayed on video screens from top to bottom in alphabetical order based arrival times. Multiple flights arriving at the same time shall be sorted and posted based upon city names with the lower alphabetic city name posting first in the top to bottom screen order. Should two or more flights arrive from the same origination, at the same time, the flight with the lowest numerical flight number will post first in the top to bottom screen order.

3. Arrival Screen Contents and Field shall initial be provisioned to support the following:

    a. City names field: The city names field shall support and display a minimum of 16 characters based upon International Air Transport Association (IATA) code conventions. MUFIDS shall accept and index IATA city code names. The MUFIDS displays shall post full city names in English.

    b. Airline logo field: The field shall support .BMP, .JPEG, .TIF and other graphics. The Contractor shall coordinate with each airline for provision of logo. Airlines not providing logos shall have field filled with airline name in text.

    c. Airline name field: The airline names field shall support and display a minimum of 13 characters based upon IATA code conventions. MUFIDS shall accept and index IATA airline code names. MUFIDS displays shall post full airline names in English.

    d. Flight number field: The flight number field shall support and display a minimum of 4 characters based upon IATA code conventions.

    e. Scheduled arrival time field: The scheduled arrival time field shall support and display a minimum of 6 characters referenced upon local time.

    f. Scheduled arrival gate field: The scheduled arrival gate field shall support and display a minimum of 4 characters to allow display of all ACY gates such as 9, 14, and hardstand parking ID’s. Note: Gate field may be replaced by baggage claim number field pending ACY’s review and approval of display formats and presentations in test lab.

    g. Scheduled outbound baggage claim field: The scheduled claim field shall support and display a minimum of 2 characters to allow display of all PWM baggage claims such as 5 and 12. (For Future use)

4. Remarks field and long-line remarks: The system shall support user-initiated remarks for each arrival flight line. Two types of remarks shall be available for the system users via local workstation edits or imported through airline host downloads, Standard Remarks and Long Line Remarks. Each of these remark types shall be linked to the associated flight line, therefore rolling on and off with the flight line.

   a. Standard remarks field: Standard arrival remarks shall support a minimum of 9 characters. The following standard or canned remarks messages shall be available for user edits to the flight lines:

      1) On time – default message

      2) Arrived – triggered by scheduled arrival time, unless a schedule edit posts a revised time.

      3) Cancelled

      4) Delayed

      5) At HH:MM – This remark shall be automatically posted by the system in the event that the system user edits a scheduled arrival time or the FAA enroute service provides and updated ETA.

      6) Ask Agent – special usage message.

      7) Bags In – Triggered by BIC entry

   b. Long-line remarks field: Long-line remarks shall be limited to 54 characters in length, with no text wrap. The design intent is to allow special messages to be manually initiated as freeform text from airline MUFIDS workstations. Long-line remarks shall be linked to specific flight records and shall roll off display at the same time as the associated flight record.

5. Arrival display roll-on/roll-off rules:

   a. Initial settings:

      1) Roll-on: 120 minutes prior to scheduled arrival.

      2) Roll-off: 30 minutes after scheduled arrival.

   b. Keyboard-adjustable range:

      1) Roll-on: 0 to 480 minutes prior to scheduled arrival.

      2) Roll-off: 0 to 60 minutes after scheduled arrival.

D. Departure Video Contents and Rules

1. Alphabetic Sort by City Name: Departure flight lines shall display on video screens from top to bottom in alphabetical order based upon city names. Multiple flights departing to the same destination city shall be sorted and posted based upon departure times with the earliest departing flight posting first in the top to bottom screen order. Should two or more flights depart to the same destination, at the same time, the flight with the lowest numerical flight number will post first in the top to bottom screen order.

2. Chronological Sort Departure Time: Departure flight lines shall display on video screens from top to bottom based upon Departure times with next departing flight displayed first. Multiple flights departing at the same time shall be sorted and posted based upon alphabetic sort of destination city names. Should two or more flights depart to the same destination, at the same time, the flight with the lowest numerical flight number will post first in the top to bottom screen order.

3. Departure Screen Contents and Field shall initial be provisioned to support the following:

    a. City names field: The city names field shall support and display a minimum of 15 characters based upon IATA code conventions. MUFIDS shall accept and index IATA city code names. The MUFIDS displays shall post full city names in English.

    b. Airline logo field: The field shall support .BMP, .JPEG, or .TIF graphics. The Contractor shall coordinate with each airline for provision of logo. Airlines not providing logos shall have field filled with airline name in text.

    c. Airline name field: The airline names field shall support and display a minimum of 13 characters based upon IATA code conventions. MUFIDS shall accept and index IATA airline code names. The MUFIDS displays shall post full airline names in English.

    d. Flight number field: The flight number field shall support and display a minimum of 4 characters based upon IATA code conventions.

    e. Scheduled departure time field: The scheduled departure time field shall support and display a minimum of 6 characters referenced upon local time.

    f. Scheduled departure gate field: The scheduled departure gate field shall support and display a minimum of 4 characters to allow display of all PWM gates such as 2, 12, and hard stand parking ID’s.

4. Remarks field and long-line remarks: The system shall support user-initiated remarks for each departure flight line. Two types of remarks shall be available for the system users via local workstation edits or imported through airline host downloads, Standard Remarks and Long Line Remarks. Each of these remark types shall be linked to the associated flight line, therefore rolling on and off with the flight line.

a. Standard remarks field: Standard departure remarks shall support a minimum of 9 characters. The following standard or canned remarks messages shall be available for user edits to the flight lines:

1) Boarding – triggered by scheduled departure time, unless a schedule edit posts a revised time.

2) Cancelled

3) At HH:MM – This remark shall be automatically posted by the system in the event the system user edits a scheduled departure time.

4) Ask Agent – special usage message

b. Long-line remarks field: Long-line remarks shall be limited to 54 characters in length, with no text wrap. The design intent is to allow special messages to be manually initiated as free form text from airline MUFIDS workstations. Long-line remarks shall be linked to specific flight records and shall roll off display at the same time as the associated flight record.

5. Departure display roll-on/roll-off rules:

a. Initial settings:

1) Roll-on: 120 minutes prior to scheduled departure.

2) Roll-off: 5 minutes after scheduled departure.

b. Dynamic Automated and Keyboard-adjustable range

1) Roll-on: 0 to 480 minutes prior to scheduled departure.

2) Roll-off: 0 to 60 minutes after scheduled departure.

E. Gate and Ticket Signage

1. Ticket Counter backdrop, and Gate Counter backdrop signage shall change to airline specific display information based on flight information assignment and airport designated ticket/gate counter assignments. Displays will change to default displays based on the above. System administrator shall have selectable option to determine, which trigger source is granted control.

2. Each associated ticket counter LCD user updatable field shall be controlled from the MUFIDS Interface on PWM Workstation Module.

F. Baggage CMakeup Carrousel Displays

1. Displays scheduled for Baggage carousel equipment locations shall be linked to the MUFIDS database to provide a display of the most updated information regard flights scheduled to use the location specific baggage carousel.

2. BICs shall be provided for bag breakdown locations. The BICs shall provide a list of flights to select from on an LCD display. Selection of valid flight is required to start baggage belt via MCP interface.

3. Bag makeup area displays shall indicate airline and flights, departure time, countdown to departure, and non-public status notes.

5.6 VISUAL PAGING MODULE

A. Visual Paging Display

1. The system shall provide delivery of messages on visual media to the public, which may also be delivered by audio systems (not in contract).

2. Any MUFIDS display shall be capable of displaying visual pages. The project includes select video display locations that will post names of passengers that have messages awaiting them at the PWM paging center.

B. Description of Visual Paging Module Operation

1. Passenger Page: From dedicated MUFIDS workstation(s) located in front of Spirit maintenance area, an authorized user will use the Visual Paging workstation screen to enter the following passenger paging information into the system:

a. Name of person that paging message is intended for: Minimum of 30-character name field.

b. Message Contents: This information shall be manually entered into the designated MUFIDS workstation and allow two options:

1) Message logged into the system and posted to the display as a link to the intended recipients name. (Name/Message)

2) Message is logged for recall by operator and a generic message instructing the intended recipient to call the PWM paging office will be posted.

2. Information Page: Authorized operator shall be able to enter free text message or canned message. Contractor shall provide a minimum of 35 canned messages for Authority Representative approval to initially populate the Visual Paging Module. A mechanism for adding and updating canned messages shall be provided.

3. Visual Paging Display Zones: The Visual Paging Module shall provide the Authorized operator with a minimum of sixteen (16) zones to choose which group of displays the visual paging name or name/message will be displayed. Zone creation shall require Authority Representative approval. Zones assignments shall be modifiable via a device assignment table or interface.

4. Queue Requirements:

a. The paging operator screen shall allow the user to select the duration of time a specific message will remain in the display queue. User selectable choices of a minimum of 3 typical duration periods including:

1) 15 minutes – default setting

2) 30 minutes

3) 90 minutes

b. Queue Priority: The visual paging software shall support a minimum of four priority levels for visual paging messages. These levels are defined as follows:

1) High Priority: Display high priority messages alternately with messages of normal priority.

2) Normal Priority: Display in sequence with all other messages of normal priority.

3) Low Priority: Display only when no messages of higher priority are active.

4) Emergency Priority: Display message and override all other messages until reset.

c. For Normal and High Priority messages, minimum display time for each message cycle shall be configurable from 1 second to 120 seconds when no Emergency Message is present in queue. Normal Messages shall default to 10 second display cycle and High Priority Messages shall default to a 15 second display cycle.

5.7 SCREEN DESIGNER MODULE

A. The MUFIDS shall include a Screen Designer Module (SDM) that shall allow an authorized user to create and edit display formats.

B. Via the SDM, the user shall create display formats for displaying data on video monitors. Data to be displayed includes, but is not limited to, flight data, baggage data, flight operations data, graphic data, and free-text data.

C. The SDM shall have a graphical user interface.

D. Each display format shall be saved in the database. Based on an "owner" field within the record the format may be utilized by other users for the display of data.

E. Minimum display characteristics shall be specified in the SDM include:

1. Background and foreground colors

2. Font type, style, and size, per field

3. Blink attributes; blink on/off colors

4. Header and footer placement and content

5. Sort order of data; ascending or descending order, sorting on one of more of the display fields including but not limited to: flight number, city name, gate, time, airline

6. Background "wallpaper"

7. Color graphics; exact placement on the screen and graphic resizing

8. Information links

9. Portrait and Landscape configurations for content.

F. The SDM shall include the capabilities for the user to "test" the new or revised format by showing it on the screen of a workstation in the same manner as it would be seen on a monitor or other display device, using live data from the actual MUFIDS databases (unless Test Lab is implemented, then shall utilize test lab data).

5.8 VIDEO ADVERTISING MODULE

A. System shall provide a video advertising module to control advertising content and video wall.

B. The module shall provide for advertising scheduling and control on MUFIDS displays.

C. The module shall track advertising display statistics for billing and interface these to the Revenue Manager via the AIMS.

D. The module shall control the video wall(s) and provide for display aggregation from one to all. Additionally, the center screen in the three and five screen array locations shall include Video Advertising driven information.

E. The module shall support full motion, audio, and static advertisements.

F. The module shall include an import feature for loading new advertising content.

PART 6 - COMMON USE SYSTEMS

6.1 COMMON USE SELF SERVICE (CUSS)

A. Requirements

1. The Contractor shall provide CUSS hardware and software system that conforms to IATA RP 1706 for identified airlines.

2. The LDCS self-service application shall run on CUSS Kiosks.

3. CUSS Kiosk Operation:

a. The CUSS kiosks shall include a common GUI interface with each airlines name/logo shown. The CUSS user interface shall be IATA RP 1706 and ADA compliant.

b. The traveler shall select the airline for check-in via the touch screen.

c. The selected airline’s self-service application shall be initiated by the selection.

d. The traveler shall be able to perform self-service check for the selected airline via the airline specific self-service check-in application.

e. The CUSS kiosks shall service the identified airlines from the same kiosk without rebooting.

f. Once a traveler has completed self-service check-in with a given airline, the kiosk shall return to the main airline selection screen.

4. The CUSS subsystem shall interface with the AIMS Database providing CUSS peripheral and use data.

5. Acceptable Manufacturers are

a. IER 918

b. Approved Equal

6. Required and acceptable Kiosk components

a. PC Nexcom EBC573 or dual core Nexcom ebc576 or approved equal

b. GPP Printer - Hengstler TPM200 or approved equal

c. UPS - Tripplite SMART1000LCD or approved equal

d. Touch screen - ELO or approved equal

e. 2D Barcode Reader - HHP 5180 or approved equal

f. DIP Card Reader - OMRON V4Kx or approved equal

B. CUSS Kiosk Manager Module

1. A software module for managing CUSS kiosks shall be provided.

2. The module shall provide for tracking and updating of printer supplies in the kiosks.

3. Low printer supply warning shall be sent to the CUPPS Admin Workstation.

4. Paper jam error monitoring and notification.

5. Kiosk operational heartbeat and inoperable notification.

PART 7 - EXECUTION AND IMPLEMENTION REQUIREMENTS

7.1 GENERAL

A. All work shall be accomplished with minimal impact to PWM operations, passengers and the various facility Tenants.

B. Portions of the work will require tasks to be completed during weekend and off-hours, Contractors shall include all costs associated with normal and non-typical labor hours.

C. Installation and connection of system equipment, materials, cabling will be performed by others.

D. All materials and equipment shall be installed in accordance with all applicable

standards of the National Electrical Code, codes of governing local authorities, and all safety codes and ordinances.

7.2 TESTING REQUIREMENTS

A. Provide test plans and procedures including test plan narrative, step-by-step procedure instructions, list test equipment used, and expected results.

B. Display equipment test plans shall include:

1. Manufactures startup and test procedures for display equipment.

C. General Testing Requirements

1. Phases of Testing:

a. Functionality Testing

b. Performance Verification Testing

c. On-Site Endurance Testing

2. Project Testing: The overall AIMS project shall not be considered complete until Performance Verification and On-Site Endurance Testing are completed on the entire system. In general these tests shall verify (refer to test sections for full testing requirements):

a. Proper function of all workstations

b. Airline user and workstation access permissions are correct

c. Host Interfaces are accepted by the associated airline(s)

d. System is performing within defined parameters.

3. Test Plan/Procedure: The Contractor shall provide six (6) copies of the test plan/procedures for each testing phase for the review and approval of the Engineer. The test plan for each phase of testing shall detail the objectives of all tests. The tests shall clearly demonstrate that the system and its components fully comply with the requirements specified herein. The test plan shall be provided at least thirty (30) days prior to the scheduled start of each test. Test plans shall contain at a minimum:

a. Functional procedures including use of any test equipment

b. Test equipment is to be identified by manufacturer and model

c. Interconnection of test equipment and steps of operation shall be defined

d. Test records shall include test equipment serial number, calibration date and calibration certification of test equipment

e. Expected results required to comply with specifications

f. Traceability matrix referencing Specification requirements with specific test procedures

g. Record of test results with witness initials or signature and date performed

h. Pass or fail evaluation with comments.

4. The test procedures shall provide conformity to all Specification requirements. Satisfactory completion of the test procedure is necessary as a condition of system acceptance.

5. The Contractor's Quality Assurance organization shall review all formal test procedures prepared by the Contractor and deliverable under the contract to assure the tests cover all requirements and that there is a conformity between the conducted test, the test results and Specification requirements

6. Documentation verification, both interconnects and operationally, shall be part of the test. Where documentation is not in accordance with the installed system interconnect and operating procedures, the system shall not be considered accepted until the system and documentation correlate.

7. The Contractor shall provide PWM Representatives the opportunity(s) to participate in any or all of tests.

8. Test Reports: The Contractor shall prepare, for each test, a test report document that shall certify successful completion of that test. Six (6) copies of the test report shall be submitted to the Authority representative for review and acceptance within seven (7) days following each test. The test report shall contain, at a minimum:

a. Commentary on test results;

b. A listing and discussion of all discrepancies between expected and actual results and of all failures encountered during the test and their resolution;

c. Complete copy of test procedures and test data sheets with annotations showing dates, times, initials, and any other annotations entered during execution of the test;

d. Signatures of persons who performed and witnessed the test.

9. Test Resolution: Any discrepancies or problems discovered during these tests shall be corrected by the Contractor at no cost to PWM. The problems identified in each phase shall be corrected and the percentage of the entire system re-tested determined by the Engineer before any subsequent testing phase is performed.

D. Functionality Testing (Factory Acceptance)

1. Functional testing may be completed at an Authority agreed upon test site. System functional load shall be simulated.

2. Test Setup Equipment: Equipment shall be actual products or identical models of products to those designated to be delivered and installed at the site. The following equipment shall be setup and used for conducting pre-delivery test:

a. Redundant core components.

b. Operator equipment associated with system.

c. End devices and displays associated with system.

d. Software associated with system.

e. Administrative console equipment.

f. Sufficient signal transmission media and associated equipment and accessories to provide a fully common use terminal system model.

g. Number of field processors required for system to be installed at site.

h. Enough load and data simulators to provide simulation of full load operational conditions as required by design. Loads shall be manually or software generated.

i. Host interface testing for connectivity and data processing.

3. Test: The purpose is to test the complete computer software package and equipment of the system and demonstrate that all specified features and performance criteria are met. All requirements of the Specification shall be tested including:

a. Functionality and response of core system and subsystems.

b. Data interaction.

c. System capacity.

d. Hardware interaction.

e. Hardware and software interaction.

f. Integration Interfaces.

g. Demonstrate report generation.

4. Acceptance: Acceptance of system to perform sufficiently and provide specified functions shall be determined by Project Representative. Testing may be witnessed by additional PWM personnel.

a. Acceptance Criteria: Performance of system shall equal or exceed criteria stated in individual Specification sections.

b. If system does not perform satisfactorily, the Contractor shall make corrections and modifications and schedule new test with Engineer.

5. Completion:

a. At successful completion of test, dismantle equipment so as to prevent damage. Replace all defective or worn items.

b. Re-pack in original containers all equipment to be delivered to site for installation.

6. Reporting:

a. Record all test procedures and results.

b. Submit report in accordance with reporting requirements in General Testing Requirements Section.

E. Performance Verification Testing (Performance Testing)

1. Procedures:

a. Complete operational testing of all components and systems shall be witnessed by the Project Representative.

b. As part of the Performance Verification Testing a Failure Recovery test procedure shall be conducted. The Failure Recovery will include a full system failure and recovery procedures for each airline. At least one (1) representative from each airline shall be included in the Failure Recovery test procedure.

c. Schedule test with Project Representative. Do not begin testing until:

1) All required systems have been installed and individually and jointly tested to ensure they are operating properly.

2) Written permission from Project Representative has been received.

2. Testing: As part of Performance Verification, test all components of the AIMS. The tests shall demonstrate all system features.

3. Verification: Verify correct operation of system under all conditions.

4. Adjustment, Correction, And Completion:

a. Correct deficiencies and retest affected components.

b. Make necessary adjustments and modification to system after obtaining approval of Project Representative.

c. Completion: Performance verification test shall be complete when testing or retesting of each component has produced a positive result and has been approved in writing by Project Representative.

5. Recording:

a. Describe actual operational tests performed and equipment used and list personnel performing tests.

b. Record in tabular form all test results, deficiencies, and corrective measures.

6. Termination

a. Performance Verification Test shall be terminated by the Project Representative when:

1) Individual components, subsystems, or the common use terminal system fail to perform as specified.

2) It is determined that the system is missing components or installation is not complete.

b. Upon termination, corrective work shall be performed and the Performance Verification Test rescheduled with Project Representative.

c. Re-testing shall be performed by Contractor at no additional expense.

d. Contractor shall continue to perform corrective actions and re-test until system passes all tests to satisfaction of Project Representative.

F. Endurance Testing

1. General:

a. Provide personnel to operate system 24 hours per day, including weekends and holidays during Endurance Testing.

b. Start test after: Successful completion of Performance Verification Testing.

c. Training as specified has been completed.

d. Correction of deficiencies has been completed.

e. Receipt of written start notification from Project Representative.

f. Monitor all systems during Endurance Testing. Coordinate monitoring with Project Representative.

g. Recording: Record data on approved forms so as to provide a continuous log of systems performance. Include:

1) Date and time for all entries.

2) Name of individual making entry.

3) Environmental conditions.

4) Airport activities in process.

5) Description of all alarm annunciations, responses, corrective actions, and causes of alarms. Classify as to type of alarm.

6) Description of all equipment failures, including software errors.

7) Description of all maintenance and adjustment operations performed on system.

8) Daily and weekly tabulations.

h. Daily entries of performance data shall be reviewed by Project Representative.

i. PWM may terminate testing at any time when the system fails to perform as specified. Upon termination of testing the Contractor shall commence an assessment period as described in Stage II.

2. Testing

a. Stage I - Initial Phase Testing:

1) Time: 24 hours per day for 15 consecutive calendar days.

2) Make no repairs during this stage unless authorized in writing by Project Representative.

3) If system experiences no emergency, critical failures, or recurring operational failures (defined as same operational failure 3 times in 24 hrs or more than 7 times during 15 days), proceed to Stage III - Final Testing.

b. Stage II - Initial Phase Assessment:

1) After conclusion of Stage I, or terminating of testing, identify all failures, determine causes, and repair. Submit report explaining: Nature of each failure, corrective action taken, results of tests performed to verify corrective action as being successful, and recommended point for resumption of testing.

2) After submission of report, schedule review meeting at job site. Schedule date and time with Project Representative.

3) At review meeting, demonstrate that all failures have been corrected by performing verification tests.

4) Based on report and review meeting, Project Representative will direct Contractor to repeat Stage I, restart Stage I, or proceed to Stage III - Final Testing.

c. Stage III - Final Phase Testing:

1) Time: 24 hours per day for 15 consecutive calendar days.

2) Make no repairs during this stage unless authorized in writing by Project Representative.

3) If system experiences emergency, critical failures, or recurring operational failure (defined as same operational failure 3 times in 24 hrs or more than 7 times during 15 days), testing will be terminated.

d. Stage IV - Final Phase Assessment:

1) After conclusion of Stage III or termination of testing, identify all failures, determine causes, and repair. Submit explaining the nature of each failure, corrective action taken, results of tests performed, and recommended point for resumption of testing.

2) After submission of report schedule review meeting at job site. Schedule date and time with Project Representative.

3) At review meeting, demonstrate that all failures have been corrected by performing verification tests.

4) Based on report and review meeting, Project Representative will approve Endurance Test or direct Contractor to repeat all or part of Stages III and IV.

3. Adjustment, Correction, And Maintenance

a. During Endurance Testing make adjustments and corrections to system only after obtaining written approval of Project Representative

b. During Endurance Testing, perform required maintenance on systems including provision of replacement parts.

4. Final Inspection And Acceptance

a. After Endurance Testing is complete, review tabulated records with Project Representative.

b. Contractor will not be responsible for failures caused by:

1) Outage of main power in excess of backup power capability provided that automatic initiation of all backup sources was accomplished and automatic shutdowns and restarts of systems performed as specified.

2) Failure of any PWM furnished power, communications, and control circuits provided failure not due to Contractor furnished equipment, installation, or software.

3) Failure of existing PWM equipment provided failure not due to Contractor furnished equipment, installation, or software.

c. When performance of system does not fall within the above parameters, determine cause of deficiencies, correct, and retest.

1) When requested by Project Representative, extend monitoring period for a time as designated by Project Representative.

2) Period shall not exceed 60 days exclusive of retesting periods caused by termination of Stages I or III and assessment period of Stages II and IV.

d. Submit final report of Endurance Testing containing all recorded data.

7.3 IMPLEMENTATION

A. General

1. System installation and construction methods shall conform to the requirements of the Authority.

2. Where undefined by codes and standards, the Contractor shall apply a safety factor of at least 2 times the rated load to all fastenings and supports of system components.

3. The Contractor shall install all system components including Authority furnished equipment in accordance with the manufacturer's instructions, NEC, ANSI-C2, IBC, EIA/TIA, and BICSI TDMM and shall furnish all cables, connectors, terminators, interconnections, services, and adjustments required for a complete and operable system.

4. Grounding shall be installed as necessary to preclude ground loops, noise, and surges from adversely affecting system operation.

5. For equipment mounted in drawers or on slides, provide the interconnecting cables with a service loop of not less than three feet and ensure that the cable is long enough to allow full extension of drawer or slide.

6. The Contractor's Quality Assurance Inspector shall conduct a visual inspection of all installations to verify that the installations are in accordance with the Authority’s and manufacturer's specifications. Records of the inspections signed and dated by the Quality Assurance Inspector shall be provided to the Engineer. The Engineer shall be notified by the Contractor of any inspection(s) and the Engineer may elect to participate in any inspection(s).

7. The Contractor shall be solely responsible for the coordination of all work with any other contractor performing work for the Interior Finish Upgrades Project.

8. The Contractor shall be responsible for the cross-connection of the horizontal cable runs to the backbone cable system.

9. The Contractor shall install all custom and packaged software in the development and production environments.

10. All products shall be new, undamaged and covered by the original manufacturer's warranty and licensed as applicable to meet project intent.

11. Products shall be shipped, handled and stored as recommended by the manufacture.

12. The Contractor shall furnish and install products in accordance with manufacturer's recommendations and as illustrated in the project drawings.

13. Should discrepancies be noted regarding quantities in schedules, specifications and/or on Project drawings, the Contractor shall provide the greater number of units.

B. Delivery and Storage

1. Contractor shall coordinate product delivery and movement to installation locations with ACY, and expect restrictions of delivery to off-hour periods, for the purpose of minimizing impacts to ACY operations.

2. Store products in accordance with manufacturer's instructions, within Contractor's staging area and with seals and labels intact and legible. Store sensitive products in weather-tight enclosures; maintain within temperature and humidity ranges required by manufacturer's instructions.

3. After installation, provide coverings to protect products from damage from traffic and construction operations, remove when no longer needed.

C. Hardware Installation

1. Final hardware selected and installation of hardware shall be coordinated with the Contractor supplying the cabinetry millwork and with the Project Representative. Additionally, the Contractor shall review the casework drawings to ensure ventilation requirements are met or recommend modifications.

2. The Contractor shall install and inspect all hardware required in this Specification in accordance with the manufacturer's installation instructions. Final placement of hardware is subject to Project Engineer's approval.

3. The Contractor shall be responsible for any and all loss or damage in the shipment and delivery of all material.

4. The Contractor shall coordinate installation with the Authority, to minimize disruption of existing business functions at the airport.

5. The Contractor shall place materials only in those locations that have been previously approved. Any other locations shall be approved, in writing, by the Authority.

6. The Contractor shall provide all tools and test equipment required to install, verify, and test the installation and to determine that it meets the specifications. The Contractor shall furnish all necessary materials required to implement and to achieve the required work performance.

D. System Start-up

1. The Contractor shall not apply power to the system until after:

a. System and components have been installed and inspected in accordance with the manufacturer's installation instructions.

b. A visual inspection of the system components has been conducted to ensure that defective equipment items have not been installed and that there are no loose connections.

c. System wiring has been tested and verified as correctly connected as indicated.

d. All system grounding and transient protection systems have been verified as properly installed and connected, as indicated.

e. Power supplies to be connected to the system and equipment have been verified as the correct voltage, phase, and frequency as indicated.

2. Satisfaction of the above requirements shall not relieve the Contractor of responsibility for incorrect installations, defective equipment items, or collateral damage as a result of Contractor work/equipment.

7.4 TRAINING

A. General

1. The Contractor shall prepare training materials and conduct all training for airline users and administrators. PWM will provide a training classroom to conduct project training.

2. The Contractor shall supply the appropriate training for designated PWM and airline personnel. The training shall provide personnel with a working knowledge of the network design and layout, and shall provide troubleshooting methods and techniques. In addition, the training shall cover testing, maintenance, and repair procedures for all equipment, which is provided under this Specification.

3. The Contractor shall supply a detailed plan of user training and system administrator training. The Contractor shall provide a course outline, course materials and syllabus to the Authority for approval 30-days prior to the scheduled training date. Each course shall require PWM’s approval prior to presentation.

4. Course materials shall be delivered to the Authority for future presentation. Final delivery of the course materials shall include a master hard copy of all materials and an electronic copy in a format approved by the Authority. The Contractor shall supply a videotape of each training course.

5. The following general training guidelines shall be followed:

a. By means of training classes augmented by individual instruction as necessary, the Contractor shall fully instruct the PWM’s designated staff and Airline personnel in the operation, adjustment and maintenance of all products, equipment and systems. The Contractor shall be required to provide all training aids (e.g., notebooks, manuals).

b. All training shall be completed a minimum of two weeks prior to the system becoming operational and utilized by tenants. Training schedule subject to Project Engineer's approval.

c. Training shall be conducted by experienced personnel and supported by training aids. An adequate amount of training material shall be provided by the Contractor. The following is considered a minimum.

1) Functional flow charts, overall block diagrams, and descriptive material for all software

2) Schematic drawings for each of the hardware components

3) All procedure manuals, specification manuals, and operating manuals

4) As-built drawings.

d. Participants shall receive individual copies of technical manuals and pertinent documentation 7-days in advance of the training course. The courses shall be scheduled such that Authority personnel can participate in all courses (no overlap).

e. A final course schedule and syllabus shall be prepared by the Contractor for each course to be conducted for PWM personnel, and submitted for review at least four (4) weeks prior to the scheduled date of the course commencement.

f. Each course outline shall include, in addition to the subject matter, a short review of the prerequisite subjects (where appropriate); how this course fits into the overall training program; the objective; the standards of evaluation; and any other topics that will enhance the training environment.

g. All training requirements identified are minimum requirements.

B. User Training

1. User training shall be conducted on site at PWM

2. End User Training: System users shall be instructed in all aspects of operations of the system. A minimum of three (3) courses (CUSS, MUFIDS) with six (6) hours of basic user training shall be provided (2 hour class repeated 3 times with 6 system users per class).

3. Advanced User Training: RMS users shall be instructed in all aspects of the system. A minimum of eight (8) hours of advanced user training shall be provided (4 hour class repeated 2 times with 3 advanced users per class).

C. Administrator Training

1. System Administrator Training: System Administrator Training shall include both classroom work and on-the-job training.

a. Classroom Training: A minimum of forty (40) hours of software training (40 hour class repeated 1 time for 1 system administrator) shall be provided. The Contractor shall structure the course to describe all systems, software and applications and support programs. The course material shall be presented in depth with the instructor covering detailed design, structure, and algorithms.

b. On-the-Job Training: An additional three (3) weeks of on-the-job training shall be provided. On-the-job training of the designated Authority personnel shall be scheduled with Authority and shall commence no later than two months prior to expiration of the equipment warranty period. This training shall be conducted on site at PWM. The Contractor shall answer any and all questions regarding the operation, repair, and maintenance of the system, software, and equipment.

END OF SECTION

SECTION 27 51 16 – PUBLIC ADDRESS AND MASS NOTIFICATION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This section pertains to the public address system to be furnished and installed in the Portland International Jetport Terminal Expansion Project – Portland, ME.

B. It is the purpose of this specification to require the furnishing of highest quality materials, equipment, and workmanship. The work shall be in accordance with current NFPA guidelines, this specification, and in conformity with the designs, layouts, and descriptions shown on the drawings.

C. The public address system is intended to provide voice announcement and paging capabilities within the spaces indicated in the drawings. The public address system will be a zoned, addressable system which integrates throughout the new portion of the terminal and interfaces with the currently installed, Innovative Electronic Design (IED), public address system in the existing terminal.

D. Due to the requirement to interface with the existing system, IED system components will be specified for the new portion of the terminal, where necessary, to ensure systems compatibility.

E. A factory upgrade to the existing system shall occur prior to the completion of this system. The upgrade will be provided under a separate contract with IED.

1.2 DEFINITION OF TERMS

A. Within this section of the specification, the following definitions shall apply:

1. The term "Owner" shall refer to Portland International Jetport.
2. The term “GC” shall refer to the construction General Contractor.
3. The term “Consultant” shall refer to Shen Milsom & Wilke, LLC.
4. The term “Architect” shall refer to Gensler.
5. The term "Contractor" shall refer to the Public Address Systems Contractor who has been awarded the Contract for the subject project and who has responsibility for performance of the work specified herein.
6. The term "Specified elsewhere" shall refer to material and work which is related to this Sub-contract and for which the Contractor is not responsible except as otherwise detailed herein. Some or all of these items may be included in the overall electrical contract.
7. The term "OFE" shall refer to "Owner Furnished Equipment", which will be provided to the Contractor by the Owner. The Contractor shall be responsible for installing and integrating this equipment as detailed herein.
8. The term "NIC" shall refer to "Not in Contract", which will refer to equipment and or scope of work that is not within the Contractor’s duties or responsibilities.

9. The term “Future Conveyance” or “Infrastructure Only” shall refer to future or planned equipment items and capabilities of the public address system otherwise know as conveyance. The Contractor is required to provide reasonable and appropriate means to facilitate the future integration of these components within the system design. Wherever possible, the systems design specifications include provisions for these anticipated expansions. The Contractor shall insure that the installation will readily support these items, including, all system cabling to the proposed equipment locations, appropriate rack and cabinet space for said equipment is available within equipment racks or equipment rooms, and control system software anticipating said future items.
10. The term "shall" is mandatory; the term "will" is informative; the term "should" is advisory; and the term "provide" means furnish and install and fully integrate.

1.3 WORK INCLUDED

A. Provide materials, labor, equipment and services necessary to furnish, deliver and install all work as shown on the drawings, as specified herein and/or required by job conditions.

B. Project Schedule

1. The project schedule for the installation shall closely follow the construction schedule for this project where adequate time will be given for pre wire during construction and equipment installation after spaces are clean and ready for electronics installation.
2. The Contractor shall pre stage, assemble and test all racks and sub assemblies prior to delivery.
3. The Contractor will also be responsible for attending construction meetings as required by the GC to coordinate with the other trades.
4. The Contractor on site installation crew may be required to attend GC sponsored safety briefings.

1.4 CONTRACTOR’S GENERAL RESPONSIBILITIES

A. The Contractor is responsible for the coordination of their efforts with the work of this contract with other Contractors and trades to insure proper installation of all equipment.

B. The Contractor is responsible for obtaining a low voltage permit as required by the local jurisdiction.

C. The Contractor is responsible for delivering a turnkey system based on this document, equipment spreadsheets and the design intent drawing package.

D. The Contractor is responsible for creating a drawing set based on their extended engineering efforts and specific components selected.

E. The Contractor is obligated to furnish all equipment and materials, either specifically mentioned herein or not, to ensure a complete and operational system, including all mounting brackets, hardware, and materials. The NIC and OFE items and materials are specifically exempted from

this requirement. However the Contractor shall be responsible for interfacing and connecting to OFE and NIC equipment to the described systems as described in and shown in the audiovisual documents.

F. The Contractor is responsible for all shop drawings and information for the complete installation and wiring of the system. The Contractor shall provide the on-site installation and wiring, and shall provide on-going supervision and coordination during the implementation phase.

G. The Contractor is responsible for the initial adjustment of the system as herein prescribed and shall provide all test equipment for the system checkout and acceptance tests.

H. The Contractor is required to provide on-the-job training in the operation and maintenance of the systems for personnel designated by the Owner's representative.

1.5 WORK SPECIFIED ELSEWHERE

A. All conduits, wire-ways, connection boxes, pull boxes, junction boxes, and outlet boxes permanently installed in walls, floors, and ceilings, are provided under applicable sections by others.

B. All electrical breaker panels required to power the audiovisual systems, are provided under applicable sections by others.

C. All telecommunication connections are provided by others. The Contractor shall coordinate their efforts with the telecommunication Contractor for the installation of all required network interface connections.

1.6 BID SUBMITTALS

A. As part of the Contractors' bid package provide (4) four copies for review by the Consultant and the Owner. These copies to be delivered to the Owner and Consultant as outlined in the bid instruction document.

B. Hardcopy submittal of qualifications and bid quote as well as an electronic bid submission using the supplied spreadsheet form via a CD.

C. The Contractor is responsible for verifying all Microsoft Excel formulas used to calculate their final bid costs.

D. The electronic bid form is included as part of this RFP distribution.

E. Note: The Contractor shall use the provided bid spreadsheet for their bid submission for this project. Please add all pricing information to this document as requested to include warranty costs and non-warranty service rates.

F. Failure to use the supplied bid spreadsheet may result in immediate bid disqualification.

G. The Contractor shall specifically, identify, similar projects of the same or greater magnitude and scope.

1. Provide current contact names and telephone numbers, as well as job description, with a clear delineation between labor and equipment costs, as well as duration of project.
2. The Contractor must identify the project team as part of this submission and declare all lower-tier Contractors and qualifications.

H. Pre bid Questions: All pre bid questions must be submitted per the RFP. All questions and answers will be sent via e-mail to all confirmed bidders.

I. The Contractor shall provide on site factory-trained engineers and installers for the completion of this project.

J. The Contractor must regularly engage in the manufacture and furnishing of commercial and industrial public address systems.

K. The Contractor shall have a permanent full service facility within a 50-mile radius of the project site to be responsible for coordination of the installation of the specified public address system. This representative must be an “IED-Approved Contractor” that has completed the required vendor’s training courses related to the installation and maintenance of the public address system.

L. The local Contractor facility must maintain a suitably staffed and equipped service organization and must regularly offer maintenance services for systems of this type and size.

1.7 PROJECT SUBMITTALS

A. The Contractor shall submit a minimum of six (6) suitably bound sets of the following shop drawings and manuals per the schedule listed below for review by the GC, Consultant, Architect and the Owner.

1. Prior to proceeding with the work:
   a. A complete list of ALL equipment and materials which are to be furnished. Accompanying the list shall be manufacturers' specification or cut sheets for all public address system equipment (e.g. microphone paging stations, announcement control system equipment, equalizers, power amplifiers, loudspeakers) and any other MAJOR items of equipment.
2. Prior to proceeding with respective portions of work:
   a. Art work, drawings, and listings indicating proposed nameplate nomenclature and arrangements for control panels, connection plates, floor boxes and nameplates prior to fabrication as described elsewhere in these specifications.
   b. Details of proposed loudspeaker suspension including attachment methods, weights, and suspension locations for review by the Architect.
   c. Front panel layouts for all equipment racks, prior to installation, reflecting equipment and labels to be used.

d. Diagrams for AC power circuit distribution and installation within equipment racks.
e. Details and descriptions of any other aspect of the public address system which must differ from the drawings due to field conditions or due to the selected equipment to be furnished.

3. At the completion of the installation:
   a. Equipment manufacturer's operation and maintenance manuals for each piece of equipment.
   b. Equipment inventory listing manufacturer, model number and serial number for all equipment items furnished under this contract.
   c. As-built drawings for each system installation, showing all equipment items, interconnection of equipment and all cable label designations. As built drawings shall be provided to the GC in both AutoCAD and PDF format; hard and electronic copy.
   d. System functional block drawing identical to the intent of the specification drawing with addition of all input and output circuit cable and terminal block numbers as well as all jack field circuit I.D. designations. A copy of this drawing shall be framed in protective plastic and mounted on the inner surface of the equipment rack door.
   e. All control software both purchased and custom written shall be the property of the Owner and shall be submitted to the GC on CD Media. Control software contained on the CD must be un-compiled, fully editable versions of both the base code and any touch panel/control screen display configurations.
   f. System Operation and Maintenance Manual: the Contractor shall produce this manual specifically for the systems detailed herein.
      1) The Operation section shall describe all typical procedures necessary to activate each system to provide for the functional requirements as listed under the Detailed Specifications.
      2) The Maintenance section shall provide a recommended maintenance schedule with reference to the applicable pages in the manufacturer's maintenance manuals. Where the manufacturer provides inadequate information, the Contractor shall provide the information necessary for proper maintenance.
4. As otherwise noted on the drawings and/or as noted herein.

B. Approved shop drawings and equipment instruction brochures, including schematic diagrams for all amplifiers and other electronic devices, shall be present at the job site during the period set aside for final system test and equalization.

1.8 QUALITY ASSURANCE

A. Contractor qualifications.

1. The Contractor shall be a firm with at least five years experience in the fabrication, assembly, and installation of public address systems of similar magnitude and quality as specified for this project.

B. Quality of Materials and Equipment

1. All materials and equipment supplied by the Contractor shall be new and shall meet or exceed the specified equipment in all respects.
2. The Contractor shall supply the latest model, available at the time of bidding, of each piece of equipment.

1.9 FIRST YEAR WARRANTY SERVICE

A. Warranty

1. The Contractor shall provide a warranty on the entire system, installation workmanship, and materials employed and on the individual pieces of equipment installed. The system warranty shall be for one (1) year commencing from the date of final system acceptance by the GC, Owners appointed technical representative and or the Owner. This warranty shall obligate the Contractor to provide all equipment, material, and labor during the warranty period, in the event of system or equipment malfunction.
2. To maintain certain manufacturers' warranties, said equipment must be installed, aligned and serviced by those installers authorized by said manufacturer to perform those duties. If said manufacturer does not authorize the Contractor, it is the sole responsibility of the Contractor to make the appropriate arrangements and bear all cost and consequences thereof.
3. All manufacturers’ equipment warranties shall be activated in the Owner's name and shall commence on the date of system acceptance by the Owner’s appointed technical representative and or the Owner. In the case of Contractor-modified equipment, the manufacturer's warranty is normally voided. In such cases, the Contractor shall provide the Owner with a warranty equivalent to that of the original manufacturer.

B. Service and Maintenance

1. During the one-year warranty period, the Contractor shall provide on site service, repair and maintenance for the public address system. First year service and maintenance shall be provided at a fixed price, regardless of the number of service visits required to maintain system operation and performance, including video projector alignment. On the Bid Spreadsheet, enter your first year service contract costs.
2. First year service and maintenance consists of telephone support and assistance, on-site services and preventative maintenance inspections. In all cases, the Contractor shall provide knowledgeable and capable staff technicians in the performance of all tasks required.

C. Telephone Assistance

1. The Contractor shall be available via phone 24/7 and respond via telephone within two hours to any request for service. This first contact should outline the nature of the problem or functional anomaly. The Contractor shall make available an individual knowledgeable with the installed system that can address specific system issues described by system operators.

D. On-site Service

1. The Contractor shall provide capable technicians for on-site service of systems equipment or control software. In all cases, the technicians dispatched must be familiar with the installed system with complete knowledge of the products used in the systems configuration. Technicians dispatched must have complete ability to address the nature of the system anomaly or performance difficulty described.
2. For this RFP, provide your first year pricing to reflect your guaranteed on-site response within 4 hours, interpreted as “same-day-emergency” service, and your guaranteed on-site response within 24 hours, interpreted as “next-day emergency” service, including the hourly pricing for a systems operator provision.
3. Normal non emergency service rates should be available during business hours, Monday through Friday, 8:00 a.m. until 5:30 p.m.

E. Preventive Maintenance Inspections (PMI)

1. This service shall include a minimum of four (4) visits at regular intervals to perform operation checks of the equipment, appropriate signal routing to specific paging zones, and verify adequate audio levels in each paging zone. Additional service visits, above the four visits above, are included in the first year warranty, subject to the time response obligations outlined above. No limit to the quantity of service visits is expressed or implied.

F. Emergency Service Provision

1. During the first year service contract, the Contractor may be called upon to provide on-site service on an emergency basis. For whatever reasons, the Owner may request a qualified technician perform on-site service within the shortest time frame possible. For purposes of this cost proposal, provide a per visit rate for a four hour minimum service call with on-site response within 4 hours from notification. This emergency service should be available 7 days per week, 24 hours per day through a communications hierarchy established by the Owner and Contractor.

1.10 ON-SITE USER TECHNICAL TRAINING

A. The Contractor shall provide on-the-job training by an instructor who is fully knowledgeable in the design and operation of the system(s), to a minimum of 4 persons designated by the Owner, to instruct them in the operation and maintenance of the systems. The Contractor at no additional cost will provide a manufacturer’s representative for such instruction in the event the Contractor does not have qualified instructors on staff for certain sophisticated equipment, to the owner. All training shall take place after the systems are operational, but not before the acceptance tests. There shall be a minimum of 24 hours, divided into six 4 hour sessions of training on the systems included in this specification. Three of these sessions should be “Train the Trainer” sessions and three of these sessions should be general user training.

1.11 SYSTEM LABELING AND IDENTIFICATION

A. All installations shall bear the following identification plate, supplied by this Contractor, permanently mounted on the front of each rack at the top:

SYSTEMS ENGINEERED & DESIGNED BY:
SHEN MILSOM & WILKE, INC.
3300 North Fairfax Drive, Suite 302
Arlington, VA 22201

SYSTEM FABRICATED & INSTALLED BY:
(This Contractor)

Engraving shall be white filled Helvetica lettering on a black background or as appropriate to the identification plate material.

PART 2 - PRODUCTS

2.1 EXPANDED TERMINAL PUBLIC ADDRESS SYSTEM

A. Display

1. None

B. Video

1. None

C. Audio

1. Digital Frame Link Card, dedicated, mulitmode w/ back strip – IEDA510N&NT
2. ACS Microphone Station, dedicated, digital, horizontal flush mount w/ graphic LCD display – IEDA528HFM-H
3. ACS Microphone Station Back Boxes, dedicated, surface mount – IEDA528
4. ACS Microphone Station, dedicated, rack mount w/ graphic LCD and speaker – IEDA528SRM-H
5. Ambient Sensor, dedicated, flush mount, 2 gang – IED0540S-2
6. Ambient Noise Sensor Collector, dedicated, 32 channel, Titan – IEDT9032NS
7. Logic/Voltage I/O Collector, dedicated, 32 channel, Titan – IEDT9032LVIO
8. Relay Interface, dedicated, 16 channel, Titan – IED T9016RY
9. Amplifier Mainframe, dedicated, 16 channel plus backup, Titan, 120VAC – IEDT9160L
10. Amplifier Card, dedicated, primary, 400 Watt, 2 channel, 70 V output, Titan, 120VAC – IEDT6472L
11. Amplifier Card, dedicated, backup, 400 Watt, 2 channel, 70 V output, Titan, 120VAC - IEDT6472L

12. Amplifier Card, dedicated, primary, 400 Watt, 1 channel, 70 V output, Titan, 120VAC - IEDT6471L
13. Amplifier Card, dedicated, backup, 400 Watt, 1 channel, 70 V output, Titan, 120VAC - IEDT6471L
14. Line Driver Card, dedicated, primary, 2 channel, Titan, 120VAC – IEDT6002L
15. Line Driver Card, dedicated, backup, 2 channel, Titan, 120VAC – IEDT6002L
16. Loudspeakers, dedicated, Type 1, Type 5, Type 6, 70 Volt, 8" dual concentric, ceiling mount – Tannoy CMS801DC or equivalent – Types 5 & 6 shall have grills painted in custom colors to match the ceiling finishes. Grills shall be painted in the field.
17. Loudspeaker, dedicated, Type 2, 70 Volt, 8" dual concentric, surface mount, all weather – Tannoy Di8DCt or equivalent
18. Line Array, dedicated, wall mount, 12-4" loudspeakers, internal 8 X 40 Watt power amplifier, DSP, RS485 serial network interface – Intellivox DC 180 or equivalent

D. Control

1. Control PC, dedicated, rack mount w/ LCD monitor, Intel Pentium Dual Core, 2 GB RAM, 120 GB HDD, 1 GB Ethernet, 256MB Graphics Memory, Windows XP Professional

E. Miscellaneous

1. Software Support, dedicated, IED0690
2. Network Switcher, dedicated, w/ fiber and POE, HP Procurve or equivalent – IEDX900-NET
3. Fiber Transmitter/Receiver Pair, dedicated, 10/100 Base-T, stand alone – Opticom DS-108/TR-L1-DSC-SA or equivalent
4. Network Switcher, dedicated, 10/100 Base-T, 5 port – Linksys EZXS55W or equivalent
5. Adapter, dedicated, POE – D-Link DWL-P50 or equivalent
6. Equipment Rack, dedicated, 44RU, 26" depth, adjustable front and rear rails, power management – Middle Atlantic MRK 4426 or equivalent
7. Rack Fan Assembly, dedicated, rack top – Middle Atlantic MW-10FT-FC or equivalent
8. Surge Eliminator & Power Conditioner, dedicated, rack mount, 20 Amp, 120 VAC – Surgex SEQ or equivalent
9. Uninterruptible Power Supply, dedicated, 20 minute backup, 20 Amp, 120 VAC – APC or equivalent
10. All cables, connectors and hardware needed to provide a complete and working system

PART 3 - EXECUTION

3.1 GENERAL

A. Installation shall include the delivery, unloading, setting in place, fastening to walls, floors, ceilings, counters, or other structures where required, interconnecting wiring of the system components, equipment alignment and adjustment, and all other work whether or not expressly required herein which is necessary to result in complete operational systems.

B. All installation practices shall be in accordance with, but not limited to, these specifications and drawings. Installation shall be performed in accordance with the applicable standards, requirements, and recommendations of National, State, and Local authorities having jurisdiction.

C. If, in the opinion of the Contractor, an installation practice is desired or required, which is contrary to these specifications or drawings, a written request for modification shall be made to the GC. Modifications shall not commence without written approval from the Owner and or the Consultant.

D. During the installation, and up to the date of final acceptance, the Contractor shall be under obligation to protect his finished and unfinished work against damage and loss. In the event of such damage or loss, he shall replace or repair such work at no cost to the Owner.

3.2 PHYSICAL INSTALLATION

A. All equipment shall be firmly secured in place unless requirements of portability dictate otherwise.

B. Fastenings and supports shall be adequate to support their loads with a safety factor of at least three.

C. All boxes, equipment, etc., shall be secured plumb and square.

D. In the installation of equipment and cable, consideration shall be given not only to operational efficiency, but also to overall aesthetic factors.

3.3 CABLE INSTALLATION

A. All cables, regardless of length, shall be marked with wrap-around number or letter cable markers at both ends. There shall be no unmarked cables at any place in the system. Marking codes used on cables shall correspond to codes shown on drawings and or run sheets.

B. A logical numbering convention shall be established between the Contractor, Owners technical representative and the Consultant as part of the pre build submission package.

C. All cables shall be terminated based on industry standards and practices for terminating such cable. Any cable not terminated based on these standards shall be rejected and shall be then terminated at the expense of the Contractor.

D. All network cabling shall be certified per the standards based on the cable category.

E. All inter-rack cabling shall be neatly strapped, dressed, and adequately supported.

F. Terminal blocks, boards, strips, or connectors, shall be furnished for all cables which interface with racks, cabinets, consoles, or equipment modules. No audio cables shall run directly to the

audio patch panel jacks. Each audio patch panel shall be furnished with an audio terminal block and all audio cables to and from the audio patch panel shall terminate on this block.

G. All cables shall be grouped according to the signals being carried. In order to reduce signal contamination, separate groups shall be formed for the following cables:

1. Power cables
2. Control cables
3. Audio cables carrying signals less than -20 dBm
4. Audio cables carrying signals between -20 dBm and +20 dBm
5. Audio cables carrying signals above +20 dBm

H. NOTE - Audio cables should not be allowed to run in the same raceway as video, computer or power cables.

I. All audiovisual copper cabling shall maintain a 3’-0” minimal separation from all other non related cabling.

J. All audiovisual fiber optic cabling shall maintain a 0’-3” minimal separation from all other non related cabling.

K. Specific equipment separation requirements are necessary in this project. These requirements will be given to the Contractor as part of the pre build submittal process.

L. As a general practice, all power cables, control cables, and high level cables shall be run on the left side of an equipment rack as viewed from the rear. All other cables shall be run on the right side of an equipment rack, as viewed from the rear.

M. All cables shall be cut to the length dictated by the run. No splices shall be permitted in any pull boxes without prior permission of the GC, Consultant and Owner appointed technical representative. For equipment mounted in drawers or on slides, the interconnecting cables shall be provided with a service loop of appropriate length.

N. No cable shall be installed with a bend radius less than that recommended by the cable manufacturer.

O. All exposed cabling shall be neatly encased in a protective covering and secured.

3.4 CONNECTION PLATE RECEPTACLES

A. Unless otherwise detailed herein, the following types of panel receptacles shall be used on all connection boxes, panels, plates, and wire ways:

1. Audio (microphone or line level) - XLR3F type
2. Loudspeakers (70 Volt or Low Impedance) - Neutrik “Speakon” type
3. Video - BNC. \ S-VIDEO
4. RGB Hs Vs Multi coax BNC/ HD 15
5. Camera Control Tri-ax

6. Fiber optic SC, ST, connectors' Single mode and Multimode

B. Cable Types

1. Unless otherwise called for in these specifications and drawings, the following cables, or their approved equals, shall be used in these systems:

a.	TYPE 1. West Pen 25291	AUDIO (MIC/LINE)
b.	TYPE 2. West Pen 25228	AUDIO (For 16 & 8 Ω PROGRAM SPEAKERS)
c.	TYPE 3. West Pen 25226	AUDIO (70 VOLT CEILING SPEAKERS)
d.	TYPE 4. CANARE MR202-**AT	** PAIR AUDIO MULTICORE
e.	TYPE 5 Extron 22-103-02	** PAIR RGB MULTICORE
f.	TYPE 6 Belden 1859A	** TRI-AX MULTICORE
g.	TYPE 7 Belden DX series	** 4 STRAND MULTI-MODE FIBER
h.	TYPE 8 Belden DX series	** 4 STRAND SINGLE-MODE FIBER
i.	TYPE 9 West Pen 25841	VIDEO / CATV RG-6
j.	TYPE 10 Belden Media twist	VIDEO / UTP Category 6

2. All cables (except video and pulse cables, which must be cut to an electrical length,) shall be cut to the length dictated by the run. No splices shall be permitted in any pull boxes without prior permission of the GC, Consultant and Owner appointed technical representative. For equipment mounted in drawers or on slides, the interconnecting cables shall be provided with a service loop of appropriate length.
3. No cable shall be installed with a bend radius less than that recommended by the cable manufacturer.

C. Grounding Procedures

1. Verify the system power and safety ground has be been installed in accordance with NFPA 72 and NEC Article 250.
2. Telecommunication and Network Grounding shall be installed in accordance with ANSI/EIA/TIA-607.
3. Ground equipment, conductor, and cable shields to eliminate shock hazard and to minimize to the greatest extent possible, ground loops, common mode returns, noise pickup, cross talk and other impairments.

D. Cooperation With Other Trades

1. It shall be the responsibility of the Contractor to cooperate at all times, and to the fullest extent, with all trades doing work in the building, to the end that lost time, work stoppages, interference, and inefficiencies do not occur.

E. Equipment Delivery and Storage

1. Costs of all shipping to the site, and of all unusual storage requirements, shall be borne by the Contractor. It shall be the responsibility of the Contractor to make appropriate arrangements, and to coordinate with authorized personnel at the site, for the proper acceptance, handling, protection, and storage of equipment so delivered. The Contractor

shall be responsible for receiving, storing, and securing all goods and materials on the job site.

F. Cleanup and Repair

1. Upon completion of the work the Contractor shall daily remove all his refuse and rubbish from and about the premises, and shall leave the relevant areas and equipment clean and in an operational state. The Contractor shall be responsible for repairing any damage caused to the premises by the Contractor's installation activities, at no cost to the Owner.

G. Owner Training

1. Please reference training within section one for the contractor's training requirements.

3.5 CONTRACTOR SYSTEM CHECKOUT

A. Before Acceptance Tests are scheduled, the Contractor shall perform his own system checkout. He shall furnish all required test equipment and shall perform all work necessary to determine and/or modify performance of the system to meet the requirements of this specification. This work shall include the following:

1. Test all audio and related systems for compliance with the Performance Standards.
2. Check all control functions, from all controlling devices to all controlled devices, for proper operation.
3. Adjust, balance, and align all equipment for optimum quality and to meet the manufacturer's published specifications. Establish and mark normal settings for all level controls, and record these settings in the "Systems Operation and Maintenance Manual".
4. Maintain documentation of all performance tests for reference by the GC and Consultant during the System Acceptance Tests.

3.6 SYSTEM ACCEPTANCE TESTS

A. System Acceptance Tests will not be performed until the Contractor's System Checkout has been completed. The System Acceptance Tests will be supervised by the GC, Consultant and the Owner's technical representative and will consist of the following:

1. A physical inventory will be taken of all equipment on site.
2. The Contractor shall demonstrate the operation of all system equipment.
3. Both subjective and objective tests will be required to determine compliance with the specifications. The Contractor shall be responsible for providing test equipment for these tests.
4. All final "as-built" drawings, run sheets, manuals, and other required documents, as detailed herein, shall be on hand. Two complete sets of these documents shall be delivered to the Owner at this time. (One complete set shall have been delivered to the GC and the Consultant prior to the scheduling of Acceptance Tests).

5. In the event further adjustment is required, or defective equipment must be repaired or replaced, tests may be suspended or continued at the option of the GC and the Consultant.

3.7 PERFORMANCE TEST SIGNAL PATHS

A. The signal paths for Performance Standards Tests shall be as an example as but not limited to the following:

1. From all source inputs (for microphones, audio tape units, etc.) through all Mixers, ADA's, switchers, etc., to all signal destinations.
2. The delineation of the above signal paths shall not exempt the Contractor from the responsibility of checking all paths and outlets for appropriate compliance with the Performance Standards as well as accepted industry standards.
3. During performance testing, all equipment shall be operated under standard conditions that are both industry standard and recommended by the manufacturer.

3.8 INVENTORY AND SERVICE LOGGING

A. The Contractor shall provide a list of equipment and serial numbers sorted by room and location.

B. The Contractor shall provide a service log within five business days following each visit detailing the work performed on each device and indicating additional actions, if required, with time frame to be completed.

END OF SECTION 27 51 16

	DESCRIPTION	MANUFACTURER	PRODUCT	PRICE	QTY	TOTAL
1						
2	**DISPLAY**					
3	OFE Rack Mounted LCD Monitor for IED Control PC	OFE	OFE		1	
4						
5	**VIDEO**					
6						
7	**AUDIO**					
8	Paging Microphone - Table Top	IED	IEDA528HFM-H		18	
9	Paging Microphone - Wall Mounted	IED	IEDA528SBB		7	
10	Paging Microphone - Rack Mounted	IED	IEDA528SRM-H		1	
11	Ambient Noise Sensor - 2 Gang Plate	IED	IED0540S-2		11	
12	Ambient Noise Sensor Collector	IED	IEDT9032NS		1	
13	Paging System Main Frame	IED	IEDA510N&NT		1	
14	8" Ceiling Mounted Speaker, 70V	Tannoy	CMS801 DC		264	
15	Surface Mounted Speaker, 70V	Tannoy	i7		6	
16	Line Array DSP Speaker	Intellivox	DC108		11	
17	Weather Resistant Surface Mount Speaker	Tannoy	DI8 DCT		6	
18	Power Amplifier Main Frame	IED	IEDT9160L		3	
19	200 watts 2Ch 70V Amplifier - Card	IED	IEDT6472L		9	
20	400 watts 1Ch 70V Amplifier - Card	IED	IEDT6471L		6	
21	2Ch Line Audio Drive - Card	IED	IEDT6002L		6	
22	200 watts 2Ch 70V Amplifier - Card - Spare	IED	IEDT6472L		1	
23	400 watts 1Ch 70V Amplifier - Card - Spare	IED	IEDT6471L		1	
24						
25	**CONTROL**					
26	OFE PC for IED Main Frame Control	OFE	OFE		1	
27						
28	**MISCELLANEOUS**					
29	10/100 Base-T Fiber Transceiver Stand Alone - Pair	Opticomm	DS-108/TR-L1-DSC-SA		3	
30	Network Swicher, POE	IED	IEDX900-NET		1	
31	Paging System Software Support	IED	IED0690		3	
32	5-Port 10/100 Base-T Network Switcher	LinkSys	EZXS55W		2	
33	Power over Ethernet Adapter	D-Link	DWL-P50		4	
34	AV Equipment Rack - 44RU	Middle Atlantic	MRK-4426		2	
35	AV Rack Top Panel with Fan	Middle Atlantic	MW-10FT-FC		2	
36	AV Rack Caster Base	Middle Atlantic	CBS-MRK-26		2	
37	Power Conditioner, 20A	Surge X	SEQ		2	
38	Misc - Cable, Connectors and Hardware	Lot			1	
39						
40						
41	EQUIPMENT SUB TOTAL					
42	NON-EQUIPMENT COSTS					
43						
44	TAX					
45	FREIGHT					
46	ENGINEERING					
47	IN-HOUSE FABRICATION					
48	ON-SITE INSTALLATION					
49	SYSTEM PROGRAMMING					
50	DOCUMENTATION & TRAINING					
51	PROJECT MANAGEMENT					
52	G & A					
53						
54	**TOTAL SYSTEM COST**				**$**	

SECTION 28 13 00 - ACCESS CONTROL

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. This Section includes an Access Control System consisting of a Central Station, one or more networked workstation computers, operating system and application software, and field-installed Controllers connected by a high-speed electronic data transmission network. The Access Control system shall have the following:

1. Access Control:

    a. Regulating access through doors, gates, and roll up doors.

    b. Surge and tamper protection.

    c. Secondary alarm annunciator.

    d. Credential cards and readers.

    e. Push-button switches.

    f. Credential creation and credential holder database and management.

    g. Monitoring of field-installed devices.

    h. Reporting.

2. Security:

    a. Key tracking.

    b. Video and camera control.

B. Related Sections include the following:

1. Division 28 Section "Video Surveillance" for interface devices and communications protocol to integrate motion detection and video camera selection and positioning into security access system.

1.3 DEFINITIONS

A. ABA Track: Magnetic stripe that is encoded on track 2, at 75-bpi density in binary-coded decimal format; for example, 5-bit, 16-character set.

B. BHS: Baggage Handling System.

C. CCTV: Closed-circuit television.

D. Central Station: A PC with software designated as the main controlling PC of the security access system. Where this term is presented with initial capital letters, this definition applies.

E. Controller: An intelligent peripheral control unit that uses a computer for controlling its operation. Where this term is presented with an initial capital letter, this definition applies.

F. CPU: Central processing unit.

G. Credential: Data assigned to an entity and used to identify that entity.

H. DIP: Door Interface Panel

I. dpi: Dots per inch.

J. DTS: Digital Termination Service: A microwave-based, line-of-sight communications provided directly to the end user.

K. File Server: A PC in a network that stores the programs and data files shared by users.

L. GFI: Ground fault interrupter.

M. Identifier: A credential card, keypad personal identification number or code, biometric characteristic, or other unique identification entered as data into the entry-control database for the purpose of identifying an individual. Where this term is presented with an initial capital letter, this definition applies.

N. I/O: Input/Output.

O. LAN: Local area network.

P. LED: Light-emitting diode.

Q. Location: A Location on the network having a PC-to-Controller communications link, with additional Controllers at the Location connected to the PC-to-Controller link with RS-485 communications loop. Where this term is presented with an initial capital letter, this definition applies.

R. PC: Personal computer. This acronym applies to the Central Station, workstations, and file servers.

S. PCI Bus: Peripheral component interconnect; a peripheral bus providing a high-speed data path between the CPU and peripheral devices (such as monitor, disk drive, or network).

T. PDF: (Portable Document Format.) The file format used by the Acrobat document exchange system software from Adobe.

U. PWM: Portland International Jetport

V. RF: Radio frequency.

W. ROM: Read-only memory. ROM data are maintained through losses of power.

X. RS-232: An TIA/EIA standard for asynchronous serial data communications between terminal devices. This standard defines a 25-pin connector and certain signal characteristics for interfacing computer equipment.

Y. RS-485: An TIA/EIA standard for multipoint communications.

Z. TCP/IP: Transport control protocol/Internet protocol incorporated into Microsoft Windows.

AA. TWAIN: (Technology without an Interesting Name.) A programming interface that lets a graphics application, such as an image editing program or desktop publishing program, activate a scanner, frame grabber, or other image-capturing device.

BB. UPS: Uninterruptible power supply.

CC. WAN: Wide area network.

DD. WAV: The digital audio format used in Microsoft Windows.

EE. Wiegand: Patented magnetic principle that uses specially treated wires embedded in the credential card.

FF. Windows: Operating system by Microsoft Corporation.

GG. Workstation: A PC with software that is configured for specific limited security system functions.

HH. WYSIWYG: (What You See Is What You Get.) Text and graphics appear on the screen the same as they will print.

1.4 SYSTEM DESCRIPTION

A. System shall consist of a PC-based Central Station, one or more networked PC-based workstations, and field-installed Controllers, connected by a high-speed electronic data transmission network.

1. System Software: Based on 32-bit, Microsoft Windows NT central-station, workstation operating system, server operating system, and application software. Software shall have the following capabilities:

    a. Multiuser multitasking to allow for independent activities and monitoring to occur simultaneously at different workstations.

    b. Graphical user interface to show pull-down menus and a menu tree format that complies with interface guidelines of Microsoft Windows operating system.

    c. System license shall be for the entire system and shall include capability for future additions that are within the indicated system size limits specified in this Section.

    d. System shall have open architecture that allows importing and exporting of data and interfacing with other systems that are compatible with Microsoft Windows operating system.

    e. Password-protected operator login and access.

B. Network connecting the Central Station and workstations shall be a LAN using Microsoft Windows-based TCP/IP with a capacity of connecting up to 99 workstations.

C. Network(s) connecting PCs and Controllers shall consist of one or more of the following:

1. Local area, IEEE 802.3 Fast Ethernet 100 BASE-TX, star topology network based on TCP/IP.

1.5 PERFORMANCE REQUIREMENTS

A. Security access system shall use a single database for access-control and credential-creation functions.

B. Distributed Processing: System shall be a fully distributed processing system so that information, including time, date, valid codes, access levels, and similar data, is downloaded to Controllers so that each Controller makes access-control decisions for that Location. Do not use intermediate Controllers for access control. If communications to Central Station are lost, all Controllers shall automatically buffer event transactions until communications are restored, at which time buffered events shall be uploaded to the Central Station.

C. Number of Locations: Support at least 32,000 separate Locations using a single PC with combinations of direct-connect, dial-up, or TCP/IP LAN connections to each Location.

1. Each Location shall have its own database and history in the Central Station. Locations may be combined to share a common database.

D. Data Capacity:

1. 130 different card-reader formats.

2. 999 comments.

3. 16 graphic file types for importing maps.

E. Location Capacity:

1. 128 reader-controlled doors.

2. 50,000 total access credentials.

3. 2048 supervised alarm inputs.

4. 2048 programmable outputs.

5. 32,000 custom action messages per Location to instruct operator on action required when alarm is received.

F. System Network Requirements:

1. Interconnect system components and provide automatic communication of status changes, commands, field-initiated interrupts, and other communications required for proper system operation.

2. Communication shall not require operator initiation or response, and shall return to normal after partial or total network interruption such as power loss or transient upset.

3. System shall automatically annunciate communication failures to the operator and identify the communication link that has experienced a partial or total failure.

G. Central Station shall provide operator interface, interaction, display, control, and dynamic and real-time monitoring. Central Station shall control system networks to interconnect all system components, including workstations and field-installed Controllers.

H. Field equipment shall include Controllers, sensors, and controls. Controllers shall serve as an interface between the Central Station and sensors and controls. Data exchange between the Central Station and the Controllers shall include down-line transmission of commands, software, and databases to Controllers. The up-line data exchange from the Controller to the Central Station shall include status data such as intrusion alarms, status reports, and entry-control records. Controllers are classified as alarm-annunciation or entry-control type.

I. System Response to Alarms: Field device network shall provide a system end-to-end response time of 1 second(s) or less for every device connected to the system. Alarms shall be annunciated at the Central Station within 1 second of the alarm occurring at a Controller or device controlled by a local Controller, and within 100 ms if the alarm occurs at the Central Station. Alarm and status changes shall be displayed within 100 ms after receipt of data by the Central Station. All graphics shall be displayed, including graphics-generated map displays, on the console monitor within 5 seconds of alarm receipt at the security console. This response time shall be maintained during system heavy load.

J. False Alarm Reduction: The design of Central Station and Controllers shall contain features to reduce false alarms. Equipment and software shall comply with SIA CP-01.

K. Error Detection: A cyclic code error detection method shall be used between Controllers and the Central Station, which shall detect single- and double-bit errors, burst errors of eight bits or less, and at least 99 percent of all other multibit and burst error conditions. Interactive or product error detection codes alone will not be acceptable. A message shall be in error if one bit is received incorrectly. System shall retransmit messages with detected errors. A two-digit decimal number shall be operator assignable to each communication link representing the number of retransmission attempts. When the number of consecutive retransmission attempts equals the assigned quantity, the Central Station shall print a communication failure alarm message. System shall monitor the frequency of data transmission failure for display and logging.

L. Data Line Supervision: System shall initiate an alarm in response to opening, closing, shorting, or grounding of data transmission lines.

M. Door Hardware Interface: Coordinate with Division 08 Sections that specify door hardware required to be monitored or controlled by the security access system. The Controllers in this Section shall have electrical characteristics that match the signal and power requirements of door hardware. Integrate door hardware specified in Division 08 Sections to function with the controls and PC-based software and hardware in this Section.

1.6 SYSTEM REQUIREMENTS

A. The equipment shall be interfaced with the existing “online” production Access Control system. Any modifications to the existing Access Control System shall take place in the presence of a PWM Security representative.

B. No equipment shall interface with the Access Control production system without prior testing and inspection, and being proven to be free of defects and installed 100% in accordance with the PWM guidelines and these documents.

C. The system must be fully programmable with multiple levels of security. These levels will give control and access to specific doors, etc. and deny access to others.

D. All hardware and software must be year 2000 compliant.

E. The system shall be a Software House access control system.

F. The PWM Operations Center will have control over all access points for all buildings.

G. Provide all programming and badge creation for the Access Control system.

H. If communications fail between the PWM Operations Center and Terminal, the Access Control system shall operate in standalone mode until communications is restored and the PWM Operations Center can update the Access Control system and upload the Controller history files.

I. Provide memory upgrades to all panels increasing the size of cardholder database to 10,000 and the transaction buffer to expand to 2,000 event capacity.

J. The systems must provide the Security Department personnel with transaction tracking and history for access points, if requested. Access points tracking reports are based on security level of the requester.

K. The system shall be delivered with the most current version of compatible software, firmware and hardware, with free software upgrades for the first year after system cutover.

L. The existing PWM Operations Center Central Station will be upgraded under this project. The most up-to-date version of Software House C-CURE 8000 software at the time will be furnished by the Contractor and will serve as a replacement to the existing Central Station.

M. The system will employ code compliant delayed egress system on doors with sirens. This will start the siren when the panic bar is pushed, and will release the door 15 seconds later. In the event of a fire alarm the system will disarm and release the locks on doors with in a specific fire zone (based on input from the fire alarm panel). Proper NFPA required signage must be included and installed for notification. In some cases multiple delayed egress locks will be released at the same time to meet code. The Contractor will be responsible for proper coordination with the Fire Alarm Contractor.

N. The audio/visual annunciator associated with door contacts will be a minimum of 80dB at two feet or adequately louder that ambient noise levels to be affective. Install a tamper switch behind the annunciator wired in series with the DIP tamper switch.

O. The system will include interfaces for operation and status of roll up metal lift gates, automatic slider doors, elevators and baggage control PLCs.

1.7 FIRE SYSTEM INTERFACE

A. The Fire Alarm Contractor will provide a demarcation interface between the Fire System and Access Control System at each DIP where integration is required. The Fire Alarm Contractor will furnish a termination strip to be installed within the DIP. The Fire Alarm Contractor will furnish a connection from the Fire Alarm System to one side of the termination strip. The Access Control Contractor shall be responsible for making the connection from the delayed egress lock to the opposite side of the termination strip.

B. Coordinate with the Fire Alarm Contractor to receive the contacts and test the system and each door. Both the Access Control Contractor and Fire Alarm Contractor must be present for all work performed by the Fire Alarm Contractor that occurs within the DIP.

C. Provide shop drawings detailing the interface with the Fire Alarm System.

D. The following door pairs shall have their delayed egress locks tied together in such a fashion such that the release of one lock will automatically release the second lock. This must be done in order to meet the code requirement that no more than 15 seconds of delay is forced via any egress path.

1. 2529A and 2529C
2. 2528A and 2528C
3. 2527A and 2527C
4. 2526A and 2526C
5. 2522B and 2505A
6. 3514A and 3514B

1.8 DOOR RELEASE

A. Request to exists shall be provided by Chexit (delayed egress), card readers, or internal request to exit devices within the physical lockset.

B. Each Chexit delayed egress panic bar unit shall be provided with concealed cabling hinge power transfer units.

C. Install a power disconnect button as an “emergency only” method to exit only where magnetic locks are installed, for code compliance.

D. Where exposed power disconnect buttons are called for, contractor shall be mounted in stainless steel faceplates. Contractor shall provide machine engraved labeling at each button stating, “EMERGENCY EXIT – ALARM WILL SOUND”. All cabling shall be run concealed to the DIP. Submit a sample for approval of PWM and the Engineer.

1.9 SECURITY INTERFACE FOR BAGGAGE HANDLING SYSTEM

A. All Baggage Handling Systems which cross from the public space to secure or sterile space or that are considered to be of particular interest to the security needs of the Jetport shall be controlled and monitored by the PWM Security Operations Center. A solid roll up door which forms a complete barrier will be provided at these boundaries by the BHS Contractor. This door will provide access for bags only and shall not be configured as a means for personnel access or egress. These doors shall all be provided with a full closed limit switch for use by the Access Control System. A heavy duty Balanced Magnetic Switch shall be provided by the Security Contractor for this purpose. The Security Contractor shall coordinate with the BHS installation to accommodate this switch.

B. Secured BHS roll up doors shall be provided Card Readers, CCTV Cameras, Door Limit Switches, and Local A/V Annunciators as indicated in the project Drawing.

C. A demarcation box between the Baggage Handling System and Access Control System shall be furnished by the Security Contractor as indicated in the project Drawings. Within this box, the Security Contractor shall furnish terminal strips and relays as required to meet the operational needs of the Security/BHS Interface. The Security Contractor will be responsible for all internal wiring within the demarcation box with the

singular exception of an RS 232 connection from the demarcation box to the BHS PLC. This connection shall be the responsibility of the BHS Contractor.

D. The Security Contractor MUST coordinate with the BHS Contractor to ensure that the following operational procedure is adhered to:

1. To Start Belt/Open Roll Up Door:

a. Swipe access card.

b. Authorization will be granted from the access control system which will provide permission to start the bag belt (close relay).

c. The bag belt start button will then be depressed by the operator and the signal will be sent to the BHS PLC which will initiate the raising of the roll up door.

2. To Stop Belt/Close Roll Up Door:

a. This function shall be handled by timers within the BHS system or in the case of emergency, an ESTOP button provided by the BHS Contractor.

b. The Access Control System will not have any interaction with the closing of the security roll up door.

3. To Restart Belt/Re-Open Roll Up Door:

a. The above procedure must be followed.

E. The card access system will NOT be used to close any roll up door. Once any security roll up door is closed, the normal procedure for opening the door will be followed.

1.10 COORDINATION

A. No changes or modifications of any existing airport security system equipment, operation, boundary, door, or AOA fencing may take place without authorization from the designated owner's security representative. The contractor is responsible to keep the airport's security boundary secure during all phases of construction and associated demolition.

B. PWM security requires a minimum of two (2) weeks notice prior to the start of security system, equipment and/or boundary changes. During this period, PWM security will advise when work can proceed and of any special actions which must take place. Coordination with PWM security is required for every step of the addition/removal process.

C. Airport security must be maintained at all times. It is the contractor's responsibility to ensure that a full height barrier and/or other owner pre-approved method is in place prior to performing and changes to the airports Access Control system and/or security boundaries. Once an authorized barrier is in place, contractor shall advise owner so that

the access door/portal may be removed (by PWM security) from the system data base. PWM security will advise when this step is complete.

D. All new security doors shall be coordinated and approved with PWM Security prior to installation.

E. A coordination meeting between the security contractor and PWM shall be required prior to the start of shop drawings in order to ensure a complete understanding of the project requirements.

F. All work to the existing security system shall be performed between the hours of midnight and 5:00am or as directed by PWM security. The contractor shall notify PWM a minimum of 72 hours in advance prior to the need to modify any elements of the existing security system. All work to the existing security system shall take place in the presence of a representative of PWM security.

G. All shop drawings shall be approved by both PWM and the project engineer before the start of construction. The contractor shall provide for added reviewal time on any shop drawing submittals requiring TSA approval.

H. The security contractor shall coordinate with the electrical contractor to ensure that proper power is supplied at all security equipment as required. Areas requiring coordination with the electrical contractor include, but are not limited to:

1. Each door interface panel location

I. The security contractor shall coordinate with the fire alarm contractor to ensure that the proper connections are made at security doors with delayed egress panic hardware which require a connection to the fire alarm system. Refer to drawing SS12.02 for more detailed information on the demarcation of contractor responsibility.

1.11 SUBMITTALS

A. Product Data: For each type of product indicated. Include operating characteristics, furnished specialties, and accessories. Reference each product to a location on Drawings. Test and evaluation data presented in Product Data shall comply with SIA BIO-01.

B. Shop Drawings:

1. Diagrams for cable management system.

2. System labeling schedules, including electronic copy of labeling schedules that are part of the cable and asset identification system of the software specified in Parts 2 and 3.

3. Wiring Diagrams. Show typical wiring schematics including the following:

a. Workstation outlets, jacks, and jack assemblies.

b. Patch cords.

c. Patch panels.

4. Cable Administration Drawings: As specified in Part 3 "Identification" Article.

5. Battery and charger calculations for Central Station, workstations, and Controllers.

6. Submit shop drawings of the DIP for approval.

7. Provide the technical information sheets and drawing for the following information:

a. Access control system schematic diagram

b. Access control system point-to-point wiring diagram

c. Access control panel details, per DIP

d. Door numbers

e. Door shunt times

f. System power and wiring requirements

g. Final controller and I/O unit locations

h. Alarm system input/output schedule

i. Access control management system software
j. Rack layouts

k. Card readers

l. Access cards

m. Keypads

n. Electric-door release mechanisms

o. Balanced magnetic switches

p. Audible/Visual Annunciator

q. Cabling

r. Complete device and system power and wiring requirements

s. Signal cable distance requirements

t. Reference door hardware

u. Miscellaneous equipment (power supply, etc.)

v. UTP patch panel

C. Project planning documents as specified in Part 3.

D. Field quality-control test reports.

E. Software upgrade information detailing the location and current version of all equipment to be upgraded. Include all relevant information on the new version of software to be furnished.

F. Operation and Maintenance Data: For security system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data" include the following:

1. Microsoft Windows software documentation.

2. PC installation and operating documentation, manuals, and software for the PC and all installed peripherals. Software shall include system restore, emergency boot diskettes, and drivers for all installed hardware. Provide separately for each PC.

3. Hard copies of manufacturer's specification sheets, operating specifications, design guides, user's guides for software and hardware, and PDF files on CD-ROM of the hard-copy submittal.

4. System installation and setup guides, with data forms to plan and record options and setup decisions.

1.12 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

B. Source Limitations: Obtain Central Station, workstations, Controllers, Identifier readers, and all software through one source from a single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with NFPA 70, "National Electrical Code."

E. Comply with SIA DC-03 and SIA DC-07.

1.13 DELIVERY, STORAGE, AND HANDLING

A. Central Station, Workstations, and Controllers:

1. Store in temperature- and humidity-controlled environment in original manufacturer's sealed containers. Maintain ambient temperature between 50 and 85 deg F, and not more than 80 percent relative humidity, noncondensing.

2. Open each container; verify contents against packing list, and file copy of packing list, complete with container identification for inclusion in operation and maintenance data.

3. Mark packing list with designations that have been assigned to materials and equipment for recording in the system labeling schedules that are generated by cable and asset management system specified in Part 2.

4. Save original manufacturer's containers and packing materials and deliver as directed under provisions covering extra materials.

1.14 PROJECT CONDITIONS

A. Environmental Conditions: System shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:

1. Control Station: Rated for continuous operation in ambient conditions of 60 to 85 deg F and a relative humidity of 20 to 80 percent, noncondensing.

2. Interior, Controlled Environment: System components, except central-station control unit, installed in temperature-controlled interior environments shall be rated for continuous operation in ambient conditions of 36 to 122 deg F dry bulb and 20 to 80 percent relative humidity, noncondensing. NEMA 250, Type 1 enclosure.

3. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambient conditions of minus 30 to plus 122 deg F dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous operation where exposed to rain as specified in NEMA 250, winds up to 85 mph. NEMA 250, Type 4X enclosures.

4. Hazardous Environment: System components located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers shall be rated, listed, and installed according to NFPA 70.

5. Corrosive Environment: For system components subjected to corrosive fumes, vapors, and wind-driven salt spray in coastal zones, provide NEMA 250, Type 4X enclosures.

1.15 EXTRA MATERIALS

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

1. Credential card blanks, ready for printing. Include enough credential cards for all personnel to be enrolled at the site plus an extra 50 percent for future use.

2. Fuses of all kinds, power and electronic, equal to 10 percent of amount installed for each size used, but no fewer than three units.

3. iStar Controllers, equal to 5 percent of the amount installed, but no fewer than five units.

4. Card readers, equal to 5 percent of the amount installed, but no fewer than five units.

PART 2 - PRODUCTS

2.1 GENERAL

A. The Contractor is to insure that all components that they are proposing are compatible with, and can interface with the existing production Access Control system. Items specified in this specification are to provide an expected level of service of the system. The Contractor shall provide all components and investigate the products prior to submission of the system. Product incompatibility is an issue that the Contractor is responsible for, failure to adequately research the products proposed is not an unacceptable reason to request a change order. Shop drawings showing product interconnections shall be required.

B. All parts shall be UL listed (as much as possible), or equal testing laboratory approved by the Engineer.

2.2 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.3 ACCESS CONTROL SYSTEM

A. Manufacturers:

1. Software House

2.4 APPLICATION SOFTWARE

A. System Software: Based on 32-bit, Microsoft Windows central-station and workstation operating system and application software. Software shall have the following features:

1. Multiuser multitasking to allow independent activities and monitoring to occur simultaneously at different workstations.

2. Graphical user interface to show pull-down menus and a menu tree format.

3. Capability for future additions within the indicated system size limits.

4. Open architecture that allows importing and exporting of data and interfacing with other systems that are compatible with operating system.

5. Password-protected operator login and access.

B. Application Software: Interface between the alarm annunciation and entry-control Controllers, to monitor sensors, operate displays, report alarms, generate reports, and help train system operators. Software shall have the following functions:

1. Contractor to upgrade the existing software package to the most up to date version of the C-CURE 8000 platform from Software House. All software for associated Controllers and equipment must be Software House products and must be compatible with the C-CURE 8000 platform.

C. Workstation Software:

1. Password levels shall be individually customized at each workstation to allow or disallow operator access to program functions for each Location.

2. Workstation event filtering shall allow user to define events and alarms that will be displayed at each workstation. If an alarm is unacknowledged (not handled by another workstation) for a preset amount of time, the alarm will automatically appear on the filtered workstation.

D. Controller Software:

1. Controllers shall operate as an autonomous intelligent processing unit. Controllers shall make decisions about access control, alarm monitoring, linking functions, and door locking schedules for its operation, independent of other system components. Controllers shall be part of a fully distributed processing control network. The portion of the database associated with a Controller and consisting of parameters, constraints, and the latest value or status of points connected to that Controller, shall be maintained in the Controller.

2. Functions: The following functions shall be fully implemented and operational within each Controller:

   a. Monitoring inputs.

   b. Controlling outputs.

   c. Automatically reporting alarms to the Central Station.

   d. Reporting of sensor and output status to Central Station on request.

   e. Maintaining real time, automatically updated by the Central Station at least once a day.

   f. Communicating with the Central Station.

   g. Executing Controller resident programs.

   h. Diagnosing.

   i. Downloading and uploading data to and from the Central Station.

E. PC-to-Controller Communications:

1. Central-station or workstation communications (for newly installed Controllers) shall use the following:

   a. TCP/IP LAN network interface cards.

2. TCP/IP network interface card shall have an option to set the poll frequency and message response time-out settings.

3. PC-to-Controller and Controller-to-Controller communications shall use a polled-communication protocol that checks sum and acknowledges each message. All communications shall be verified and buffered and retransmitted if not acknowledged.

F. TCP/IP PC-to-Controller Communications:

1. Communication software on the PC shall supervise the PC-to-Controller communications link.

2. Loss of communications to any Controller shall result in an alarm at all PCs running the communications software.

3. When communications are restored, all buffered events shall automatically upload to the PC, and any database changes shall be automatically sent to the Controller.

G. Database Downloads:

1. All data transmissions from PCs to a Location, and between Controllers at a Location, shall include a complete database checksum to check the integrity of the

transmission. If the data checksum does not match, a full data download shall be automatically retransmitted.

2. If a Controller is reset for any reason, it shall automatically request and receive a database download from the PC. The download shall restore data stored at the Controller to their normal working state and shall take place with no operator intervention.

H. Alarms:

1. System Setup:

a. Assign manual and automatic responses to incoming point status change or alarms.

b. Automatically respond to input with a link to other inputs, outputs, operator-response plans, unique sound with use of WAV files, and maps or images that graphically represent the point location.

c. 60-character message field for each alarm.

d. Operator-response-action messages shall allow message length of at least 65,000 characters, with database storage capacity of up to 32,000 messages. Setup shall assign messages to access point.

e. Secondary messages shall be assignable by the operator for printing to provide further information and shall be editable by the operator.

f. Allow 25 secondary messages with a field of 4 lines of 60 characters each.

g. Store the most recent 1000 alarms for recall by the operator using the report generator.

2. Software Tamper:

a. Annunciate a tamper alarm when unauthorized changes to system database files are attempted. Three consecutive unsuccessful attempts to log onto system shall generate a software tamper alarm.

b. Annunciate a software tamper alarm when an operator or other individual makes three consecutive unsuccessful attempts to invoke functions beyond their authorization level.

c. Maintain a transcript file of the last 5000 commands entered at the each Central Station to serve as an audit trail. System shall not allow write access to system transcript files by any person, regardless of their authorization level.

d. Allow only acknowledgment of software tamper alarms.

3. Read access to system transcript files shall be reserved for operators with the highest password authorization level available in system.

4. Animated Response Graphics: Highlight alarms with flashing icons on graphic maps; display and constantly update the current status of alarm inputs and outputs in real time through animated icons.

5. Multimedia Alarm Annunciation: WAV files to be associated with alarm events for audio annunciation or instructions.

6. Alarm Handling: Each input may be configured so that an alarm cannot be cleared unless it has returned to normal, with options of requiring the operator to enter a comment about disposition of alarm. Allow operator to silence alarm sound when alarm is acknowledged.

7. CCTV Alarm Interface: Allow commands to be sent to CCTV systems during alarms (or input change of state) through serial ports.

8. Camera Control: Provides operator ability to select and control cameras from graphic maps.

I. Training Software: Enables operators to practice system operation including alarm acknowledgment, alarm assessment, response force deployment, and response force communications. System shall continue normal operation during training exercises and shall terminate exercises when an alarm signal is received at the console.

2.5 SURGE AND TAMPER PROTECTION

A. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor-entry connection to components.

1. Minimum Protection for Power Connections 120 V and More: Auxiliary panel suppressors complying with requirements in Division 26 Section "Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits."

2. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Connections: Comply with requirements in Division 26 Section "Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits" as recommended by manufacturer for type of line being protected.

B. Tamper Protection: Tamper switches on enclosures, control units, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled. Control-station control-unit alarm display shall identify tamper alarms and indicate locations.

2.6 CENTRAL-STATION HARDWARE

A. Central-Station Computer: Standard unmodified PC of modular design.

B. The system must meet or exceed the minimum system requirements for the newly installed version of the C-CURE 8000 platform. If the existing system is unable to meet these requirements, the Contractor shall be required to provide a computer system which exceeds the minimum recommended performance requirements set forth by Software House.

C. The Central Station is to be upgraded prior to the addition of any new security doors. The existing Access Control system must be upgraded and fully operational prior to the addition of any new security doors to the Access Control System.

2.7 STANDARD WORKSTATION HARDWARE

A. Workstation shall consist of a standard unmodified PC, with accessories and peripherals that configure the workstation for a specific duty.

B. Workstation Computer: Standard unmodified PC of modular design.

C. The system must meet or exceed the minimum system requirements for the installed workstation software.

2.8 CONTROLLERS

A. Controllers: Intelligent peripheral control unit, complying with UL 294, that stores time, date, valid codes, access levels, and similar data downloaded from the Central Station or workstation for controlling its operation.

B. The Controllers shall be the Software House iStar Pro 2U Rack-Mount product.

C. All Controllers will be mounted in IDF and MDF rooms as specified on Drawings.

D. Controllers shall process information from the DIP or alarmed points based on contact closure, sensors, balanced magnetic switches or other alarm contacts.

2.9 CARD READERS

A. Power: Card reader shall be powered from its associated Controller, including its standby power source.

B. Card reader shall be a Software House product and shall match the majority of existing card readers present in the Terminal.

C. Card reader shall be able to interpret the existing access cards in use at the facility.

D. Card readers at all boarding doors and Jetway doors shall have a keypad as well.

E. All wiring shall be installed concealed in a tamper resistant manner.

F. Enclosure: Suitable for surface, semiflush, or pedestal mounting. Mounting types shall additionally be suitable for installation in the following locations:

1. Indoors, controlled environment.

2. Indoors, uncontrolled environment.

3. Outdoors, with built-in heaters or other cold-weather equipment to extend the operating temperature range as needed for operation at the site.

G. Display: LED or other type of visual indicator display shall provide visual and audible status indications and user prompts. Indicate power on/off, whether user passage requests have been accepted or rejected, and whether the door is locked or unlocked.

2.10 DOOR INTERFACE PANEL

A. Each DIP is to be configured to suit the needs of the security hardware sets indicated for each door on the Drawings.

B. All door hardware is to be wired to the DIP. The DIP will pass information upstream to the Controller.

C. The DIP shall be a 24" by 24" by 8" NEMA 3R or greater enclosure. The DIP shall be provided with a best core locking system.

D. Contractor to provide Shop Drawings indicating the contents of each DIP.

E. This Contractor shall provide all required jumper cables.

2.11 AUDIBLE AND VISUAL ANNUNCIATORS

A. Audible and visual annunciators are to be connected to secure doors to alert local workers that an unauthorized egress is being attempted. The annunciators will be connected to the delayed egress system and sound as described under that section.

B. The annunciators will be powered from the DIP that controls the door.

C. A minimum of 80dB at two feet or as required maintaining same effect over ambient noise.

D. Provide a tamper switch wired in series with the DIP tamper switch.

E. Acceptable product shall be

1. Wheelock – Model # MTWP-2475W-FW

2. Or approved equal

2.12 TAMPER SWITCH

A. Provide single pole, double throw (DPDT) switch.

B. Acceptable product shall be

1. Sentol – 3015 Series

2. Or approved equal

2.13 DOOR AND GATE HARDWARE INTERFACE

A. Exit Device with Alarm: Operation of the exit device shall generate an alarm and annunciate a local alarm. Exit device and alarm contacts are specified in Division 08 Section "Door Hardware."

B. Exit Alarm: Operation of a monitored door shall generate an alarm. Exit devices and alarm contacts are specified in Division 08 Section "Door Hardware."

C. Electric Door Strikes: Use end-of-line resistors to provide power line supervision. Signal switches shall transmit data to Controller to indicate when the bolt is not engaged and the strike mechanism is unlocked, and shall report a forced entry. Power and signal shall be from the Controller. Electric strikes are specified in Division 08 "Door Hardware."

D. Electromagnetic Locks: End-of-line resistors shall provide power line supervision. Lock status sensing signal shall positively indicate door is secure. Power and signal shall be from the Controller. Electromagnetic locks are specified in Division 08 Section "Door Hardware."

2.14 FLOOR SELECT ELEVATOR CONTROL

A. Elevator access control shall be integral to security access.

1. System shall be capable of providing full elevator security and control through dedicated Controllers without relying on the control-station host PC for elevator control decisions.

2. Access-control system shall enable and disable car calls on each floor and floor select buttons in each elevator car, restricting passengers' access to the floors where they have been given access.

3. System setup shall, through programming, automatically secure and unsecure each floor select button of a car individually by time and day. Each floor select button within a car shall be separately controlled so that some floors may be secure while others remain unsecure.

4. When a floor select button is secure, it shall require the passenger to use his/her access code and have access to that floor before the floor select button will operate. The passenger's credential shall determine which car call and floor select buttons are to be enabled, restricting access to floors unless authorized by system's access code database. Floor select button shall be enabled only in the car where the credential holder is the passenger.

5. The Contractor shall coordinate with PWM Security to properly program the elevator access control settings to allow for proper access to levels throughout the building.

B. Access Control system shall record which call button is pressed, along with credential and time information.

1. System Controller shall record elevator access data.

2. The Controller shall reset all additional call buttons that may have been enabled by the user's credential.

3. The floor select elevator control shall allow for manual override either individually by floor or by cab as a group from a workstation PC.

2.15 VIDEO AND CAMERA CONTROL

A. Control station or designated workstation displays live video from a CCTV source.

B. Display mouse-selectable icons representing each camera source, to select source to be displayed. For CCTV sources that are connected to a video switcher, control station shall automatically send control commands through a COM port to display the requested camera when the camera icon is selected.

2.16 CABLES

A. Available Manufacturers:

1. Belden Inc.; Electronics Division.

2. Berk-Tek; a Nexans Company.

3. West Penn Wire/CDT; a division of Cable Design Technologies.

B. PVC-Jacketed, RS-232 Cable: Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors, polypropylene insulation, and individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage; PVC jacket. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.

1. NFPA 70, Type CM.

2. Flame Resistance: UL 1581 Vertical Tray.

C. Plenum-Type, RS-232 Cable: Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors, plastic insulation, and individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage; plastic jacket. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.

1. NFPA 70, Type CMP.

2. Flame Resistance: NFPA 262 Flame Test.

D. RS-485 communications require 2 twisted pairs, with a distance limitation of 4000 feet.

E. PVC-Jacketed, RS-485 Cable: Paired, 2 pairs, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors, PVC insulation, unshielded, PVC jacket, and NFPA 70, Type CMG.

F. Plenum-Type, RS-485 Cable: Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors, fluorinated-ethylene-propylene insulation, unshielded, and fluorinated-ethylene-propylene jacket.

1. NFPA 70, Type CMP.

2. Flame Resistance: NFPA 262 Flame Test.

G. Paired PVC Readers and Wiegand Keypads Cables: Paired, 3 pairs, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors, polypropylene insulation, individual aluminum foil-polyester tape shielded pairs each with No. 22 AWG, stranded tinned copper drain wire, 100 percent shield coverage, and PVC jacket.

1. NFPA 70, Type CM.

2. Flame Resistance: UL 1581 Vertical Tray.

H. Plenum-Type, Paired, Readers and Wiegand Keypads Cable: Paired, 3 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors, plastic insulation, individual aluminum foil-polypropylene tape shielded pairs each with No. 22 AWG, stranded tinned copper drain wire, 100 percent shield coverage, and fluorinated-ethylene-propylene jacket.

1. NFPA 70, Type CMP.

2. Flame Resistance: NFPA 262 Flame Test.

I. Paired Lock Cable: 1 pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors, PVC insulation, unshielded, and PVC jacket.

1. NFPA 70, Type CMG.

2. Flame Resistance: UL 1581 Vertical Tray.

J. Plenum-Type, Paired Lock Cable: 1 pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors, PVC insulation, unshielded, and PVC jacket.

1. NFPA 70, Type CMP.

2. Flame Resistance: NFPA 262 Flame Test.

K. Paired Input Cable: 1 pair, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors, polypropylene insulation, overall aluminum foil-polyester tape shield with

No. 22 AWG, stranded (7x30) tinned copper drain wire, 100 percent shield coverage, and PVC jacket.

1. NFPA 70, Type CMR.

2. Flame Resistance: UL 1666 Riser Flame Test.

L. Plenum-Type, Paired Input Cable: 1 pair, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors, fluorinated-ethylene-propylene insulation, aluminum foil-polyester tape shield (foil side out), with No. 22 AWG drain wire, 100 percent shield coverage, and plastic jacket.

1. NFPA 70, Type CMP.

2. Flame Resistance: NFPA 262 Flame Test.

M. Paired AC Transformer Cable: 1 pair, twisted, No. 18 AWG, stranded (7x26) tinned copper conductors, PVC insulation, unshielded, and PVC jacket.

1. NFPA 70, Type CMG.

N. Plenum-Type, Paired AC Transformer Cable: 1 pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors, fluorinated-ethylene-propylene insulation, unshielded, and plastic jacket.

1. NFPA 70, Type CMP.

2. Flame Resistance: NFPA 262 Flame Test.

O. Elevator Travel Cable: Steel center core, with shielded, twisted pairs, No. 20 AWG conductor size.

1. Steel Center Core Support: Preformed, flexible, low-torsion, zinc-coated, steel wire rope; insulated with 60 deg C flame-resistant PVC and covered with a nylon or cotton braid.

2. Shielded Pairs: Insulated copper conductors; color-coded, insulated with 60 deg C flame-resistant PVC; each pair shielded with bare copper braid for 85 percent coverage.

3. Jute Filler: Electrical grade, dry.

4. Binder: Helically wound synthetic fiber.

5. Braid: Rayon or cotton braid applied with 95 percent coverage.

6. Jacket: 60 deg C PVC specifically compounded for flexibility and abrasion resistance. UL VW-1 and CSA FT1 flame rated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.

B. Examine roughing-in for LAN and control cable conduit systems to PCs, Controllers, card readers, and other cable-connected devices to verify actual locations of conduit and back boxes before device installation.

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

3.2 PREPARATION

A. Comply with recommendations in SIA CP-01.

B. Comply with EIA/TIA-606, "Administration Standard for the Telecommunications Infrastructure of Commercial Buildings."

C. Obtain detailed Project planning forms from manufacturer of access-control system; develop custom forms to suit Project. Fill in all data available from Project plans and specifications and publish as Project planning documents for review and approval.

1. Record setup data for control station and workstations.

2. For each Location, record setup of Controller features and access requirements.

3. Propose start and stop times for time zones and holidays, and match up access levels for doors.

4. Set up groups, facility codes, linking, and list inputs and outputs for each Controller.

5. Assign action message names and compose messages.

6. Set up alarms. Establish interlocks between alarms, intruder detection, and video surveillance features.

7. Prepare and install alarm graphic maps.

8. Develop user-defined fields.

9. Develop screen layout formats.

10. Propose setups for guard tours and key control.

11. Discuss badge layout options; design badges.

12. Complete system diagnostics and operation verification.

13. Prepare a specific plan for system testing, startup, and demonstration.

14. Develop acceptance test concept and, on approval, develop specifics of the test.

15. Develop cable and asset management system details; input data from construction documents. Include system schematics and Visio Technical Drawings.

D. In meetings with Architect and Owner, present Project planning documents and review, adjust, and prepare final setup documents. Use final documents to set up system software.

3.3 CABLING

A. Comply with NECA 1, "Good Workmanship in Electrical Contracting."

B. Install cables and wiring according to requirements in Division 28 Section "Conductors and Cables for Electronic Safety and Security."

C. Wiring Method: Install wiring in conduit except within consoles, cabinets, desks, and counters. Use NRTL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.

D. Install LAN cables using techniques, practices, and methods that are consistent with Category 5E rating of components and that ensure Category 5E performance of completed and linked signal paths, end to end.

E. Install cables without damaging conductors, shield, or jacket.

F. Boxes and enclosures containing security system components or cabling, and which are easily accessible to employees or to the public, shall be provided with a lock. Boxes above ceiling level in occupied areas of the building shall not be considered to be accessible. Junction boxes and small device enclosures below ceiling level and easily accessible to employees or the public shall be covered with a suitable cover plate and secured with tamperproof screws.

G. Install end-of-line resistors at the field device location and not at the Controller or panel location.

H. Power shall be in separate conduit.

I. All door components shall be connected to the DIP through concealed conduits to recessed boxes.

J. No cable shall be visible or exposed to physical damage.

3.4 CABLE APPLICATION

A. Comply with EIA/TIA-569, "Commercial Building Standard for Telecommunications Pathways and Spaces."

B. Cable application requirements are minimum requirements and shall be exceeded if recommended or required by manufacturer of system hardware.

C. RS-232 Cabling: Install at a maximum distance of 50 feet.

D. RS-485 Cabling: Install at a maximum distance of 4000 feet.

E. Card Readers and Keypads:

1. Install number of conductor pairs recommended by manufacturer for the functions specified.

2. Unless manufacturer recommends larger conductors, install No. 22 AWG wire if maximum distance from Controller to the reader is 250 feet, and install No. 20 AWG wire if maximum distance is 500 feet.

3. For greater distances, install "extender" or "repeater" modules recommended by manufacturer of the Controller.

4. Install minimum No. 18 AWG shielded cable to readers and keypads that draw 50 mA or more.

F. Install minimum No. 16 AWG cable from Controller to electrically powered locks. Do not exceed 500 feet.

G. Install minimum No. 18 AWG ac power wire from transformer to Controller, with a maximum distance of 25 feet.

3.5 GROUNDING

A. Comply with Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Comply with IEEE 1100, "Power and Grounding Sensitive Electronic Equipment."

C. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

D. Bond shields and drain conductors to ground at only one point in each circuit.

E. Signal Ground:

1. Terminal: Locate in each equipment room and wiring closet; isolate from power system and equipment grounding.

2. Bus: Mount on wall of main equipment room with standoff insulators.

3. Backbone Cable: Extend from signal ground bus to signal ground terminal in each equipment room and wiring closet.

3.6 INSTALLATION

A. Push Buttons: Where multiple push buttons are housed within a single switch enclosure, they shall be stacked vertically with each push-button switch labeled with 1/4-inch- high text and symbols as required. Push-button switches shall be connected to the Controller associated with the portal to which they are applied, and shall operate the appropriate electric strike, electric bolt, or other facility release device.

B. Install card, fob, and biometric readers.

3.7 IDENTIFICATION

A. In addition to requirements in this Article, comply with applicable requirements in Division 26 Section "Identification for Electrical Systems" and with TIA/EIA-606.

B. Using cable and asset management software specified in Part 2, develop Cable Administration Drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable, and label cable and jacks, connectors, and terminals to which it connects with same designation. Use logical and systematic designations for facility's architectural arrangement.

C. All labels shall be machine engraved or printed on clear or opaque tape, stenciled onto adhesive labels, or type written onto adhesive labels. The font shall be at least one-eighth inch (1/8") in height, block characters, and legible. The text shall be of a color contrasting with the label such that it may be easily read. If labeling tape is utilized, the width of the tape shall not exceed 3/8", and the font color shall contrast with the background. See project drawings for specifics.

D. Handwritten labels are not acceptable.

E. Plastic embossing tape is not acceptable.

F. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

1. All wiring conductors connected to terminal strips shall be individually numbered, and each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with the name and number of the particular device as shown.

2. Each wire connected to building-mounted devices is not required to be numbered at the device if the color of the wire is consistent with the associated wire connected and numbered within the panel or cabinet.

G. At completion, cable and asset management software shall reflect as-built conditions.

3.8 SYSTEM SOFTWARE

A. Develop, install, and test software and databases for the complete and proper operation of systems involved. Assign software license to Owner.

B. The contractor shall supply to PWM copies of all software installed under this project.

3.9 FIELD QUALITY CONTROL

A. General

Contractor shall be required to conduct an Installation Test and total Acceptance Test upon completion of equipment installation. Testing shall be coordinated with other contractor(s), as necessary, to demonstrate that all interfaces have been successfully implemented.

B. Installation and Acceptance Test Procedures and Reports

1. General:

Installation and acceptance tests shall be conducted in the normal operational environment to the maximum extent possible. The tests shall represent operation in the normal mode in which each system will operate. If interfaces are incomplete, provide simulation of those interfaces so that the system may be tested as a complete and stand-alone entity. Perform all equipment repair and/or adjustment which may be required during acceptance testing.

2. Availability Tests:

Installation and acceptance testing shall include conducting individual availability tests for each equipment item. Requirements for availability tests are as follows:

a. Availability shall be determined in accordance with Quality Assurance procedures, except for the test duration as specified herein.

b. The availability tests shall consist of the equipment being operated as a complete standalone entity with the exception that incomplete interfaces may be simulated. In all other respects, the equipment shall be operated in the mode that would normally prevail.

c. The duration of each availability test, as a minimum, shall consist of a 5 day period with the specified availability ratios being met or exceeded over the total period.

d. Demonstration of equipment reliability shall be accomplished as part of, and in support of, availability testing. This demonstration shall verify that predicted reliability has been realized by measured Mean Time Between Failure (MTBF).

e. Demonstration of equipment maintainability shall also be accomplished as part of, and in support of, availability testing. In this demonstration, Contractor shall verify that the objectives of the maintainability program have been realized by measured Mean Time To Repair (MTTR). The maintainability demonstration shall include preparation and use of a failure log.

f. Equipment preventive maintenance or service shall be excluded from measurement of maintainability. However, Contractor shall conduct at least one period of preventive maintenance during availability testing to demonstrate compliance with the maintenance plan.

g. Submit availability test reports to PWM for review. Test reports shall include tabulations of MTBF and MTTR.

3. Final Acceptance Test.

The following shall apply:

a. The final acceptance shall consist of the equipment being operated as a complete stand-alone entity. The equipment shall be operated in the mode that would normally prevail.

b. The final acceptance test shall verify to PWM that all security equipment (both existing and new) operates as a functionally integrated system.

C. System Commissioning

1. General:

After all installation and acceptance test requirements specified have been complied with, the equipment shall be commissioned. After commissioning has been completed, PWM will take possession of the equipment and utilize it in accordance with the conditions described in the contract documents.

2. Prerequisites to System Commissioning:

Outstanding work items that may exist, such as facility interfaces, Project Record Drawings, and/or in-process change orders, shall be documented and submitted to PWM for review prior to start of equipment commissioning. Documentation of outstanding work items shall take the form of punch lists of critical action items lists which describe the work, the expected completion schedule, and the impact upon operation. Depending upon the nature of the outstanding work item, PWM may grant a waiver to accomplish partial commissioning of any of the equipment. Completion of waived outstanding work items shall then be assigned to the post-commissioning operations and maintenance.

3. Commissioning Procedure:

The Commissioning Procedure will be witnessed by PWM. The commissioning procedure shall be conducted by Contractor and shall consist of a detailed

inspection, and physical accounting of each equipment item. An operational demonstration shall then be conducted in which the equipment shall function in the normal operational mode, and shall operate equipment failure shall terminate the demonstration. The demonstration shall restart and run for a period of time designated by PWM after the failure has been corrected. Except for any outstanding work items as previously described, this shall complete the commissioning procedure.

3.10 TRAINING

A. Description

Contractor shall prepare, administer, and conduct a training program for the designated Airport personnel for the operation of Security System equipment provisions. Training shall be in sufficient scope and depth to ensure that all designated personnel who complete the program shall be fully qualified, certified, and capable to operate the equipment as installed. Contractor shall provide training, orientation, and "hands-on" practical familiarization necessary to ensure effective equipment operational use. All required training shall be completed at least seven (7) prior to scheduled beneficial occupancy.

B. Training Aids, Hardware/Equipment, And Materials

Provide and use all training aids such as films, slides, audio/video tapes, etc. as necessary to complement instruction and enhance learning. Also provide hardware/equipment, materials, and other facilities necessary for the use to perform operation and simulated system and equipment adjustments during training.

C. Training Manual

Provide Training Manual for trainee use during and after completion of training. The Training Manuals shall include a list of recommended references useful for learning.

3.11 OPERATIONS AND MAINTENANCE DOCUMENTATION

Contractor shall provide the DOA with applicable Operations and Maintenance (O&M) manual(s) which describe the equipment installed under this contract. The O&M manual(s) shall, as a minimum, consist of an operations section, a maintenance section, and a drawings section when necessary.

A. Documentation

Except as otherwise specified, all documentation shall contain sufficient written text and illustrations necessary to present a full description of the equipment, including an overview, concept of operation or maintenance, operating instructions using all functions and capabilities, and interfaces with other systems/subsystems. The requirements are as follows:

1. System Description:

a. Describe As Installed

Fully describe the equipment as installed. Present a complete, organized, and comprehensive overview of the equipment and software provided. Information presented shall include, but not be limited to the following:

1) Equipment overview description, theory of operation.

2) Overview of recommended equipment operating policies.

3) Summary plans, layouts, and block diagrams, as appropriate.

4) Interrelationships overview of each item of equipment with other systems and subsystems, equipment, utilities, or other installations.

5) Significant characteristics of the equipment.

6) Other information, as necessary, to achieve a thorough understanding of the operation of the equipment.

b. Equipment Functions

Provide a full and comprehensive discussion of the function of each primary item of equipment.

c. Equipment Illustrations

Provide line drawings, renderings or photographic illustrations of each item of equipment. Illustrations shall include assemblies, subassemblies, and major components. All operating features shall be clearly identified by name and location on the equipment.

d. Special Or Non-Standard Installations

In situations where off-the-shelf items of equipment are combined into special or non-standard installations, provide separate sections containing complete operation related information for each non-standard or specialized configuration of equipment as installed.

e. Operating Instructions

Operating instructions shall be clear, simple, and concise for each item of equipment to be used by operating personnel for day-to-day operation. It shall be in such format that photocopy of operating instructions for the item of equipment could be provided to operation for use. Operating instructions shall consist of:

1) Warning Information. Provide emergency or special warnings, instructions and procedures pertaining to the equipment.

2) System Operation. Provide sequential, step-by-step instructions on how to properly perform all operational tasks and procedures associated with equipment operation, in any mode, under both normal and abnormal and emergency conditions. Also, instructions on how the operator may test the equipment to verify correct operation, detect and identify malfunctions, and return the equipment to normal operation.

3) Equipment Performance. Provide equipment operational limitations and how it shall be operated to obtain the best performance. If applicable, also provide instructions on how to modify equipment performance to suit individual needs or conditions.

f. Drawings

Provide all drawings, illustrations, and equipment related reference materials not provided elsewhere within the manual(s). This documentation shall be assembled in the manner specified herein, shall be listed in Table of Contents, and shall contain the following information as a minimum:

1) Mechanical drawings showing dimensions.

2) Schematic drawings and diagrams for each item of equipment.

3) Equipment schematic drawings.

4) Contractor shall ensure that the latest Project Record Drawings are incorporated in all final copies of manuals as part of the Completion of Work; and shall update these in all copies to reflect any changes made during Maintenance.

5) Interface drawings.

6) Other related documentation.

3.12 STARTUP SERVICE

A. Engage a factory-authorized service representative to supervise and assist with startup service. Complete installation and startup checks according to approved procedures that were developed in "Preparation" Article and with manufacturer's written instructions.

1. Enroll and prepare badges and access cards for Owner's operators, management, and security personnel.

3.13 PROTECTION

A. Maintain strict security during the installation of equipment and software. Rooms housing the control station, and workstations that have been powered up shall be locked and secured, with an activated burglar alarm and access-control system reporting to a

Central Station complying with UL 1610, "Central-Station Burglar-Alarm Units," during periods when a qualified operator in the employ of Contractor is not present.

3.14 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the Access Control system. Refer to Division 01 Section "Demonstration and Training"

B. Develop separate training modules for the following:

1. Computer system administration personnel to manage and repair the LAN and databases and to update and maintain software.

2. Operators who prepare and input credentials to man the control station and workstations and to enroll personnel.

3. Security personnel.

4. Hardware maintenance personnel.

5. Corporate management.

END OF SECTION

SECTION 28 23 00 - VIDEO SURVEILLANCE

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 a video surveillance system consisting of cameras, digital video recorder, data transmission wiring, and a control station with its associated equipment.

B. Video surveillance system shall be integrated with monitoring and control system specified in Division 28 Section "Access Control," which specifies systems integration.

1.3 DEFINITIONS

A. AGC: Automatic gain control.

B. BNC: Bayonet Neill-Concelman - type of connector.

C. B/W: Black and white.

D. CCD: Charge-coupled device.

E. FTP: File transfer protocol.

F. IP: Internet protocol.

G. LAN: Local area network.

H. MPEG: Moving picture experts group.

I. NTSC: National Television System Committee.

J. PC: Personal computer.

K. PTZ: Pan-tilt-zoom.

L. RAID: Redundant array of independent disks.

M. TCP: Transmission control protocol - connects hosts on the Internet.

N. UPS: Uninterruptible power supply.

O. WAN: Wide area network.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include dimensions and data on features, performance, electrical characteristics, ratings, and finishes.

B. CCTV Site Survey: For each camera location indicated.

1. The Contractor shall conduct a CCTV site survey to verify/determine the scene and lens size. The Contractor shall use a pole-mounted portable camera and digital recording device to conduct the survey. If the survey reveals that certain camera locations do not provide adequate or desired coverage due to an obstruction, interference, lens selection or other cause, an alternate location or lens will be selected by Owner and the Engineer.

2. The survey equipment shall be furnished by the Contractor and shall remain the property of the Contractor. The survey report shall indicate the camera number, lens size, location (on each photograph of the image of the camera and its agreed location), time, date and names of representatives present.

3. The Contractor shall conduct site survey for all cameras to be installed. The cost to survey the site is that sole responsibility of the Contractor.

4. Alternate locations or lens sizes may be submitted in addition to those requested. Owner will review and approve an alternate submission if they deem it to be more desirable.

5. Any errors or omissions in the Contractor's bid by not including the camera survey, submission, or any other reason is the sole responsibility of the Contractor and does not constitute grounds for a change request. Provide two weeks advance notice to Owner and the Engineer prior to commencing the survey.

C. Shop Drawings: For video surveillance. Include bill of materials, plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Functional Block Diagram: Show single-line interconnections between components for signal transmission and control. Show cable types and sizes.

3. Submit an I/O points list for each component, with identification of: type of point, voltage, engineering units, from and to connections. List the capacity provided and maximum expandable capacity for all components proposed.

4. Dimensioned plan and elevations of equipment racks, control panels, and consoles. Show access and workspace requirements.

5. UPS: Sizing calculations.

6. Wiring Diagrams: For power, signal, and control wiring.

D. Equipment List: Include every piece of equipment by model number, manufacturer, serial number, location, and date of original installation. Add pretesting record of each piece of equipment, listing name of person testing, date of test, set points of adjustments, name and description of the view of preset positions, description of alarms, and description of unit output responses to an alarm.

E. Field quality-control reports.

F. Operation and Maintenance Data: For cameras, power supplies, monitors, digital video recorders, video switches, and control-station components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Lists of spare parts and replacement components recommended to be stored at the site for ready access.

G. Warranty: Sample of special warranty.

H. Format: Submittal drawings shall be provided in 3-ring binders, with index and tabbed sections, three (3) copies, for review and approval by Owner and one (1) copy for the Engineer as follows:

1. Project Schedule: The Contractor shall submit a complete schedule of his activities on this project for review by the Engineer. These shall include but are not limited to: Submittal Phase, Installation Phase, Configuration Phase, Start-up Phase, Training, Testing and Final Inspection/ Acceptance.

2. “System” testing procedure.

3. Detailed equipment cabinet, console and rack layouts.

4. Detailed wiring schematics and point-to-point wiring diagrams.

5. Technical data sheets and product manuals for all products proposed.

6. Trouble reporting procedures including names, address, phone numbers, hours of operation, escalation procedures and guaranteed response times.

7. List all required training included for the Owner to operate equipment correctly, make changes, test system, gather performance statistics, and perform maintenance or trouble shooting procedures, and additional recommended training, source of that training and costs. Included training shall be provided for a minimum of 5 people, for 40 hours each, within 150 miles of the Airport. Training shall be videotaped for future referral. Include cost to provide 5 copies of that training video recording in VHS format. All training provided by Manufacturer’s direct factory trained engineers.

8. Name of the Contractors' Project Manager, and phone number, (who will be the primary contact for the Owner). This person must have an extensive background in integrating security systems. A resume listing experiences must be submitted with the bid.

9. Name of the Technical support contact, and phone number.

10. Name of the Account Manager, and phone number.

11. Maintenance schedule for proposed equipment.

12. Provide component labeling samples to include: component naming conventions, component type, component manufacturer, component model number, configuration and location. Labeling plan must be in accordance with ANSI/TIA/EIA-606 standard. The labeling plan shall be coordinated with the existing plan used by OCC staff for existing equipment.

13. Copies of certifications and successful completed manufacturer training courses for components proposed, and authorization to distribute and install these products.

14. List of recommended spare parts and equipment that the Airport should keep on hand.

15. Defined test process for installed network, including test equipment used, test method and expected results.

16. Programming Plan for American Dynamics head end.

1.5 QUALITY ASSURANCE

A. 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.

B. Comply with NECA 1.

C. Comply with NFPA 70.

D. Electronic data exchange between video surveillance system with an access-control system shall comply with SIA TVAC.

1.6 PROJECT CONDITIONS

A. Environmental Conditions: Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:

1. Control Station: Rated for continuous operation in ambient temperatures of 60 to 85 deg F and a relative humidity of 20 to 80 percent, noncondensing.

2. Interior, Controlled Environment: System components, except central-station control unit, installed in temperature-controlled interior environments shall be rated for continuous operation in ambient temperatures of 36 to 122 deg F dry bulb and 20 to 80 percent relative humidity, noncondensing. Use NEMA 250, Type 1 enclosures.

3. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambient temperatures of minus 30 to plus 122 deg F dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous operation when exposed to rain as specified in NEMA 250, winds up to 85 mph. Use NEMA 250, Type 4X enclosures.

4. Hazardous Environment: System components located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers shall be rated, listed, and installed according to NFPA 70.

5. Corrosive Environment: System components subject to corrosive fumes, vapors, and wind-driven salt spray in coastal zones. Use NEMA 250, Type 4X enclosures.

6. Security Environment: Camera housing for use in high-risk areas where surveillance equipment may be subject to physical violence.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of cameras, equipment related to camera operation, and control-station equipment that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Three years from Opening Date.

1.8 COORDINATION

A. No changes or modifications of any existing airport security system equipment or operation, may take place without authorization from the designated owner's security representative.

B. PWM security requires a minimum of two (2) week’s notice prior to the start of security system or equipment. During this period, PWM security will advise when work can proceed and of any special actions which must take place. Coordination with PWM security is required for every step of the addition/removal process.

C. All new CCTV hardware shall be coordinated and approved with PWM Security prior to installation.

D. A coordination meeting between the security contractor and PWM shall be required prior to the start of shop drawings in order to ensure a complete understanding of the project requirements.

E. All work to the existing security system shall be performed between the hours of midnight and 5:00am or as directed by PWM security. The contractor shall notify PWM a minimum of 72 hours in advance prior to the need to modify any elements of the existing security system. All work to the existing security system shall take place in the presence of a representative of PWM security.

F. All shop drawings shall be approved by both PWM and the project engineer before the start of construction. The contractor shall provide for added reviewal time on any shop drawing submittals requiring TSA approval.

G. The security contractor shall coordinate with the electrical contractor to ensure that proper power is supplied at all security equipment as required. Areas requiring coordination with the electrical contractor include, but are not limited to:

1. Each outdoor security camera

2. Each PTZ security camera

PART 2 - PRODUCTS

2.1 SYSTEM REQUIREMENTS

A. The system shall be as specified herein, as shown on the Contract Drawings and/or as approved by the Engineer. Any discrepancy between these sources becomes the Engineer's final decision as to the correct configuration.

B. The surveillance system shall be fully compliant with the project documents and the PWM Security Plan.

C. The general areas that will be covered by surveillance will include:

1. Ticket Counters

2. Security Checkpoint Areas

3. Public Lobby Areas

4. Roadway/Curbside Baggage Areas

5. Administrative/Tenant Areas

6. Airside Access Doors and Gates

7. Baggage Handling Areas

8. Federal Inspection Services Areas

9. All External Entrances

D. The exact location for all equipment is to be coordinated with the Owner and the Engineer and others.

E. The system installation shall be coordinated with all other trades working in the buildings. 120VAC to CCTV equipment to be provided by others.

F. Video-signal format shall comply with NTSC standard, composite interlaced video. Composite video-signal termination shall be 75 ohms.

G. Integration: All components shall be capable of integrating and interfacing into the existing video surveillance system.

1. All components must have the ability to be controlled and configured by the existing surveillance system head end in the PWM Operations Center.

2. The PWM Operations Center shall have the ability to automatically monitor and record all cameras when an "event" occurs, when an alarm contact closes, or on demand. The PWM Operations Center shall be able to observe any live feed or recorded images without loss of time in local record.

H. The system shall be programmed by an American Dynamics authorized and trained subcontractor. The surveillance system shall be delivered with the most current version of software and hardware, with free software upgrades to all components for the first year after system cutover.

I. The surveillance system shall provide local monitoring at the Security Checkpoint and OSR Room for the TSA. This shall be accomplished by furnishing a PC in each room which can access the CCTV Ethernet network. Software and training shall be provided at each PC to enable viewing of cameras specifically required for viewing by the TSA.

J. The system shall be flexible and user configurable. Cameras, monitors, etc. can be assigned to groups for use by different functional groups.

K. Digital recording with the American Dynamics digital recording hardware shall be included in the system. The American Dynamics devices shall communicate through a network link to the PWM Operations Center where the images shall be monitored. All video recording will take place on the American Dynamics devices in the new IDF's and MDF.

L. The existing PWM Operations Center shall be furnished with a software upgrade from American Dynamics to allow for the viewing of video feeds captured by remote DVRs being installed by this project. The software upgrade shall give the PWM staff in the Operation Center full control of any remote DVR at the project site.

M. All video inputs shall have the capability to enter text for identification in the frame's edge. Submit the camera names for approval by the Owner. The Contractor shall program them into the American Dynamics digital recording hardware.

N. All American Dynamics digital recording hardware shall be mounted into equipment racks. If the equipment has no rack mounting capabilities, then the Contractor must

provide a shelf or adapter bracket for that equipment. The rack shall be neat and ergonomic, with no cables exposed and no need to move equipment in order to use it.

O. The project shall install both fixed and PTZ cameras. Fixed cameras shall be configured during a camera survey with the PWM staff to best capture views of the areas for recording. PTZ cameras shall be installed as per the camera survey and set to record at all times. All PTZ's shall be controllable by the PWM Operations Center.

P. Coordinate with the Electrical Contractor for Surge Protection as required.

Q. The Contractor shall be responsible for ground loop isolation. Include in the bid price for the correction of any ground loop problem that occurs on the project.

R. The Contractor shall be responsible to train key personnel in the normal operating procedures, correct equipment uses and capabilities, maintenance and trouble shooting of the installed system. All training shall be videotaped to allow the Owner to review the training in the future with new employees.

S. The following items are critical for the success of the system and shall be provided in the system configuration.

1. Expandability - The system must allow for modular growth and increase in the number of ports and control points.

2. Scalability: The ability for the system to be grown, in terms of speeds and camera counts, with only changes of modular components, rather than the entire system.

3. Redundancy: A single failure in the network may not interrupt the remaining security services.

4. Management: Components shall be capable of being managed to quickly identify problems or trouble spots that require attention.

2.2 DIGITAL IMAGE STORAGE

A. All video images shall be stored in a digital fashion.

B. The standard storage for video images shall be configured as follows

1. Cameras focused on access control doors shall record at 4 CIF @ 1 frames per second (fps) when video motion is not detected, or at 15 fps during motion (plus three minutes). This recording capability shall occur 24x7x365.

2. Cameras viewing circulation areas shall record at 4 CIF @ 15 frames per second (fps) at all times. This recording capability shall occur 24x7x365.

3. High Profile Checkpoint Cameras shall record at 4 CIF @ 1 frames per second (fps) at all times, or at 15 fps during video motion detection (plus fifteen minutes). This recording capability shall occur 24x7x365.

C. The digital recording equipment shall be provided with a growth factor of 50%.

D. Operator shall be able to play back images without loss of time in recording images.

2.3 VIDEO MOTION ALERTING.

A. The surveillance system shall provide the ability to detect motion from the video image through the digital video recorder. Motion is determined by the system through "scene illumination" changes or the like.

B. Program the system to alarm in the event there is motion. The system shall direct the live image to the Operator's monitor at the monitoring station and alert them of a possible event. On PTZ cameras the alarm should also trigger a preset position for the camera.

2.4 CAMERA CONTROL

A. The system shall provide the ability for Operator to view live images and if a PTZ camera, control the cameras producing those images.

B. The system shall be integrated seamlessly for camera selection and PTZ control through receiver/drivers either external to the camera or integrated with the camera.

C. Easy to use camera pre-sets and automated camera selection shall be programmed into the system for events and to meet PWM requirements. Camera presets shall have stored parameters that automatically adjust the image quality of the camera.

2.5 PLAY BACK CAPABILITIES.

A. The digital recording system shall continue to record all live camera feeds during searches and playbacks. No lost time in video images will be acceptable.

B. Playback shall possess features to make event review easier including, rewind, pause/still frame, variable speed playback, etc. without altering the recorded images.

C. Event time, date and camera name shall always be available in the video image.

2.6 SECURITY CHECKPOINT SCREENING

A. The Supervisor's station in the TSA space on the 4th floor shall be equipped with a computer with the following specifications:

1. Intel Core Duo processor at 2.5 GHz or greater

2. 4 GB RAM or greater

3. NVIDIA GeForce 9800 with 256 MB of DDR2 SDRAM or greater

4. 120 GB disk drive or greater

5. DVD-ROM/CD-RW Drive

6. Minimum of 2 USB 2.0 ports

7. Network Interface Card (Ethernet IEEE 802.3 10/100/1000 BaseT Gigabit Ethernet)

8. Mouse

9. Keyboard

10. Fully updated version of Microsoft Windows XP or greater

11. Five (5) year protection plan or greater

B. The computer shall be furnished with a twenty (20) inch or greater high resolution LCD screen for image viewing.

C. The computer shall be networked via a RJ45 jack to the IDF room on Level 4 of the PWM Expansion. The computer shall reside on the PWM Security network and have access to the CCTV images being captured by PWM DVRs.

D. The contractor shall provide software on the computer to allow for monitoring (ONLY) of CCTV images from any or all of the checkpoint cameras. The contractor shall coordinate with PWM and the TSA to correctly identify all cameras which will be viewed. At no time shall this viewing station be capable or altering or modifying any settings or video images on the PWM CCTV system.

2.7 OSR ROOM SCREENING

A. A station in the OSR TSA space on the 1st floor shall be equipped with a computer with the following specifications:

1. Intel Core Duo processor at 2.5 GHz or greater

2. 4 GB RAM or greater

3. NVIDIA GeForce 9800 with 256 MB of DDR2 SDRAM or greater

4. 120 GB disk drive or greater

5. DVD-ROM/CD-RW Drive

6. Minimum of 2 USB 2.0 ports

7. Network Interface Card (Ethernet IEEE 802.3 10/100/1000 BaseT Gigabit Ethernet)

8. Mouse

9. Keyboard

10. Fully updated version of Microsoft Windows XP or greater

11. Five (5) year protection plan or greater

B. The computer shall be furnished with a twenty (20) inch or greater high resolution LCD screen for image viewing.

C. The computer shall be networked via a RJ45 jack to the IDF room on Level 2 of the PWM Expansion. The computer shall reside on the PWM Security network and have access to the CCTV images being captured by PWM DVRs.

D. The contractor shall provide software on the computer to allow for monitoring (ONLY) of CCTV images from any portion of the checked baggage screening areas. The contractor shall coordinate with PWM and the TSA to correctly identify all cameras which will be viewed. At no time shall this viewing station be capable or altering or modifying any settings or video images on the PWM CCTV system.

E. The contractor must coordinate with the Baggage Handling System contractor to add software required for the Baggage System. This software will be installed by the BHS contractor on the computer being provided by the Security Contractor.

2.8 IMAGE EXPORT

A. Still images shall be able to be printed to a high-resolution color printer.

B. Video segments or clips shall be able to be recorded on VHS recorders for use by external sources.

C. INTEGRATION – Provide the ability to add/integrate alarm and control systems including, but not limited to:

1. Controlled access systems including:

a. Door access controls, card readers, key pads, biometric systems, etc.

b. Automatic doors.

2. Production and configuration of access card with:

a. Photographic capabilities.

b. Tamper resistant features.

c. Common partitioned user database.

d. Automatic expiration features.

3. Input of other alarm signals such as, but not limited to:

a. Fire alarms.

b. Metal detectors.

c. Environmental system alarms (pumps, HVAC, etc.)

d. Panic or duress buttons.

e. Silent alarms.

2.9 CABLING

A. All distribution cables (fiber or copper) shall be installed in EMT conduit.

B. All cables are to be tagged in accordance with the component labeling plan, as directed by PWM and Engineer.

C. No cable shall be exposed to any physical damage. Cables shall be protected from point of termination to point of termination. No cables are to be installed where visible.

2.10 LABELING

A. All components shall follow the labeling plan as directed by PWM and the Engineer and must be updated for an as-built submittal. This will include all cables and equipment.

B. The Contractor will label all components following this plan, using permanent/legible typed or machine engraved labels.

C. Handwritten labels are not acceptable.

D. Plastic embossing tape is not acceptable.

E. All labels shall be machine printed on clear or opaque tape, stenciled onto adhesive labels, or type written onto adhesive labels. The font shall be at least one-eighth inch (1/8") in height, block characters, and legible. The text shall be of a color contrasting with the label such that it may be easily read. If labeling tape is utilized, the width of the tape shall not exceed 3/8", and the font color shall contrast with the background, or as detailed on Drawings.

F. All components shall be labeled with: component name or number and port assignment. Labeling plan to include nearest room number, end-user name, etc.

G. A schematic plan clearly labeled with all component names and numbers shall be included in the as-built drawings. All labels shall correspond to labeling plan, component informational matrix, and with final test reports.

2.11 INDOOR AND OUTDOOR FIXED CAMERAS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings (PELCO CC3751H-2) or a comparable product to be reviewed by the Engineer as an approved equal.

B. Color CCD:

1. Interline Transfer Imager: 1/3-inch, NTSC signaling
2. White Balance: Automatic
3. Iris Control: Electronic
4. Automatic Gain Control: Manually selectable
5. Minimum Illumination: 0.03 lux
6. Video Output: 1 Vp-p, 75 ohms
7. Signal-to-Noise Ratio: >50dB (AGC off)
8. Backlight Compensation: Manually selectable
9. Signal Processing: Digital signal processing
10. Lens Mount: C/CS mount (adjustable)
11. Certifications: UL and CE approval

C. Electrical:

1. Input Voltage: 18-30 VAC
2. Power Consumption: 4 watts maximum
3. Video Output: 75 ohms terminated
4. Power Connection: 2-pin terminal strip
5. Video Connector: BNC
6. Lens Jack: 4-pin connector

2.12 INDOOR AND OUTDOOR PTZ CAMERAS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings (PELCO SPECTRA IV) or a comparable product to be reviewed by the Engineer as an approved equal.

B. Zoom must be at least 35X

C. Electrical:

1. Input Voltage: 18-32 VAC
2. Power Consumption: 23 watts maximum w/o heater (73 watt with heater)

3. Video Output: 75 ohms terminated

4. Video Connector: BNC

D. Control of each PTZ camera must be capable by personnel within the PWM Operation Center.

2.13 LENSES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings (PELCO 13VD Series) or a comparable product to be reviewed by the Engineer as an approved equal.

B. Description: Optical-quality coated lens, designed specifically for video-surveillance applications and matched to specified camera. Provide color-corrected lenses with C or CS mounting type and electronic iris. Iris shall have circuit set to maintain a constant video level in varying lighting conditions.

C. Size lenses as indicated on Drawings, although some changes in the field may be made based on field conditions observed during the CCTV Site Survey.

2.14 POWER SUPPLIES

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings (Altronix R2416UL) or a comparable product to be reviewed by the Engineer as an approved equal.

B. Cameras within or mounted on building shall be powered by power supplies located within the IDF and MDF rooms as specified on Drawing. Each power supply shall meet or exceed the following specifications:

1. Outputs for 16 cameras

2. Circuit breaker protection; includes breakers that reset

3. 120 VAC @ 3 amp input

4. 24 VAC output or 28 VAC output for longer wire runs

5. UL and CE approval

6. AC power indicator with power on/off switch

7. Compatible with specified cameras

8. Cabinet enclosure suitable for wall mounting

9. Operating temperature within 35° to 120°F

C. Power supplies are not to be filled to more than 85% capacitor (or 13 cameras).

D. Power supply must be rack mountable in a standard 19” rack.

2.15 CAMERA-SUPPORTING EQUIPMENT

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product to be reviewed by the Engineer as an approved equal.

B. Minimum Load Rating: Rated for load in excess of the total weight supported times a minimum safety factor of two.

C. Mounting Brackets for Fixed Cameras: Type matched to items supported and mounting conditions. Include manual pan-and-tilt adjustment.

D. Protective Housings for Fixed and Movable Cameras: Steel enclosures with internal camera mounting and connecting provisions that are matched to camera/lens combination and mounting and installing arrangement of camera to be housed.

1. Tamper switch on access cover sounds an alarm signal when unit is opened or partially disassembled. Central-control unit shall identify tamper alarms and indicate location in alarm display. Tamper switches and central-control unit are specified in Division 28 Section "Intrusion Detection."

2. Camera Viewing Window: Polycarbonate or Lexan window, aligned with camera lens.

3. Duplex Receptacle: Internally mounted.

4. Alignment Provisions: Camera mounting shall provide for field aiming of camera and permit removal and reinstallation of camera lens without disturbing camera alignment.

5. Built-in, thermostat-activated heater and blower units for uncontrolled environments. Units shall be automatically controlled so the environmental limits of the camera equipment are not exceeded.

6. Sun shield shall not interfere with normal airflow around the housing.

7. Mounting bracket and hardware for wall or ceiling mounting of the housing. Bracket shall be of same material as the housing; mounting hardware shall be stainless steel.

8. Finish: Housing and mounting bracket shall be factory finished using manufacturer's standard finishing process suitable for the environment.

2.16 DIGITAL VIDEO RECORDERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings (American Dynamics Intellex ULTRA).

B. All network video recorders will be rack mounted and located in MDF and IDF rooms as indicated on Drawings.

C. The System shall be provided with an internal hard drive capable of recording greater than 30 days using the following parameters:

1. Resolution – 4CIF

2. Video Mode – NTSC

3. Quality – Normal

4. Frame Rate Per Camera – 15 fps

5. Number of Cameras – 16

6. Record Audio – Off

D. All existing American Dynamics Intellex Digital Video Recorders in the PWM Operations Center shall be furnished with a software upgrade to the newest version of software by American Dyanmics.

E. A software package by American Dynamics shall be furnished in the PWM Operations Center to allow for video control and viewing of the remote DVR units being installed by this project. The PWM Operations Center shall have the ability to have complete control over all remote DVR settings through this software.

2.17 COAXIAL CABLE

A. General Coaxial Cable Requirements: Broadband type, recommended by cable manufacturer specifically for CCTV transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.

B. RG-6/U: NFPA 70, Type CM. To be used between all cameras and network video recorders.

1. No. 18 AWG, solid copper conductor; gas-injected, PE insulation.

2. Shielded with 95 percent bare copper braid.

3. Jacketed with black PVC.

4. Suitable for indoor installations.

C. RG59/U: NFPA 70, Type CM. Only to be used for distances less than 100 ft in IDF and MDF rooms.

1. No. 20 AWG, solid copper conductor; gas-injected, PE insulation.

2. Shielded with 95 percent bare copper braid.

3. Jacketed with black PVC.

4. Suitable for indoor installations.

D. Coaxial-Cable Connectors: Type BNC, 75 ohms.

2.18 RS-485 CABLE

A. Standard Cable: NFPA 70, Type CM.

1. Paired, 2 pairs, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors.

2. PVC insulation.

3. Unshielded.

4. PVC jacket.

5. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.

2. Fluorinated ethylene propylene insulation.

3. Unshielded.

4. Fluorinated ethylene propylene jacket.

5. Flame Resistance: NFPA 262, Flame Test.

2.19 SIGNAL TRANSMISSION COMPONENTS

A. Cable: Coaxial cable elements have 75-ohm nominal impedance. Comply with requirements in Division 28 Section "Conductors and Cables for Electronic Safety and Security."

B. Video Surveillance Coaxial Cable Connectors: BNC type, 75 ohms. Comply with requirements in Division 28 Section "Conductors and Cables for Electronic Safety and Security."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine pathway elements intended for cables. Check raceways and other elements for compliance with space allocations, installation tolerance, hazards to camera installation, and other conditions affecting installation.

B. Examine roughing-in for LAN, WAN, and IP network before device installation.

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

3.2 WIRING

A. Wiring Method: Install cables in raceways unless otherwise indicated.

B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

C. Splices, Taps, and Terminations: For power and control wiring, use numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

D. For LAN connection and fiber-optic and copper communication wiring, comply with Division 27 Sections "Communications Backbone Cabling" and "Communications Horizontal Cabling."

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1.

B. Conductors: Size according to system manufacturer's written instructions unless otherwise indicated.

C. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.

2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."

3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.

4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

5. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.

6. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

7. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.

8. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

D. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-B recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.

2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.

b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.

c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.

b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.

c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

a. Electrical Equipment Rating Less Than 2 kVA: No requirement.

b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.

c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.

5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.

6. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.4 VIDEO SURVEILLANCE SYSTEM INSTALLATION

A. Install cameras level and plumb.

B. Unless noted otherwise on Drawings, install cameras with 84-inch- minimum clear space below cameras and their mountings. Change type of mounting to achieve required clearance.

C. Set pan unit and pan-and-tilt unit stops to suit final camera position and to obtain the field of view required for camera. Connect all controls and alarms, and adjust.

D. Install power supplies and other auxiliary components at control stations unless otherwise indicated.

E. Install tamper switches on components indicated to receive tamper switches, arranged to detect unauthorized entry into system-component enclosures and mounted in self-protected, inconspicuous positions.

F. Avoid ground loops by making ground connections only at the control station.

1. For 12- and 24-V dc cameras, connect the coaxial cable shields only at the monitor end.

G. Identify system components, wiring, cabling, and terminals according to Division 26 Section "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. General

Contractor shall be required to conduct an Installation Test and total Acceptance Test upon completion of equipment installation. Testing shall be coordinated with other contractor(s), as necessary, to demonstrate that all interfaces have been successfully implemented.

B. Installation and Acceptance Test Procedures and Reports

1. General:

Installation and acceptance tests shall be conducted in the normal operational environment to the maximum extent possible. The tests shall represent operation in the normal mode in which each system will operate. If interfaces are incomplete, provide simulation of those interfaces so that the system may be tested as a complete and stand-alone entity. Perform all equipment repair and/or adjustment which may be required during acceptance testing.

2. Availability Tests:

Installation and acceptance testing shall include conducting individual availability tests for each equipment item. Requirements for availability tests are as follows:

a. Availability shall be determined in accordance with Quality Assurance procedures, except for the test duration as specified herein.
b. The availability tests shall consist of the equipment being operated as a complete standalone entity with the exception that incomplete interfaces may be simulated. In all other respects, the equipment shall be operated in the mode that would normally prevail.
c. The duration of each availability test, as a minimum, shall consist of a 5 day period with the specified availability ratios being met or exceeded over the total period.
d. Demonstration of equipment reliability shall be accomplished as part of, and in support of, availability testing. This demonstration shall verify that predicted reliability has been realized by measured Mean Time Between Failure (MTBF).
e. Demonstration of equipment maintainability shall also be accomplished as part of, and in support of, availability testing. In this demonstration, Contractor shall verify that the objectives of the maintainability program have been realized by measured Mean Time To Repair (MTTR). The maintainability demonstration shall include preparation and use of a failure log.
f. Equipment preventive maintenance or service shall be excluded from measurement of maintainability. However, Contractor shall conduct at least one period of preventive maintenance during availability testing to demonstrate compliance with the maintenance plan.
g. Submit availability test reports to PWM for review. Test reports shall include tabulations of MTBF and MTTR.

3. Final Acceptance Test.

The following shall apply:

a. The final acceptance shall consist of the equipment being operated as a complete stand-alone entity. The equipment shall be operated in the mode that would normally prevail.
b. The final acceptance test shall verify to PWM that all security equipment (both existing and new) operates as a functionally integrated system.

C. System Commissioning

1. General:

After all installation and acceptance test requirements specified have been complied with, the equipment shall be commissioned. After commissioning has been completed, PWM will take possession of the equipment and utilize it in accordance with the conditions described in the contract documents.

2. Prerequisites to System Commissioning:

Outstanding work items that may exist, such as facility interfaces, Project Record Drawings, and/or in-process change orders, shall be documented and submitted to PWM for review prior to start of equipment commissioning. Documentation of outstanding work items shall take the form of punch lists of critical action items lists which describe the work, the expected completion schedule, and the impact upon operation. Depending upon the nature of the outstanding work item, PWM may grant a waiver to accomplish partial commissioning of any of the equipment. Completion of waived outstanding work items shall then be assigned to the post-commissioning operations and maintenance.

3. Commissioning Procedure:

The Commissioning Procedure will be witnessed by PWM. The commissioning procedure shall be conducted by Contractor and shall consist of a detailed inspection, and physical accounting of each equipment item. An operational demonstration shall then be conducted in which the equipment shall function in the normal operational mode, and shall operate equipment failure shall terminate the demonstration. The demonstration shall restart and run for a period of time designated by PWM after the failure has been corrected. Except for any outstanding work items as previously described, this shall complete the commissioning procedure.

3.6 TRAINING

A. Description

Contractor shall prepare, administer, and conduct a training program for the designated Airport personnel for the operation of Security System equipment provisions. Training shall be in sufficient scope and depth to ensure that all designated personnel who complete the program shall be fully qualified, certified, and capable to operate the equipment as installed. Contractor shall provide training, orientation, and “hands-on” practical familiarization necessary to ensure effective equipment operational use. All required training shall be completed at least seven (7) prior to scheduled beneficial occupancy.

B. Training Aids, Hardware/Equipment, And Materials

Provide and use all training aids such as films, slides, audio/video tapes, etc. as necessary to complement instruction and enhance learning. Also provide hardware/equipment, materials, and other facilities necessary for the use to perform operation and simulated system and equipment adjustments during training.

C. Training Manual

Provide Training Manual for trainee use during and after completion of training. The Training Manuals shall include a list of recommended references useful for learning.

3.7 OPERATIONS AND MAINTENANCE DOCUMENTATION

Contractor shall provide the DOA with applicable Operations and Maintenance (O&M) manual(s) which describe the equipment installed under this contract. The O&M manual(s) shall, as a minimum, consist of an operations section, a maintenance section, and a drawings section when necessary.

A. Documentation

Except as otherwise specified, all documentation shall contain sufficient written text and illustrations necessary to present a full description of the equipment, including an overview, concept of operation or maintenance, operating instructions using all functions and capabilities, and interfaces with other systems/subsystems. The requirements are as follows:

1. System Description:

a. Describe As Installed

Fully describe the equipment as installed. Present a complete, organized, and comprehensive overview of the equipment and software provided. Information presented shall include, but not be limited to the following:

1) Equipment overview description, theory of operation.

2) Overview of recommended equipment operating policies.

3) Summary plans, layouts, and block diagrams, as appropriate.

4) Interrelationships overview of each item of equipment with other systems and subsystems, equipment, utilities, or other installations.

5) Significant characteristics of the equipment.

6) Other information, as necessary, to achieve a thorough understanding of the operation of the equipment.

b. Equipment Functions

Provide a full and comprehensive discussion of the function of each primary item of equipment.

c. Equipment Illustrations

Provide line drawings, renderings or photographic illustrations of each item of equipment. Illustrations shall include assemblies, subassemblies, and major components. All operating features shall be clearly identified by name and location on the equipment.

d. Special Or Non-Standard Installations

In situations where off-the-shelf items of equipment are combined into special or non-standard installations, provide separate sections containing complete operation related information for each non-standard or specialized configuration of equipment as installed.

e. Operating Instructions

Operating instructions shall be clear, simple, and concise for each item of equipment to be used by operating personnel for day-to-day operation. It shall be in such format that photocopy of operating instructions for the item of equipment could be provided to operation for use. Operating instructions shall consist of:

1) Warning Information. Provide emergency or special warnings, instructions and procedures pertaining to the equipment.

2) System Operation. Provide sequential, step-by-step instructions on how to properly perform all operational tasks and procedures associated with equipment operation, in any mode, under both normal and abnormal and emergency conditions. Also, instructions on how the operator may test the equipment to verify correct operation, detect and identify malfunctions, and return the equipment to normal operation.

3) Equipment Performance. Provide equipment operational limitations and how it shall be operated to obtain the best performance. If applicable, also provide instructions on how to modify equipment performance to suit individual needs or conditions.

f. Drawings

Provide all drawings, illustrations, and equipment related reference materials not provided elsewhere within the manual(s). This documentation shall be assembled in the manner specified herein, shall be listed in Table of Contents, and shall contain the following information as a minimum:

1) Mechanical drawings showing dimensions.

2) Schematic drawings and diagrams for each item of equipment.

3) Equipment schematic drawings.

4) Contractor shall ensure that the latest Project Record Drawings are incorporated in all final copies of manuals as part of the

Completion of Work; and shall update these in all copies to reflect any changes made during Maintenance.

5) Interface drawings.

6) Other related documentation.

3.8 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Tasks shall include, but are not limited to, the following:

1. Check cable connections.

2. Check proper operation of cameras and lenses. Verify operation of auto-iris lenses and adjust back-focus as needed.

3. Adjust all preset positions; consult Owner's personnel.

4. Recommend changes to cameras, lenses, and associated equipment to improve Owner's use of video surveillance system.

5. Provide a written report of adjustments and recommendations.

3.9 CLEANING

A. Clean installed items using methods and materials recommended in writing by manufacturer.

B. Clean video-surveillance-system components, including camera-housing windows, lenses, and monitor screens.

3.10 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain video-surveillance equipment. The assistance of a factory-authorized service representative is recommend but not required.

END OF SECTION

SECTION 28 31 00 - FIRE DETECTION AND ALARM

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 thru 34 Specification Sections, apply to this Section.

B. Specification Section 271300 – Communications Backbone and Horizontal Cabling

1.2 DESCRIPTION

A. Existing Condition: The fire alarm system at the Portland International Jetport is a two node SimplexGrinnell 4020 network, consisting of addressable and conventional devices with two annunciator panels.

B. The contractor shall demolish, and furnish, install equipment, materials, tools, labor, programming, drawings, calculations, testing and provide associated documentation for a complete peer to peer, global annunciation, fiber optic networked fire alarm system with municipal signal transmission of alarms as described by these plans and specifications for the Portland International Jetport expansion and existing facility.

C. The scope of work shall include the following:

1. One (1) SimplexGrinnell 4100U FACP, associated transponder cabinets, booster power supplies, amplifiers, initiating devices, notification appliances, control and monitor modules and associated relays for building safety interfaces for terminal expansion. Programming, points list and sequence of operation to be approved by the Owner, Engineer and City of Portland Fire Department.

2. One (1) SimplexGrinnell fire command annunciator panel consisting of a InfoAlarm Command Center, fire department communication phone with capacity to hold 6 headsets and paging zone audio module in terminal expansion.

3. Two way fire department communications in terminal expansion with 6 headsets.

4. Two (2) SimplexGrinnell 4100U FACPs for replacement of two existing SimplexGrinnell 4020 FACPs in existing locations. Programming, points list and sequence of operation to remain the same as approved by the Owner, Engineer and City of Portland Fire Department.

5. SimplexGrinnell True Sight Workstation in the existing Operations Communication Center (OCC). New and existing fire sprinkler zones on floor plans shall be shown on the True Sight Workstation. Any condition in the fire system shall be graphically segregated by fire sprinkler zone. New fire sprinkler points shall show alarm condition in the area in which the device serves as well as its physical location.

6. Addressable strobes with emergency voice evacuation and paging capability in terminal expansion.

7. SimplexGrinnell remote annunciator replacing existing annunciator in existing terminal.

8. One Digitize DET-6B indoor masterbox for municipal fire alarm signal transmission adjacent to existing masterboxes. The fire alarm system shall be arranged in a way such that one master box does not serve more than 100,000 square feet of total fire area. Provide additional boxes for any portions that are greater than 100,000 square feet. Program initiating devices, Floor 1-2 of the new building as one zone and Floors 3-5 as another zone on the DET-6 with relays provided by Simplex. This shall be approved by the PFD.

9. Conduits, fittings, outlets, junction boxes, supports, hangers, wire and cable and other items incidental to and/or required to complete the installation, in accordance with the intent of the drawings and specifications. This shall include wire and conduit required to operate both new and existing equipment during each phase of the work. This shall also include steel supports for conduit, pull boxes, panels and other equipment, as indicated and/or required to complete the installation.

10. Perform all programming and downloads for the nodes during each phase of the system modificationNew and Existing Programming matrix shall be audited by the system manufacturer. Any corrections including changes to the existing NAC pairings for audio and visual shall be made and reflected on the contractor's shop drawings.

D. Please refer to the project phasing plan and notes for specific criteria for construction sequencing. The contractor shall be responsible for a complete project phasing plan that shall be submitted in the shop drawing package for approval.

E. Prior to the start of work, the contractor shall survey the existing terminal and all fire alarm equipment in its entirety and perform an initial system functionality test. Documented test results shall be submitted to the engineer for approval. contractor shall be responsible to determine existing points at the existing Fire Alarm Control Panel (FACP) in order to size the new 4100U panel and maintain existing sequence of operation.

F. All areas which are a part of a defined exit system (hallways, stairways, lobbies etc.) and any areas prone to smoldering fires shall be protected with smoke detectors. All other areas shall be protected with heat detector. The heat detectors shall be rate of rise in all cases when practical.

G. Prior to the start of construction and to shop drawing submission, the contractor shall schedule a meeting with the construction manager and the city of portland fire department to review the proposed alarm programming matrix. In the event that the fire department requires software changes that deviate from the alarm matrix provided in this package, then it shall be borne by the contractor at no additional cost.

H. Detection devices located within concealed spaces or spaces deemed inaccessible by the Portland Fire Department shall have an indicator visual to the firefighter from all normally occupied spaces.

I. All control equipment must have transient protection devices to comply with UL864 requirements.

J. All equipment installations shall be in compliance with applicable Rules and Regulations of the Portland Fire Department.

K. Watchdog function to be approved by PFD.

L. Monitor all conditions of the DET-6 including trouble, secure, low battery by the 4100U.

M. All notification appliance circuits shall be synchronized per NFPA 72.

N. Scope shall include labeling, tagging, and marking of all devices, fire alarm conduits and raceways, and control equipment.

O. Seal all openings created through fire and smoke barriers with a UL-listed fire/smoke penetration sealant system, in accordance with manufacturer’s recommendations.

P. Furnish, install and connect grounding as required by the Code, and as required by the specifications.

Q. Coordinate work with other contractors and the Owner.

R. All new devices and components of the fire alarm system shall be fully compatible with the existing system.

1.3 QUALIFICATIONS

A. The fire alarm system must be provided by SimplexGrinnell and/or any authorized dealer of SimplexGrinnell.

B. The personnel shall have current NICET Level IV qualified and certified in the installation and operation of the SimplexGrinnell 4100U fire alarm system and provide copy to engineer.

C. The NICET Level IV qualified and certified personnel shall perform shop drawing design, programming, and supervise all testing, adjustments to the system.

1.4 APPLICABLE PUBLICATIONS

A. The edition of the publications listed below form an integral part of this Specification to the extent referenced.

B. City Of Portland Building Regulations (International Building Code 2003 as Amended) based on a mixed use non-separated A-3 Use Group.

C. City of Portland Fire Code 2005.

D. National Fire Protection Association (NFPA).

1. NFPA 1, Uniform Fire Code, 2006 Edition

2. NFPA 13 Standard For The Installation Of Sprinkler Systems 2007 Edition

3. NFPA 14 Standard For The Installation Of Standpipe, Private Hydrants And Hose Systems, 2007 Edition

4. NFPA 70, National Electric Code, 2005 Edition

5. NFPA 72, National Fire Alarm Code, 2007 Edition

6. NFPA 90A, Standard For The Installation Of Air-Conditioning And Ventilating Systems, 2002 Edition

7. NFPA 101, Life Safety Code, 2006 Edition

8. NFPA 415, Airport Terminal Buildings, Fueling Ramp Drainage, And Loading Walkways, 2008 Edition

E. Underwriters' Laboratories, Inc. (UL): Fire Protection Equipment Directory

F. FM Global Approval Guide.

G. ADAAG - Americans with Disabilities Act of Guidelines 2002

H. SimplexGrinnell Printed installation instructions

1.5 SUBMITTALS

A. Submit the following information complete in accordance with the Contract General Requirements. **Partial submittals will be rejected.**

B. Shop Drawings shall be prepared by persons with the following qualifications:

1. Trained and certified by manufacturer in fire-alarm system design
2. NICET-certified fire-alarm technician, Level IV minimum
3. Licensed or certified by authorities having jurisdiction
4. Licensed as a Professional Engineer in the State of Maine

C. Submit manufacturer's data sheets for the following items. Data that describes more than one type of item shall be clearly marked to indicate which type the Contractor intends to provide.

1. 4100U FACP
2. Data gathering panels/Transponder Cabinets
3. Remote Annunciator
4. Audio Modules
5. Fire department communication components
6. True sight Workstation
7. Manual pull stations
8. Smoke detectors
9. Heat detectors
10. Addressable monitor module
11. Addressable control module
12. Speakers
13. Strobe appliances
14. Speaker/strobes
15. Relays
16. Wire and cable
17. Fiber

18. Fiber Patch Panels

19. Cable/Wire Markers

20. Duct smoke detectors

21. Duct detector housing

22. Amplifiers

23. Booster Power Supplies

24. Batteries

25. Battery charger

26. Cabinets

27. Nameplates

28. Backboxes and extender rings

29. Terminal Blocks

30. Knox Box

31. Others as required/requested

D. Shop Drawings shall be coordinated with the approved shop drawings for the following disciplines: Fire Sprinkler, Access Control, Elevators, Escalators, Electrical, Baggage Handling, HVAC, Electrical and any other system requiring Fire Alarm monitor or control.

E. Fire Alarm Shop Drawings shall only be submitted after all coordination has been completed.

F. Provide detailed working drawings, including, but not limited to plans, details, wiring diagrams, and riser diagram for the system provided. The riser diagram shall be complete, showing all circuiting, equipment and size, type and number of all conductors. As required by Section 1.9B, drawings shall clearly show interim configurations as proposed for phased work; where required, separate drawings shall be provided for interim configurations.

G. Working drawings shall indicate all circuit assignments as well as device addresses and/or device ID tags. Drawings shall also show the existing building programming matrix, inclusive of all Notification Appliance Circuits and System Interfaces. The contractor shall develop a Programming Matrix for the Entire Facility for Engineer Approval.

H. Working Drawings shall show Notification Appliance details such as candela ratings for visual appliances, settings for audible appliances (wattage taps), mounting requirements, hardware necessary for synchronization, and hardware necessary for selectable horn and/or strobe silencing.

I. Working Drawings shall indicate 24 Volt power circuits necessary for system functionality. System Manufacturer shall verify the functionality and capacity of the existing circuits and reflect modifications and additions on the drawings.

J. Details for control wiring associated with:

1. Elevator Shutdown and Recall

2. Baggage Handling Fire Door

3. AHU Shutdown

4. Automatic Fire Shutter

5. Fire/Smoke Damper Control

K. Submit wiring diagrams and schematics showing point-to-point equipment connections and terminals used for all electrical field connections in the system.

L. Submit Finish Samples for Networkable Annunciator (Stainless Steel).

M. Mounting details for all field devices.

N. Any application for a fire alarm system for a Class A fire alarm system shall include:

1. Complete descriptive data indicating UL listings for all system components.

2. A complete description of the sequence of operation.

3. A complete system wiring diagram for all components being connected to the system.

4. Floor plans indicating the placement of all equipment.

5. Annunciation details showing the labeling of all zones.

6. Battery calculations.

7. Drill switch

O. Upon completion of final testing, the system manufacturer shall submit record drawings detailing as-built circuiting and incorporating all field and design directives given throughout the project.

P. Provide a draft Operation & Maintenance manual for review and approval. Upon approval of the manual, and turnover and acceptance of the Fire Alarm and Detection System to the owner, provide six copies of the Operation & Maintenance manuals for the Fire Alarm and Detection System. The manuals shall be bound in a ring type binder so that sheets can be inserted or removed at convenience. At a minimum, the notebooks shall be divided into the following sections and tabbed accordingly: detailed description and operating characteristics of system, maintenance requirements, maintenance checklists, list of parts and part identification numbers and supplier information, schematics, other technical information, shop drawings and catalog cuts.

Q. Upon completion of this project, the contractor shall turn over to PWM, a copy the most current downloadable as-built fire alarm software programming. This information shall be issued as a Printed Reproducible Hard Copy. In addition, any revisions created during the warranty period shall also be issued to PWM, in the format as described at no additional cost due to warranty related work.

1.7 SEQUENCE OF OPERATION

A. The operation of the new and existing fire alarm system shall be programmed in accordance with Drawing FA12.02.

1. Alarm verification of 60 seconds shall be provided for all smoke detection.

2. Initiating devices shall provide the appropriate general alarm, supervisory, or trouble signals.

DEVICE TYPE	SIGNAL TRANSMISSION
MANUAL PULL STATION	ALARM
SMOKE DETECTOR	ALARM
SMOKE DETECTOR (BHS FIRE DOOR)	ALARM
SMOKE DETECTOR (ELEVATOR HOISTWAY, ELEV MACHINE ROOM)	ALARM, RECALL
HEAT DETECTOR (ELEVATOR HOISTWAY, ELEV MACHINE ROOM)	ALARM, SHUNT TRIP
SMOKE DETECTOR (FIRE SHUTTER)	ALARM
SMOKE DETECTOR (FIRE SHUTTER)	SUPERVISORY
HEAT DETECTOR	ALARM
DUCT SMOKE DETECTOR	SUPERVISORY
TAMPER SWITCH	SUPERVISORY
BHS DOOR CLOSURE	SUPERVISORY

3. The entire building notification shall be activated simultaneously upon fire “alarm” condition.

4. Elevator Shunt operation:

a. Heat detectors at the following locations shall initiate automatic elevator shunt.

1) Heat detector in elevator machine room.

2) Heat detectors in elevator pit.

5. Elevator Recall operation:

a. Smoke detectors at the following locations shall initiate automatic elevator recall:

1) Smoke detectors in elevator lobbies.

2) Smoke detectors in elevator machine rooms.

3) Smoke detectors in elevator pit.

6. Duct detectors shall be grouped and zone annunciated within the facility fire alarm system. Activation of any duct detector shall cause the associated HVAC unit to be shutdown and send a supervisory signal to the fire alarm system.

1.8 COORDINATION

A. At no time shall the existing fire alarm system be put out of service without notifying PWM and the Insurance Underwriter. The Contractor shall make every attempt to keep the system in operation. No work shall be done on any sprinkler system or fire detection system tied to the City without first notifying the Dispatch Center to prevent false alarms. (Telephone: 874-8576). The interpretation or application of these Rules and Regulations shall be resolved by the Fire Chief before the contractor proceeds with the installation.

B. Work shall be scheduled such that there is no interference with Airport Operations as well as the traveling public.

C. All work and shutdowns associated with fire alarm system interfaces shall be coordinated through the general contractor:

1. Automatic sprinkler systems

2. Baggage handling systems

3. HVAC systems

4. Elevator recall and shunt-trip systems

5. Escalator Shutdown

6. Special hazards suppression systems

7. Others, as applicable

D. Work that is required to be done off-hours; note that this requires PWM approval and shall not be the basis of any extra Contract cost. In the case that additional off hours work is required to allow the Airport to remain operational, that cost shall be borne by the Contractor.

E. Interim testing for each proposed phased configuration, as well as interface testing and final testing after completion of all work. Interface testing shall include HVAC, Baggage Handling, Escalator Control, Sprinkler System, and Elevator control interfaces.

F. All applications for “Fire Alarm Permits” shall be made at the building inspection office on forms provided by the Fire Prevention Bureau. All information requested on the forms shall be completed when applicable to the proposed installation and all supportive documentation provided before the permit can be reviewed.

PART 2 PRODUCTS

2.1 PERIPHERAL DEVICE

A. FIRE ALARM CONTROL PANEL (FACP)

1. The FACPs shall be a SimplexGrinnell Model 4100U comply with UL 864, "Control Units for Fire-Protective Signaling Systems” and FM Approved.

2. The FACPs shall be provide as described below as a minimum and shall include everything required to meet the performance and sequence of operation as indicated on plans and specifications in addition to changes required by the City of Portland Fire Department.

    a. 4100U Power Limited base panel with red cabinet and door, 120 VAC input power.

    b. 2,000 point minimum capacity to be able to monitor and control entire airport and 50% expansion.

    c. Battery voltage and ammeter readouts on the FACP LCD Display.

    d. Municipal City Circuit Connection with Disconnect switch, 24VDC Remote Station (reverse polarity), local energy, shunt master box, or a form "C" contact output.

    e. Auxiliary Relays, SPDT 2A @32VDC, programmable as a supervisory relay, either as normally energized or de-energized, or as an auxiliary control.

f. Intelligent Remote Battery Charger for charging up to 110Ah batteries.

g. Power Supplies with integral intelligent Notification Appliance including 10% expansion

h. Supervised serial communication channel for control and monitoring of remotely located annunciators and I/O panels.

i. One FACP shall be provided with multiple relays to allow for zoned connections to the Municipal Master Box. Provide 6 4100-3206 relay module with eight (8) programmable SPDT relays.

4. Distributed Module Operation: FACP shall be capable of allowing remote location of the following modules; interface of such modules shall be through a Style 4 (Class B) supervised serial communications channel (SLC):

a. Amplifiers, voice and telephone control circuits

b. Addressable Signaling Line Circuits

c. Initiating Device Circuits

d. Notification Appliance Circuits

e. Auxiliary Control Circuits

f. Graphic Annunciator LED/Switch Control Modules

5. Cabinet: Lockable steel enclosure. Arrange unit so all operations required for testing or for normal care and maintenance of the system are performed from the front of the enclosure. If more than a single unit is required to form a complete control unit, provide exactly matching modular unit enclosures.

6. Alphanumeric Display and System Controls: Panel shall include an 80 character LCD display to indicate alarm, supervisory, and component status messages and shall include a keypad for use in entering and executing control commands.

2.2 PC Graphic Annunciator with Printer

A. Fire Alarm Control Unit shall be capable of operating remote CRT's and/or printers; output shall be ASCII from an RS-232-C connection with an adjustable baud rate.

B. Fire Alarm Control Unit shall be capatible with the TrueSight Workstation which provides status annunciation and system control using a Microsoft Windows® XP operating system based interface.

C. PC Annunciator shall provide the following functions:

1. Login/logout password protection with time duration selectable automatic logout.

2. Displays Alarm, Supervisory, Priority 2, and Trouble conditions with numerical tallies for each.

3. Displays first and last alarms.

4. Different event types have separate visible indicators with a common audible indicator.

5. Event logs can be searched and printed.

6. View and/or print TrueAlarm status reports and service reports (printing requires an available local or network printer).

7. Alarm Silence; System Reset; and Priority 2 Reset.

8. Global and individual point acknowledge.

9. Set system time and date; and clear event log.

10. Individual point access for control or parameter revisions.

11. Silence, Acknowledge, Reset entire fire alarm system.

D. Each RS-232-C port shall be capable of supporting and supervising a remote Printer; the FACP shall support as many as two (2) remote displays. The Fire Alarm Control Panel shall support five (5) RS-232-C ports.

E. Provide a dot-matrix type, listed and labeled as an integral part of the fire alarm system UL listed with the True Sight Workstation

2.3 FIRE COMMAND ANNUNCIATOR PANEL

A. The panel shall include a InfoAlarm Command Center Model 4100-9401 in a in Stainless Steel finished cabinet and shall have the following features:

1. Historical event logs shall maintain separate 600 Alarm and 600 Trouble events.

2. Microphone Station capable of selective paging throughout the Terminal Facility. The Annunciator shall also be capable of two way fire fighters phone service communication.

3. The network shall provide a means to log into any node on the system via a laptop computer or CRT/Keyboard and have complete network

access (Set Host) for diagnostics, maintenance reporting, and information gathering of all nodes in the system. Systems not meeting this requirement must provide all diagnostic tools required to support this function from selected points on the network.

4. Provide six (6) hand held phone sets in the annunciator panel bay for fire department use and shall be installed in the new building ticketing lobby.

2.4 MASTER BOX

A. Provide a Digitize Model DET –B, 6-Zone indoor masterbox Part Number 450247 – 0000 with the following components to meet the City of Portland Fire Code.

1. Two (2) - Lightning Protection Board Part Number 900435 – 0001

2. Master Trip PC Board Part Number 450404-0001

2.5 EMERGENCY POWER SUPPLY

A. The fire alarm system shall be provided wth dedicated 120v backed by generator power.

B. Components include battery, charger, and an automatic transfer switch.

C. Battery: Sealed lead-acid or nickel cadmium type. Provide sufficient capacity to operate the complete alarm system in normal or supervisory (non-alarm) mode for a period of 24 hours. Following this period of operation on battery power, the battery shall have sufficient capacity to operate all components of the system, including all alarm indicating devices in alarm or supervisory mode for a period of 15 minutes.

2.6 MANUAL PULL STATIONS

A. Manual pull stations shall be Simplex Grinnell addressable Model RMS-1T-KL shall be the color red.

B. Manual pull stations shave have a LL-805 key reset.

C. Station will mechanically latch upon operation and remain so until manually reset by opening with a key common with the control units.

D. Where required provide a tamperproof, clear LEXAN shield and red frame that easily fits over manual pull stations. When shield is lifted to gain access to the station, a battery powered piercing warning horn shall be activated. The horn shall be silenced by lowering and realigning the shield. The horn shall provide 85dB at 10 feet and shall be powered by a 9 VDC battery.

2.7 SMOKE DETECTORS

A. General: Comply with UL 268, "Smoke Detectors for Fire Protective Signaling Systems." Include the following features:

1. Factory Nameplate: Serial number and type identification and tagged per drawings.

2. Operating Voltage: 24 VDC, nominal.

3. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore normal operation.

4. Detector and associated electronic components are mounted in a module that connects to a fixed base with a twist-locking plug connection. Base shall provide break-off plastic tab that can be removed to engage the head/base locking mechanism. No special tools shall be required to remove head once it has been locked. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control unit.

5. Each sensor base shall contain an LED that will flash each time it is scanned by the Control Unit (once every 4 seconds). In alarm condition, the sensor base LED shall be on steady.

6. Each sensor base shall contain a magnetically actuated test switch to provide for easy alarm testing at the sensor location.

7. The sensor's electronics shall be immune from false alarms caused by EMI and RFI.

B. Type: Smoke sensors shall be of the photoelectric or combination photoelectric / heat type.

C. Bases: Relay output, sounder and isolator bases shall be supported alternatives to the standard base.

2.8 DUCT SMOKE DETECTORS

A. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applicable.

B. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

C. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector as needed.

2.9 HEAT DETECTORS

A. Heat detectors of the fixed temp/rate of rise shall be installed in elevator machine rooms within 24 inches of any sprinkler head and shall be able to trip the shunt trip breaker. These shall be 135 degree Fahrenheit.

1. Detector fixed temperature sensing shall be independent of rate-of-rise sensing and programmable to operate at 135-deg F or 155-deg F. Sensor rate-of-rise temperature detection shall be selected at the FACP for 15-deg F per minute.

B. Heat detectors in the generator room shall be fixed, resettable, high temperature detector.

1. Fixed-temperature unit with plug-in base and alarm indication lamp; 135-deg F fixed-temperature setting that is resettable.

2.10 ADDRESSABLE CIRCUIT INTERFACE MODULES

A. Addressable Circuit Interface Modules: Arrange to monitor one or more system components that are not otherwise equipped for addressable communication. Modules shall be used for monitoring of water flow, valve tamper, non-addressable devices, and for control of evacuation indicating appliances and AHU systems.

B. Addressable Circuit Interface Modules will be capable of mounting in a standard electric outlet box. Modules will include cover plates to allow surface or flush mounting. Modules will receive their operating power from the signaling line or a separate two wire pair running from an appropriate power supply as required.

C. Monitor Circuit Interface Module

1. For conventional 2-wire smoke detector and/or contact device monitoring with Class A wiring supervision: The supervision of the zone wiring will be Class A. This module will communicate status (normal, alarm, trouble) to the FACP.

2. For conventional 4-wire smoke detector with Class A wiring supervision: The module will provide detector reset capability and over-current power protection for the 4-wire detector. This module will communicate status (normal, alarm, trouble) to the FACP.

D. Line Powered Monitor Circuit Interface Module

1. This type of module is an individually addressable module that has both its power and its communications supplied by the two wire multiplexing signaling line circuit. It provides location specific addressability to an initiating device by monitoring normally open dry contacts. This module shall have the capability of communicating four zone status conditions (normal, alarm, current limited, trouble) to the FACP.

2. This module shall provide location specific addressability for up to five initiating devices by monitoring normally closed or

normally open dry contact security devices. The module shall communicate four zone status conditions (open, normal, abnormal, and short). The two-wire signaling line circuit shall supply power and communications to the module.

E. Single Address Multi-Point Interface Modules

1. This multipoint module shall provide location specific addressability for four initiating circuits and control two output relays from a single address. Inputs shall provide supervised monitoring of normally open, dry contacts and be capable of communicating four zone status conditions (normal, open, current limited, and short). The input circuits and output relay operation shall be controlled independently and disabled separately.

2. This dual point module shall provide a supervised multi-state input and a relay output, using a single address. The input shall provide supervised monitoring of two normally open, dry contacts with a single point and be capable of communicating four zone status conditions (normal, open, current limited, and short). The two-wire signaling line circuit shall supply power and communications to the module.

3. This dual point module shall monitor an unsupervised normally open, dry contact with one point and control an output relay with the other point, using a single address. The two-wire signaling line circuit shall supply power and communications to the module.

F. Line Powered Control Circuit Interface Module

1. This module shall provide control and status tracking of a Form "C" contact. The two-wire signaling line circuit shall supply power and communications to the module.

G. Circuit Interface Modules shall be supervised and uniquely identified by the control unit. Module identification shall be transmitted to the control unit for processing according to the program instructions.

H. Modules shall have an on-board LED to provide an indication that the module is powered and communicating with the FACP.

2.12 ALARM NOTIFICATION APPLIANCES

A. The Contractor shall furnish and install Addressable Notification.

1. Addressable Notification appliance shall be Class A.

2. SLC channel wiring shall be unshielded twisted pair (UTP), with a capacitance rating of less than 60pf/ft and a minimum 3 twists (turns) per foot.

3. Class A circuit "T" Tapping is not permitted.

4. Each Addressable notification appliance shall contain an electronic module and a selectable address setting to allow it to occupy a unique location on the channel.

B. Addressable Controller: Addressable Controller shall supervise Channel (SLC) wiring, communicate with and control addressable notification appliances. It shall be possible to program the High/Lo setting of the audible (horn) appliances by channel from the addressable controller.

C. Strobe Only: Addressable strobe shall be listed to UL 1971. The strobe shall consist of a xenon flash tube and associated lens/reflector system. The strobe enclosure shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings. Appliances shall be wired with UTP conductors, having a minimum of 3 twists per foot. The strobe shall be provided with different minimum flash intensities of 15cd, 75cd and 110cd.

D. Speaker/Strobe: The combination speaker/strobe shall be listed to UL 1971 and UL 1480. Addressable functionality controls visible operation, while the speaker operates on a 70.7 VRMS NAC.

1. Twisted/shielded wire is required for speaker circuits on a standard 25VRMS or 70.7VRMS NAC using and UTP conductors, having a minimum of 3 twists per foot.

2. The minimum speaker taps shall be 1.0 Watt minimum as approved by the Portland Fire Department for intelligibility. Tap assignments shall be provided by SimplexGrinnell in the shop drawing package.

3. Speaker/strobe shall be surface or flush mounted as directed by Architect on a 4" square, 3 in. deep electrical box.

2.13 TRUEALERT ADDRESSABLE NAC POWER EXTENDER

A. The TrueAlert Addressable Controller shall be a stand-alone panel capable of powering a minimum of 3 TrueAlert Signaling line circuits. Each channel shall be rated for 2.5 amps and support up to 63 TrueAlert addressable notification appliances. Power and communication for the notification appliances shall be provided on the same pair of wires.

B. The internal power supply & battery charger shall be capable of charging up 12.7 Ah batteries internally mounted or 18Ah batteries mounted in an external cabinet.

C. The NAC extender panel may be mounted close to the host control panel or can be remotely located.

2.15 FIRE DEPARTMENT COMMUNCATIONS

A. An approved Class A, two-way, fire department communication system shall be shall be provided between a fire command center panel and elevators, elevator lobbies, emergency and standby power rooms, fire pump rooms, areas of refuge and inside enclosed exit stairways. The fire department communication device shall be provided at each floor level within the enclosed stairway.

B. Remote Phone Jack Stations Model 2084-9023 shall be provided.

C. Remote Microphone Module Model 4100-1244 to be located in Fire Command Annunciating Panel

D. Operator Interface Module 3-8 Channel Model Number 4100-1255

E. Six (6) Phone Headsets Model 2084-9024 Red Pluggable Phone, Push-to-Talk.

2.16 PROTECTIVE GUARD FOR NOTIFICATION APPLIANCES

A. Provide a tamperproof, protective wire guard that easily fits over the S/V units and smoke sensors to prevent accidental or intentional damage and vandalism. All products shall be UL listed and installed in accordance with the manufacturer's instructions.

B. All protective wire guards shall be spray painted once prior to installation to match ceiling and approved by the architect. Wire guard shall be centered over the fire alarm devices.

C. Under no circumstances shall protective shields impair the candela or the decibel rating of the S/V devices. In case of impairment, contractor shall notify the engineer immediately and shall be responsible to adjust the device rating as necessary to provide adequate coverage per NFPA 72 without exceeding the system capacity.

PART 3 EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the manufactures instructions and requirements and applicable portion of the Division 26, 27, and 28 specifications.

B. The Contractor shall be responsible for coordination efforts with other construction trades working within the scope of this project.

C. Construction Phasing shall be in conjunction with the Phasing Plan shown on the Drawings.

D. Provide in accordance with the manufacturer's instruction all wiring, conduit and outlet boxes required for the installation of a complete and operable system.

E. Provide end-of-line resistors as required.

F. All wiring shall be in galvanized rigid steel conduit outdoors or where unprotected or exposed, and in EMT in all other locations inside the building in accordance with Division 26, 27, and 28 specifications.

3.2 PHASING

A. All work that will require any part of the fire alarm system to be out of service will need to be performed between the hours of 12 am and 4 am. All work in the public areas shall also be required to be performed between the hours of 12 am and 4 am. Work done on the third shift will require a tenant advisory and coordination with the respective flight schedules and airport operations. Contractor shall coordinate with airport engineering and prepare a schedule of system shutdowns (areas to be affected) in the two (2) week look ahead schedule as indicated below. Requests for system shutdowns need to be scheduled a minimum of two (2) weeks in advance of the event. Coordination of system shutdowns shall be thru PWM engineering representative. Due to changes in weather and airport operations the amount of time allowed for the system to be shutdown will be at the discretion of the PWM engineer. Also, PWM will advise insurance underwriter of system shutdown areas and duration as required, based on contractor’s shutdown schedule.

B. In case the work requires that a fire alarm system to be offline, a qualified fire watch per IFC at the fire alarm panel shall be provided. All costs associated with the fire watch shall be borne under this contract.

C. The contractor shall update his schedule and phasing plan on a monthly basis, for submission to PWM engineering. A 2 week look ahead will also be required, every 2 weeks.

D. At no time, shall more than one node be put out of service in any manner or at any time. The contractor shall perform work on, no more than, one node at a time from start of conversion, the work shall be sequenced in 2 phases:

1. Installation of 4100u, modification of NAC circuits.

2. Modification of SLC circuits.

E. Prior to each node being put back into service at the conclusion of each phase, a full test of all devices and appliances will be performed for the PWM to accept and approve.

F. All system shall be restored to normal condition at the conclusion of every working shift.

G. The contractor shall be required to conduct a 4100u training session at the start of installation for select personnel as dictated by PWM engineering. PWM maintenance will have to be notified two (2) weeks in advance for training to be provided for each shift personnel on all three (3) work shifts.

H. The contractor shall make provisions within the phasing plans for areas in which the system will require an existing device originating from a 4020 node to be cross - zoned with a device originating from the 4100u panel. Contractor shall ensure, during the construction duration, that at no time shall the integrity of the fire alarm programming matrix be impaired throughout the installation and construction period.

I. The phasing plan is a guideline. The contractor shall be responsible for a complete and detailed plan for incorporation into the shop drawing submission package. The phasing plan is a guideline and does not constitute contractor means and methods. This phasing plan/schedule is proposed only and is intended to provide guidance to the contractor as to how the PWM expects the work to proceed. Contractor shall review the entire project and submit a phasing plan that meets the requirements of the drawings, specifications and suggested phasing plan to the PWM for approval prior to start of work. The selected contractor shall prepare and submit final work schedule and phasing plan to the PWM engineer within ten (10) working days from the NTP.

3.3 FIRE ALARM CONTROL PANEL REPLACEMENT/CONVERSION METHOD

A. Contractor shall be responsible for final selection of locations for new control equipment within the FACP rooms. The contractor shall submit final room layouts and panel locations in the shop drawings submission. Accessibility and NFPA code requirements must be met when selecting and preparing layouts.

B. At the conclusion of the project, all existing SimplexGrinnell panels that are not to be re-used for new 4100U equipment shall be removed in their entirety, including any residual/abandoned conduit and wiring back to its source, by the contractor.

C. All new panels shall be equipped with the proper equipment and pre-programmed prior to the start of the conversion process.

D. Contractor shall reference the project phasing plan for requirements.

E. The conversion methods shall be as follows:

1. Mount new 4100U panel and cabinets as shown on the approved shop drawings.

2. Install and program the new 4100U panel to act as a slave panel to the 4020 node. Install necessary inputs and outputs between 4020 and 4100u panels to communicate alarm, supervisory and trouble between both panels, per the existing FA programming matrix.

3. Convert existing conventional NAC circuits to 4100u NAC circuits. See project phasing plan for requirements.

4. Program and download true sight workstation.

5. Convert 4020 addressable/conventional SLC circuits to 4100u SLC circuits.

6. Local/interface/final test all notification and initiating points associated with the system.

7. Modify and program class ‘A’ network ring to incorporate new panel.

8. Program and download true sight workstation.

9. Local/interface/final test all input/control points associated with the system.

10. Remove existing 4020 fire alarm panels.

3.4 IDENTIFICATION AND LABELING

A. Conductors

1. ALL circuit conductors shall be identified within each enclosure where a tap, splice or termination is made.

2. EACH cable shall be identified as to service within each enclosure, pull box and junction box.

3. Conductor and cable identification shall be by single piece, plastic coated self-laminating printed markers, or by heat-shrink type sleeves. Markers shall be attached in a manner that will not permit accidental detachment.

B. Conduits and Boxes

1. Identify all fire alarm conduits, exposed or concealed, with self adhesive vinyl markers located at not more than 20 ft. intervals. Markers shall read "FIRE ALARM" and shall be readable from the floor when in place.

2. All pull boxes and junction boxes shall have their covers stenciled "F.A." in red paint. Letters shall be a minimum of 2 inches high with 1/2 inch stroke.

3.5 TRAINING

A. Provide to the PWM’s representatives formally scheduled training sessions, such that the select representatives are fully familiar with the system's configuration, software field changes, and minor trouble shooting capabilities.

B. The contractor shall coordinate with PWM, the number of representatives that are to be trained. As well as the location and the time required completing the formalized training.

C. In addition, the operation of the completed system shall be thoroughly demonstrated to PWM and Professional's satisfaction. At least two formally scheduled sessions shall be conducted to allow all facility personnel to attend.

3.6 TESTING

A. General

1. Testing of the fire alarm system shall meet the requirements set forth in NFPA 72, IBC 2003 and City of Portland Fire Code. A Record of Completion is required for each of the three (3) FACPs.

2. The Contractor shall submit a schedule to PWM prior to the start of installation.

3. The contractor shall perform a test of the existing terminal prior to construction to verify points and sequence of operation. All results and a copy of the existing software shall be provided to the engineer for review. At the conclusion of the installation of the new system, the entire new and existing building shall be tested per the project specifications.

4. Scope of testing shall be as follows:

a. Local Test

1) Initiating points (Upon Completion of Installation Phase)

2) Fire alarm indicating devices (Upon Completion of Installation Phase)

b. Interface Test

1) Baggage Handling System Shutdown and Fire Shutter Closure

2) Elevator Recall and Shunt Trip

3) Sprinkler System Flow, Pressure, High and Low Air and Tampers

4) AHU Shutdown

c. Final Test

1) PWM

2) Engineer

3) Authorities Having Jurisdiction

B. Tests During Installation

1. Contractor shall conduct the following tests during installation of wiring and system components. Any deficiency pertaining to these requirements shall be corrected by the Contractor prior to any functional and operational tests of the system.

2. Fiber optic installed and test to be performed in accordance with Specification Section 271300

3. Megger Test all copper cable.

4. GROUND RESISTANCE. The resistance of each connection to ground shall be measured and shall not exceed 10 ohms.

5. OPERATION OF SYSTEM. Operate ALL new initiating and signaling devices.

6. OPERATION OF SUPERVISORY SYSTEM. Operate ALL portions to demonstrate correctness of installation.

C. Final Acceptance Testing of New and Existing Fire Alarm System

1. Written test procedure: Contractor shall submit a written test procedure to be followed for the systems final testing. No testing shall proceed without the approval by the Engineer of the written test procedure. The test procedure shall include a dated sign off verification section for EACH DEVICE TESTED both initiating and indicating. Explanation of deficient devices shall be provided, along with recommended deficiency resolution.

2. The Contractor shall notify the Engineer when the system is ready for final acceptance tests. The system shall be considered ready for such testing only after all necessary preliminary tests have been made and all deficiencies found have been corrected to the satisfaction of the equipment manufacturer's technical representative. Any correction to deficiencies found during this project shall be a responsibility of the contractor.

3. The complete system shall be in service at least 10 days prior to the scheduled final acceptance test.

4. The Contractor shall notify the Engineer at least 15 days prior to the date the final acceptance test is to take place.

5. The system shall be tested for approval in the presence of representatives of the manufacturer, the engineer and local authorities having jurisdiction.

6. All necessary NFPA 72 tests shall be made and any deficiency found shall be corrected and the system retested.

7. After acceptance and prior to occupancy the installer shall present an electronic drawing of the fire alarm system in a format to be determined by the fire chief.

D. Additional Tests

1. When deficiencies, defects or malfunctions develop during the test required, all further testing of the system shall be suspended until proper adjustments, correction or revisions have been made to assure proper performance of the system. If these revisions require more than a nominal delay, the Engineer shall be notified when the additional work has been completed, to arrange a new inspection and test of the fire alarm system. All tests required shall be repeated prior to final acceptance, unless directed otherwise.

E. Documentation of Tests

1. All test results shall be recorded on suitable forms. Eight (8) certified copies of all tests shall be filed with the Engineer.

2. All test forms shall be submitted by the Contractor for approval by the Engineer prior to commencement of testing.

3.7 WARRANTY

A. The fire alarm system supplied under this Specification shall be covered by the manufacturer's warranty including labor and equipment shall be one (1) year from date of occupancy.

B. All defects in material, workmanship, design and/or failure to meet guaranteed performance shall be corrected by the Contractor, at his own expense and in accordance with instructions of the Engineer.

C. All damages caused by faulty workmanship, materials and/or design shall be repaired, to the satisfaction of the Engineer, within not more than three (3) days after the Contractor and/or manufacturer has been notified in writing of failure to meet the warranty. The Engineer reserves the right to use the equipment as needed for operations, prior to repairs being completed.

END OF SECTION 28 31 00

SECTION 310913 – GEOTECHNICAL INSTRUMENTATION AND MONITORING

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. Provide and maintain safe means of access to all instrumentation locations as required for data collection by the Engineer and Contractor during the duration of the project. Cooperate with the Engineer during instrumentation monitoring and schedule activities considering that monitoring will occur over the duration of the project.

B. The Contractor shall protect from damage and maintain instruments shown on the Drawings. The Contractor shall furnish all labor, equipment, materials and incidentals necessary to repair and replace damaged and inoperative instruments at no additional cost to the Owner.

C. The Engineer will undertake the following:

1. Furnish, install, and monitor five Building Reference Points at the north end of the existing terminal building at the locations shown on the Drawings.
2. Furnish vibration monitoring equipment and monitor vibrations during construction activities, including but not limited to blasting.

D. Related Sections:

1. Division 02 Section “Subsurface Explorations” for existing subsurface information.
2. Division 31 Section "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
3. Division 31 Section "Earth Moving" for excavating, backfilling, site grading, and for site utilities.
4. Division 31 Section "Dewatering" for lowering and disposing of ground water during construction.
5. Division 31 Section "Rock Removal" for removal of bedrock using controlled blasting techniques.
6. Division 33 Section “Subdrainage” for foundation drain system requirements.

1.3 DEFINITIONS AND REFERENCES

A. ASTM: Specifications of the American Society for Testing and Materials.

B. Engineer: For the scope of work covered under this section, this term will refer to Haley & Aldrich, Inc.

1.4 JOB CONDITIONS

A. Refer to Section 023000 for available information on existing subsurface conditions.

B. Prior to submitting their bid, the Contractor shall review and understand the information provided herein and the information outlined in Section 023000. The subsurface information is made available to the Contractor for information on factual data only and shall not be interpreted as a warranty of subsurface conditions whether interpreted from written text, boring logs or other data.

1.5 QUALITY ASSURANCE

A. The Engineer will record and plot instrumentation data collected by the Engineer as specified herein. This work does not relieve the Contractor of the Contractor's responsibility to complete the work in accordance with the Contract.

B. Data acquired by the Engineer will be made available to the Contractor in a timely manner for their independent assessment. The Contractor may observe the Engineer's acquisition of instrumentation data at any time or may take supplementary readings at no additional cost to the Owner.

C. The Contractor shall obtain additional data from the instrumentation and/or furnish, install, and monitor additional instrumentation to monitor construction performance and safety aspects of the Work as necessary at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 BUILDING REFERENCE POINTS

A. Building Reference Points will be furnished by the Engineer. See detail on the Drawings.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. The Engineer will monitor the instrumentation, unless otherwise indicated, on a schedule based on the location and extent of construction activities. The Contractor shall cooperate in every way with the Engineer to accomplish instrumentation monitoring. Data collected by the Engineer will be made available to the Contractor in a timely manner.

B. The Contractor shall exercise caution during the progress of work and shall prevent damage to all instrumentation devices. Any damage or loss of function caused by the Contractor's operations, or by any other cause, to new or existing instrumentation devices installed by Engineer shall be immediately repaired or replaced by the Contractor as determined by the Engineer at no additional cost to the Owner.

3.2 MOVEMENT THRESHOLD/LIMITING VALUES

A. The Contractor shall maintain the maximum vertical movement and angular distortion of the existing terminal building below a Threshold Value of ½ inch vertical movement and a Limiting Value of 1 inch vertical movement and 1:360 angular distortion.

B. The Contractor shall submit and implement a Movement Mitigation Plan immediately if the Threshold Value specified above is exceeded, or if excessive movements and/or rates of movement occur as judged by the Engineer. The proposed plan may include, but not be limited to, bracing, segmented and/or slotted excavation, temporary berms or other measures. The Contractor shall demonstrate that the proposed measures can be implemented immediately if required to prevent damage to the site improvements. If the Limiting Value is reached, the Contractor shall stop that portion of the work identified by the Engineer as contributing to the settlement until mitigation measures are implemented.

END OF SECTION 310913

SECTION 31 10 00 - SITE CLEARING

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. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing, and removing site utilities and abandoning site utilities in place.
7. Temporary erosion- and sedimentation-control measures.

B. Related Sections:

1. Division 01 Section "Temporary Facilities and Controls" for temporary utility services, construction and support facilities, security and protection facilities, and temporary erosion- and sedimentation-control measures.
2. Division 01 Section "Execution" for field engineering and surveying.
3. Division 01 Section(s) "Construction Waste Management and Disposal and "Sustainable Design Requirements" for additional LEED requirements.

1.3 DEFINITIONS

A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.

E. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.

1. Use sufficiently detailed photographs or videotape.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site.

1.7 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Architect.

C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

D. Utility Locator Service: Notify Dig Safe System for area where Project is located before site clearing. For those utilities that are not members of Dig Safe, contact owners of such utilities to locate their utilities or hire a private locate company to locate those utilities.

E. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place.

F. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

G. Do not direct vehicle or equipment exhaust towards protection zones.

H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

I. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Division 31 Section "Earth Moving."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 DECOMMISSIONS OF MONITORING WELLS

A. Flush monitoring wells with potable water to clear out and evacuate accumulated sediment, which will be verified by comparing the cleared well depth to the installed well depth record.

B. Tremie grout the entire well screen and riser column. The monitoring well screen and riser shall be tremie-grouted starting at the well bottom to approximately one (1) ft below ground surface, or level of foundation excavation whichever is deeper, using a thick, Portland cement and bentonite grout mix. The grout may not be placed by pouring. The volume of grout must be sufficient to compensate for settling. The grout will also be “topped-off” if settling of the grout

occurs. The grout mixing is to be performed using a Moyno-type cavity pump or a portable "grout plant" equipped with an accessory pump.

C. Remove the existing roadway boxes, surface seals, steel casing and PVC piping from the ground surface to approximately two (2) ft depth below surface grade, or level of foundation excavation if applicable, and the resulting void space backfill and tamped with a manufactured sand/gravel concrete aggregate (such as Sakrete® gravel mix) to surface grade.

D. Restore the ground surface and clear the work area of debris. As part of their site restoiration services, the contractor will be responsible for disposal of debris generated by the well decommissioning process (roadway boxes, casings, broken surface seals, etc.).

3.2 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated. Flag each tree trunk at 54 inches above the ground.

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.3 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.4 TREE AND PLANT PROTECTION

A. General: Protect trees and plants remaining on-site according to requirements in Division 01 Section "Temporary Tree and Plant Protection."

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Landscape Architect.

3.5 EXISTING UTILITIES

A. Coordinate with owners of utilities and project owner for the disconnecting and sealing of utilities that are not required to serve existing structures before site clearing.

1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap utilities required to be removed or abandoned in place as a result of work of this project.

1. Arrange with utility companies and Owner to shut off indicated utilities.

C. Locate, identify, and disconnect utilities required to be abandoned in place as a result of work of this project.

D. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Owner's written permission.

E. Excavate for and remove underground utilities required to be removed as a result of work of this project.

F. Removal of underground utilities is included in Division 21, Division 22, Division 23, Division 26, Division 27, Division 28 and Division 33 Sections.

3.6 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Grind down stumps and remove roots, obstructions, and debris to a depth of 18 inches below exposed subgrade.
3. Use only hand methods for grubbing within protection zones.
4. Chip removed tree branches and dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.7 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth indicated on Drawings or to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects more than one inch in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

1. Limit height of topsoil stockpiles to 72 inches.
2. Do not stockpile topsoil within protection zones.
3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
4. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.8 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.
3. Remove existing granite curb, stockpile as direct by Engineer and reset where directed by Engineer.

3.9 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 31 10 00

SECTION 31 20 00 - EARTH MOVING

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. Work to be done under this Section includes, but is not limited to, providing all labor, materials, equipment, and incidentals as necessary to conduct and complete the Work specified in this Section and shown on the Drawings.

1. Excavate all materials, including soil, abandoned utilities, existing building debris, and all other materials, to construct site improvements and utilities shown on the Drawings.
2. The Contractor shall be solely responsible for impacts and damage to structures and existing and new improvements due to his/her work, and for corrective action or repairs needed to restore the structure(s) to its original condition at no additional cost to the Owner. Where structures are adversely affected by construction operations, they shall be repaired, restored and replaced in accordance with the requirements outlined herein.
3. Furnish materials specified in this Section from off site approved sources to complete the Work.
4. Over-excavate organic soil, fill, and other unacceptable materials for support of new foundation elements, slabs and pavements to expose firm, inorganic natural soils. The Contractor shall be solely responsible for stabilization of exposed soil subgrade surfaces.
5. Excavate and backfill trenches for utilities and pits for buried utility structures as shown on the Drawings.
6. Excavate well hole to accommodate elevator-cylinder assembly.
7. Provide, place, moisture condition, compact, and grade fill, backfill and other materials to the horizontal and vertical limits to construct the proposed site improvements and achieve the lines and grades as shown on the Drawings.
8. Place plastic separators, vapor barriers, crushed stone, mudmats, and geotextiles as necessary and as shown on the Drawings.
9. Segregate, handle, stockpile, manage, and reuse suitable excavated materials. Excavated soils shall be reused on site only as specified in this Section. The Contractor shall take steps and provide equipment and materials as necessary to reuse on site soils including, but not limited to, covering stockpiles to protect from moisture, mixing, handling multiple times, and mechanically screening to remove debris to meet specification requirements prior to reuse. Only those soils and other materials approved by the Engineer shall be reused on-site.
10. Manage and legally dispose off site all excess or unsuitable generated materials including but not limited to soil, rock, cobbles, boulders, water, old building slabs and footings, demolition waste, reinforced concrete and all other materials and debris that cannot be reused on site.

11. Process demolished building materials and bituminous pavement for reuse as specified in this Section.

B. Soil, rock or other backfill and grading materials (temporary or permanent) shall not be delivered to the site unless approved by the Engineer.

C. The Contractor shall conduct all work in accordance with the Drawings.

D. The Contractor shall legally dispose of all groundwater and soil. No groundwater shall be discharged into adjacent wetlands, storm drains, or sewer drains without required permits.

E. The Contractor shall not conduct any excavation without the presence of the Engineer.

F. The Contractor shall be responsible for obtaining all permits.

G. Related Sections:

1. Division 01 Section "Construction Progress Documentation and Photographic Documentation" for recording preexcavation and earth moving progress.
2. Division 01 Section "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities; also for temporary site fencing if not in another Section.
3. Division 02 Section “Subsurface Investigation” for existing subsurface information.
4. Division 03 Section "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
5. Divisions 21, 22, 23, 26, 27, 28, and 33 Sections for installing underground mechanical and electrical utilities and buried mechanical and electrical structures.
6. Division 31 Section "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
7. Division 31 Section “Rock Removal” for removal of bedrock using controlled blasting techniques.
8. Division 31 Section "Dewatering" for lowering and disposing of ground water during construction.
9. Division 31 Section "Lateral Support of Excavation" for shoring, bracing, and sheet piling of excavations.
10. Division 32 Section "Turf and Grasses" for finish grading in turf and grass areas, including preparing and placing planting soil for turf areas.
11. Division 32 Section "Plants" for finish grading in planting areas and tree and shrub pit excavation and planting.
12. Division 33 Section "Subdrainage" for drainage of below-grade foundation walls, slabs-on-grade, retaining walls and landscaped areas.

1.3 UNIT PRICES

A. Work of this Section is affected by unit prices for earth moving specified in Division 01 Section "Unit Prices."

B. Rock Measurement: See Division 31 Section “Rock Removal.”

1.4 DEFINITIONS AND REFERENCE STANDARDS

A. ASTM: Specifications of the American Society for Testing and Materials.

B. AASHTO: American Association of State Highway and Transportation Officials

C. OSHA: Occupational Health and Safety Administration

D. Site Improvements: When used in the context of "protecting adjacent site improvements" shall include, but not be limited to, buildings, utilities, lighting, pavements, roadways, slabs, sidewalks, curbs, foundations, and all other improvements and features that are outside the limits of the site, or those elements within the limits of the site that are to remain.

E. Zone of Influence (ZOI): The zone beneath a structure defined by imaginary lines extending outward 2 ft laterally beyond the bottom edge of the structure and down on a one horizontal to one vertical (1H:1V) slope to the top of the suitable natural inorganic bearing soils. Soils located within the ZOI provide foundation support for the structure.

F. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

G. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

H. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

I. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

J. Excavation: Removal of material encountered above subgrade elevations as indicated on the Drawings.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by the Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.

K. Fill: Soil materials used to raise existing grades.

L. Earth: All material not classified as Rock (See Division 31 Section "Rock Removal.")

M. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

N. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

O. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

P. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

Q. Engineer: Authorized representatives of the Owner. For the scope of work covered under this Section, this term will include Haley & Aldrich, Inc. and OEST Associates, Inc., an AMEC Company.

R. Civil Engineer: Authorized representative of the Owner. For the scope of work covered under this Section, this term will include OEST Associates, Inc., an AMEC Company.

1.5 JOB CONDITIONS

A. Refer to Division 02 Section “Subsurface Investigation” for available information on existing subsurface conditions.

B. Prior to submitting their bid, the Contractor shall review and understand the information provided herein and the information outlined in Division 02 Section “Subsurface Investigation”. The subsurface information is made available to the Contractor for information on factual data only and shall not be interpreted as a warranty of subsurface conditions whether interpreted from written text, boring logs or other data.

C. Below-Grade Utilities and Obstructions

1. The Contractor is advised that the in-situ fill soils may contain cobbles, boulders and man-made structures. These items will not be considered obstructions and shall be removed as needed at no additional cost to the Owner.
2. Cobbles and boulders within the naturally deposited soils will not be considered obstructions.
3. Refer to the Drawings for locations of existing utilities.

D. Protection of Adjacent Property and Utilities:

1. The Contractor shall protect adjacent structures (above ground and buried) from damage associated with the Work of this Section. Damage due to the Work of this Section shall be repaired immediately by the Contractor at no additional cost to the Owner.

1.6 SUBMITTALS

A. General

1. The Contractor shall forward submittals to the Engineer a minimum of 2 weeks prior to any planned work related to the Contractor’s submittals.

2. The time periods for submittals are the minimum required by the Engineer to review, comment, and respond to the Contractor. The Engineer may require resubmission or resubmissions for various reasons. The Contractor is responsible for scheduling specified submittals and resubmittals so as to prevent delays in the work.
3. The Contractor's submittals shall be reviewed and accepted by the Engineer prior to conducting any work.
4. Acceptance of the Contractor's submittals by the Engineer does not relieve the Contractor of the responsibility for the adequacy, safety, and performance of the Work.

B. Backfill Materials and Equipment

1. Proposed types and sources of all off site fill materials including topsoil. For each type of soil to be utilized as fill or backfill the Contractor shall deliver a 50-lb. bag sample from each borrow source or supplier to the Engineer for review and laboratory testing. Do not import any material to site unless the material has been accepted by the Engineer. With each sample provide the following documentation:

    a. Location of the borrow source site.
    b. Present and past usage of the source site and material.
    c. All previously existing reports associated with an assessment of the source site as relates to the presence of oil or hazardous materials.

2. Submit additional material samples every 2,500 cubic yards throughout the course of the Work, if requested by the Engineer, to evaluate the consistency of the source or process at no additional cost to the Owner.
3. Details of compaction equipment proposed for use in compacting fill and backfill materials. The Details shall include descriptions, product literature, specifications and ratings.
4. For use of geotextile fabrics, controlled low-strength material and warning tapes, submit manufacturer's literature for approval by the Engineer. Submit design mixture for controlled low-strength material.

C. Samples for Verification: For the following products, in sizes indicated below:

1. Geotextile: 12 by 12 inches.
2. Warning Tape: 12 inches long; of each color.

1.7 QUALITY ASSURANCE

A. The Engineer will monitor the Contractor's earthwork activities including excavation, subgrade preparation, dewatering, backfilling, and installation of foundation and pavement drainage. The Contractor shall provide sufficient notice to the Engineer to allow the Engineer to be present to monitor the Work.

B. The Engineer will conduct field and laboratory testing to confirm compliance with the requirements of this Section. Field and laboratory testing will be conducted in general accordance with ASTM or other applicable reference standards. The Contractor shall cooperate with the Engineer to facilitate observations, measurements, monitoring, and testing.

C. The Contractor shall not prepare subgrades or place soils or concrete on soil subgrade surfaces unless the Engineer is present to monitor the Work. Materials placed and/or compacted which have not been observed by the Engineer or otherwise do not conform to project specifications shall be removed and replaced with appropriate, suitable material as directed by the Owner or the Engineer at no additional cost to the Owner. Costs related to testing or replacement of nonconforming Work or materials, and/or delays caused by nonconforming Work or materials, shall be paid for by the Contractor at no additional cost to the Owner.

D. The presence of the Engineer shall not relieve the Contractor of its responsibility to perform the Work in accordance with the Contract Documents, nor shall it be construed to relieve the Contractor from full responsibility for the means and methods of construction, protection of soil subgrades and site improvements from damage, and for safety on the construction site.

E. The Contractor shall adhere to the applicable requirements of the Drawings, OSHA Standards, and to all other applicable ordinances, codes, statutory rules, and regulations of federal, state, and local authorities having jurisdiction over the Work of this Section.

F. The Contractor may conduct additional field and laboratory testing or screening tests for their own information at no additional cost to the Owner.

G. Work not in accordance with the specified requirements shall be improved or removed and replaced at no additional cost to the Owner. All costs related to testing of nonconforming Work or materials shall be paid for by the Contractor at no additional cost to the Owner.

H. Preexcavation Conference: Conduct conference at Project site.

1.8 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Utility Locator Service: Notify "Dig Safe System" for area where Project is located before beginning earth moving operations. For those utilities that are not members of Dig Safe, contact owners of such utilities to locate their utilities or hire a private locate company to locate those utilities.

C. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures, specified in Division 01 Section "Temporary Facilities and Controls," and Division 31 Section "Site Clearing," are in place.

D. Do not commence earth moving operations until plant-protection measures specified in Division 01 Section "Temporary Tree and Plant Protection" are in place.

E. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

F. Do not direct vehicle or equipment exhaust towards protection zones.

G. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

1. Satisfactory Soils: Soil materials defined in the remainder of this Section.
2. Unsatisfactory Soils: Materials containing excessive amounts of clay, vegetation, organic matter, debris, pavement, stones or boulders over 6 inches in greatest dimension, frozen material, and material which, in the opinion of the Engineer, will not provide a suitable subgrade surface.

B. Compacted Granular Fill (CGF) shall consist of clean, mineral, aggregate sand and gravel material free of organic material, loam, trash, snow, ice, frozen soil, or other deleterious material well graded within the following limits:

Sieve Size (ASTM D422)	Percent Passing by Weight
6 in.	100
No. 4	30 – 80
No. 40	10 – 50
No. 200	0 – 8

CGF shall be used below foundations, slabs, sidewalks, exterior slabs, and at other locations shown on the Drawings only when accepted by the Engineer.

MaineDOT Type D Subbase Aggregate (Maine DOT Standard Specifications, Highways and Bridges, Section 703.06b, Type D) is an acceptable substitute for CGF as specified above.

C. Common Fill shall consist of mineral sandy soil free from organic matter, loam, plastic, metal, wood, snow, ice, frozen soil, or deleterious materials.

1. Common Fill shall not contain particles larger than 6 inches in maximum dimension and shall have a maximum of 80 percent passing the No. 40 sieve and a maximum of 30 percent passing the No. 200 sieve. It shall possess physical properties such that it can be

readily spread and compacted to the specified densities in a reasonable length of time. The material shall not contain materials subject to decay, decomposition, or dissolution.

2. On-site soils reused as Common Fill shall meet the requirements above and shall be free of organic material, loam, trash, snow, ice, frozen soil, clay, peat or other deleterious material including but not limited to wood, glass, brick, concrete, rubble, asphalt, steel, and wire. This fill shall possess physical properties such that it can be readily spread and compacted to the specified densities. The material shall not contain materials subject to decay, decomposition, or dissolution. The Contractor shall mechanically screen on site soils to remove debris, cobbles and boulders prior to reuse.

D. Screened/Crushed Gravel Base shall be in accordance with the requirements of MaineDOT Standard Specification, Highways and Bridges; Section 703.06a, Type A. Screened/Crushed Gravel Base shall be used at the locations shown on the Drawings.

E. Recycled Bituminous Pavement Base shall meet the requirements of MaineDOT Standard Specification, Highways and Bridges; Section 703.06a, Type A. Recycled Bituminous Pavement Base may be used in place of Screened/Crushed Gravel Base in the parking lots.

F. Sand/Gravel Subbase shall be in accordance with the requirements of MaineDOT Standard Specification, Highways and Bridges; Section 703.06b, Type D. Sand/Gravel Subbase shall be used at the locations shown on the Drawings.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

H. ¾-inch Crushed Stone shall be in accordance with the requirements of MaineDOT Standard Specification, Highways and Bridges; Section 703.12. ¾-inch Crushed Stone shall be used as the drainage material for the foundation drainage system and pavement drainage system and as indicated on the Drawings. ¾-inch Crushed Stone shall be angular and washed to remove fine grained soils prior to use on the Project.

I. Drainage Course: As defined for ¾-inch Crushed Stone above.

J. Demolished building material (ABC Material): Brick and concrete demolition material (ABC Material) may be used only as Retaining Wall Backfill, Subbase Gravel, or CGF outside of the building footprint at the site. The ABC Material is not suitable for use as CGF inside of the building footprint and shall not be placed within the ZOI of footings or beneath slabs. The ABC material shall not be used as Base Material.

The ABC Material shall be:

1. Free of wood, organic matter, soil, debris or other material that could adversely impact its placement or performance as compacted fill. If the materials contain rebar (metal reinforcing), all rebar shall be removed and recycled or disposed of in an approved solid waste management facility.
2. Placed in relatively uniform thickness lifts, and spread in a manner that limits segregation of the larger and smaller sized particles, and results in a uniform fill mass.
3. Confirmed to be compatible with plantings, utilities, overlying fill and other features in the fill area.

4. Sampled prior to use and as judged necessary by the Engineer during production to confirm that the gradation requirements are being achieved.
5. Crushed and reused within a reasonable time.

K. Filter Media: As defined on the Drawings.

2.2 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched, synthetic, chemically resistant non-biodegradable fabric. Subsurface Drainage Geotextile shall be used to prevent fine-grained soils from migrating into coarse grain materials as judged necessary by the Engineer. Geotextile shall be installed at the locations shown on the Drawings. Mirafi 140N, AMOCO 4551, EXXON GTF-150EX, or approved equivalent shall be used as Subsurface Drainage Geotextile.

B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and as in the Maine DOT Standard Specifications referenced:

2.3 CONTROLLED LOW-STRENGTH MATERIAL

A. Controlled Low-Strength Material: Self-compacting, low-density, flowable concrete material as specified in the Maine DOT Standard Specifications.

2.4 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 SITE MAINTENANCE AND EROSION CONTROL

A. Erosion Control: Install, place erosion/sedimentation control materials and devices as indicated to protect slopes, retain embankments, prevent segregation of materials, and prevent discharge of suspended solids into drains.

B. Site Surface Drainage Control: Provide and maintain drainage controls such as swales, gutters, pipe, conduit, portable sedimentation basins/tanks, filter materials, and pumps as necessary to maintain stable slopes and excavation subgrades.

C. Protect structures, utilities, sidewalks, pavements and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

D. Maintenance of Fill Slopes:

1. Stability of excavations and job safety are the sole responsibility of the Contractor.
2. Maintain acceptable soil slopes. Promptly repair slides, slipouts, washouts, settlement or sinkholes that occur for any reason, and refinish the slope or embankment to the original lines and grades or as required to conduct the work in a safe manner.
3. Material, if stockpiled, shall be stored so as not to interfere with the established sequence of the construction.

E. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING – See Division 31 Section "Dewatering"

3.3 EXPLOSIVES – See Division 31 Section "Rock Removal"

3.4 EXCAVATION

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:

a. 24 inches outside of concrete forms other than at footings.
b. 12 inches outside of concrete forms at footings.
c. 6 inches outside of minimum required dimensions of concrete cast against grade.
d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
e. 12 inches beneath bottom of concrete slabs-on-grade.
f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.
g. 24 inches outside precast concrete utility structure.

B. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross

sectioned by Engineer. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents. Changes in the Contract Time may be authorized for rock excavation.

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.

    a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.

2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:

    a. 24 inches outside of concrete forms other than at footings.
    b. 12 inches outside of concrete forms at footings.
    c. 6 inches outside of minimum required dimensions of concrete cast against grade.
    d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
    e. 12 inches beneath bottom of concrete slabs-on-grade.
    f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.
    g. 24 inches outside precast concrete utility structure.

C. All excavations shall be made in accordance with all OSHA and other applicable regulatory agency requirements. The Contractor shall be responsible for the design, stability and safety of all temporary and permanent excavations. The Contractor shall be responsible for stabilization of exposed soil subgrade surfaces.

D. All excavation and backfilling for structures, utilities, and site improvements shall be performed in–the-dry.

E. The Contractor shall control the grading to prevent water from running to excavated areas or damaging subgrades or site improvements.

F. Where final subgrade soils have been softened, frozen, or otherwise disturbed due to the presence of water, unfavorable weather, or any other cause, remove the material and replace with CGF or ¾-inch Crushed Stone at no additional cost to the Owner.

G. Exercise care to preserve the material below and beyond the lines of excavation. Where excavation is carried out through error below indicated grade or beyond the lines of excavation backfill to the indicated grade with CGF or ¾-inch Crushed Stone at no additional cost to the Owner.

H. Excavate the final 2 ft to subgrade in fine grained soils with a smooth-edged bucket or by hand methods using flat shovels.

I. Where excavations are required to be made into the Zone of Influence (ZOI) below an existing or new foundation, utility or other structure, the Contractor shall design excavation and bracing system, underpinning, or other system acceptable to Engineer to: 1) provide support to protect

the soil within the ZOI from loosening and becoming disturbed, and 2) protect the structure from movement.

J. The Contractor shall provide access and allow time for the Engineer to observe and sample the bottom of all excavations, including trench excavations, as needed.

K. Temporary cut slopes shall be constructed in accordance with OSHA requirements.

3.5 SOIL SUBGRADE PREPARATION

A. General

1. Care shall be taken to avoid disturbance to subgrades. The Contractor shall be solely responsible for stabilization of exposed soil subgrade surfaces.
2. The Contractor shall consider implementation of methods for protection of approved subgrade surfaces, including but not limited to placement of a layer of crushed stone or a lean concrete mud-mat.
3. Make final 2 ft of excavation into natural bearing soils using smooth-bladed equipment or by hand to limit disturbance. Loose, disturbed soil shall be removed by hand shovel.
4. Subgrades consisting of cohesive soils shall not be "backbladed" or compacted to prepare a smooth surface.
5. Subgrades consisting of saturated soils shall not be recompacted to avoid disturbance.
6. Movement of construction equipment directly over exposed final subgrades, except for compaction equipment, shall not be permitted.
7. The exposed subgrade will be examined in the field by the Engineer to observe the strength and bearing capacity of the soils. Disturbed or soft or unstable soils, as judged by the Engineer, shall be excavated and replaced with lean concrete, CGF, or other acceptable materials at no additional cost to the Owner.
8. Temporary drainage trenches or other dewatering facilities shall not be permitted to extend below the bearing level near footings.
9. Prevent soil subgrades from freezing and frost. Soil subgrades that freeze prior to concrete or backfill placement shall be thawed and recompacted, or removed and replaced with non-frozen backfill, lean concrete or other acceptable material as directed by the Engineer.

B. Building Footings

1. For all footings, remove all Unsuitable Materials, including topsoil, in-situ fill, soft to medium stiff marine clay, organic soils, debris, disturbed soil and other compressible materials, as judged by the Engineer, from within the ZOI of footings down to the top of the naturally-deposited, undisturbed, inorganic suitable bearing soils in a manner that minimizes disturbance to the bearing surface.
2. Following excavation to the acceptable bearing stratum, exposed soil surfaces shall not be proof-compacted with vibratory compaction equipment, unless recommended by the Engineer.
3. Where needed, place and compact CGF, ¾-inch Crushed Stone or other approved structural fill in engineered lifts from the prepared subgrade elevation to the design footing bearing elevation.
4. Footings shall bear on:

a. naturally deposited, undisturbed inorganic bearing soils (stiff to very stiff marine clay, glacial till or bedrock);
b. CGF, 3-in. minimum thickness lean concrete mudmats or a lift of ¾-inch Crushed Stone placed over naturally-deposited, undisturbed inorganic bearing soils susceptible to disturbance during footing construction; or

5. Soil surfaces below completed foundations and slabs shall be protected against freezing, before and after foundation construction. Footings constructed during freezing weather shall be either backfilled to a depth of 4.5 feet or protected with insulating blankets or other means to prevent subgrade soil surfaces from freezing.

C. Building Slabs-on-Grade, Pavement Areas and Sidewalks

1. Over-excavate all topsoil, organic soils, debris and disturbed soil within the ZOI of building slabs. Any utility abandoned in-place below the slab-on-grade shall be entirely backfilled with lean concrete or other grout material approved by the Engineer.
2. Proof-compact sand and gravel or man-placed fill soil surfaces beneath building slabs-on-grade and sidewalks with a self-propelled vibratory compaction equipment, as recommended by the Engineer, to achieve a firm subgrade. Do not proof-compact marine clay subgrade soils.
3. Over-excavate all topsoil, debris and organic soils within the limits of the access roads and parking areas. If sand and gravel or man-placed fill is present at subgrade, proof-compact surface with a heavy-duty hand-guided vibratory plate or a self-propelled vibratory roller, until firm, based on inspection by the Engineer. Marine clay soils exposed at the subgrade level shall not be proof-compacted to minimize disturbance.

3.6 EXCAVATION AT EDGE OF TREE- AND PLANT-PROTECION ZONES

A. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

B. Cut and protect roots according to requirements in Division 01 Section "Temporary Tree and Plant Protection."

3.7 EXCAVATION FOR UTILITY TRENCHES

A. The Contractor shall slope or shore all trenches, as required to protect site improvements and meet OSHA requirements.

B. Coordinate all work with the utility companies and comply with utility company backfill requirements.

C. Excavate trenches to indicated gradients, lines, depths, and elevations.

D. Excavate trenches to uniform widths to provide clearance on each side of pipe or conduit as shown on the Drawings. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.

E. Trench Bottoms for Ductile Iron Water Pipes: Excavate and shape trench bottoms to provide uniform bearing and support of pipes. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of pipes. Remove projecting stones and sharp objects along trench subgrade.

1. For pipes less than 6 inches in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
2. For pipes 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
3. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

F. Trench Bottoms for Flexible Pipes and Conduits: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

G. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots according to requirements in Division 01 Section "Temporary Tree and Plant Protection."

3.8 UNAUTHORIZED EXCAVATION

A. Do not fill unauthorized excavations until observed by the Engineer.

B. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Engineer.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Engineer.

3.9 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 PLACEMENT AND COMPACTION OF MATERIALS

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Fill Placement

1. Place and compact fill to the limits specified in this Section and as shown on the Drawings in order to complete the Work. Unless otherwise specified or directed, material used for filling and backfilling shall meet the requirements specified. If material removed from the excavations does not meet requirements to be reused on site (either for physical or chemical properties), provide other acceptable material.
2. Place and compact the following materials as shown on the Drawings:

    a. CGF within the ZOI of building footings.
    b. ¾-in. Crushed Stone within the upper 12 inches below the bottom of floor slabs in the new building area (where underslab drainage is shown on the Drawings) and surrounding all foundation and subsurface drainage pipes.
    c. CGF within the upper 12 inches below the bottom of the replaced floor slabs in the existing terminal building.
    d. Common Fill or CGF as foundation backfill greater than 12 inches below the bottom building floor slabs and pavements outside of the ZOI of footings. Common fill suitable for reuse as foundation backfill shall be granular in nature and must be able to be placed in lifts and compacted in accordance with the requirements of this Section.
    e. CGF behind site retaining walls.

3. Do not place frozen fill. Do not place fill, susceptible to freezing, in temperatures less than 32 degrees Fahrenheit. Do not place fill on frozen ground.
4. Slope fill surfaces at the end of each day to provide for free surface drainage.
5. Placement of fill shall not begin prior to observation and acceptance of subgrade conditions by the Engineer. The Contractor shall not place any fill material within the footprints of the proposed buildings in the absence of the Engineer unless authorized by the Engineer.
6. If excessive weaving or instability, as judged by the Engineer, is observed within the footprint of the proposed buildings during compaction, compaction efforts shall be discontinued until the Contractor stabilizes the subgrade. If required, the Contractor shall excavate and replace the unstable fill material with acceptable compacted material at no additional cost to the Owner.
7. Compaction by puddling or jetting is prohibited.
8. Whenever placing fill, provide suitable transition layers or Subsurface Drainage Geotextile as required to prevent the migration of fine material into void spaces of coarser material.

9. Place fill to the elevations and grades shown on the Drawings. Where fill material meets previously existing grades, provide a smooth transition to meet existing grades.

C. Additional Requirements for Backfilling

1. Protect structures and pipes from damage during backfilling operations.
2. Protect existing and new site improvements during foundation construction operations including but not limited to, prepared and approved soil subgrade surfaces. Repair damage at no additional cost to the Owner.
3. Backfill shall not be placed against walls until they are braced and have sufficiently cured to develop strength necessary to withstand, without damage, pressure from backfilling and compacting operations.
4. For walls not designed to resist lateral earth pressures, maintain the top of the backfill on either side of the wall within 2 ft of each other.
5. Utility bedding material shall be placed in trenches uniformly on both sides of the utility for the entire width of the trench to the springline of the utility. The backfill material shall be placed to the limits shown on the Drawings by hand shovels in layers not more than 4 inches thick in loose depth and each layer shall be thoroughly and evenly compacted by tamping on each side of the pipe to provide uniform support around the pipe, free from voids.
6. Trench backfill material placed above the utility bedding or cover material may consist of previously excavated on-site soils (Common Fill) provided the excavated soils meet the physical and chemical requirements specified in this Section. Peat, organic soils, debris, or other compressible soils shall not be used as trench backfill.
7. Any trenches or excavations improperly backfilled or where settlement occurs shall be reopened to the depth required for proper compaction and refilled and compacted with the surface restored to the required grade and condition at no additional cost to the Owner.
8. During filling and backfilling operations, pipelines may be checked by the Civil Engineer to determine whether any displacement of the pipe has occurred. If the inspection of the pipelines shows poor alignment, displaced pipe, or any other defects they shall be remedied in a manner satisfactory to the Civil Engineer at no additional cost to the Owner.

D. Compaction Equipment: The Contractor shall use vibratory compaction equipment to obtain the specified compaction at all times.

E. The degree of compaction is expressed as the in place fill dry unit weight as a percentage of the maximum dry density at optimum moisture content as determined by ASTM Test D1557, Method C. The minimum compaction requirements are as follows:

1. Under structures, soil-supported building slabs, steps, and adjacent to foundation walls: 95 percent.
2. Under walkways and pavements: 92 percent up to 3 feet below finished grade, 95 percent in the upper 3 feet.
3. Behind retaining walls: 95 percent
4. Under turf or unpaved areas: 90 percent.

F. Moisture Control

1. Fill that is too wet for proper compaction shall be aerated, harrowed, dried, or treated with stabilizing agents such as lime to achieve a proper moisture content to allow compaction to the required density.
2. Fill that is too dry for proper compaction shall receive water uniformly applied over the surface of the loose layer. Sufficient water shall be added to allow the fill soils to be compacted to the required density.
3. In no case shall fill be placed over material that is frozen. No fill material shall be placed, spread, or rolled during unfavorable weather conditions. When work is interrupted by rainfall, operations shall not be resumed until the moisture content and the density of the previously placed fill are as specified.

G. Lift Thickness of Material

1. Place fill in uniform horizontal layers.
2. Place CGF and Common Fill in layers not to exceed 12 inches in thickness prior to compaction ("loose measure") when utilizing heavy self propelled vibratory compaction equipment and 9 inches loose measure when utilizing hand operated compaction equipment. Systematic passes of the compaction equipment shall be used to compact each lift until the density requirements are met as determined by the Engineer. Cobbles or boulders having a size exceeding 2/3 of the loose lift thickness should be removed prior to compaction.
3. Place Subbase course material in layers not to exceed 8 inches loose measure prior to compaction and compact with heavy self propelled vibratory compaction equipment to meet the compaction requirements provided in this Section.
4. Place Base course material in one loose lift and compact with heavy self propelled vibratory compaction equipment. Compact material with heavy self propelled vibratory compaction equipment to meet the compaction requirements provided in this Section.

H. No off-site soil materials shall be used as fill at the site without approval of the Engineer.

I. Reuse of Excavated In-Situ Soils

1. In-situ glaciomarine soils shall not be used as CGF within the ZOI beneath footings, within the footprint of new buildings, as foundation or retaining wall backfill, or as base/subbase material within new paved areas.
2. In-situ glaciomarine clay soils could be reused as common fill for general site grading at the site. Please note that these soils may be difficult to place and compact when wet and the material may have to be spread out and dried prior to use. The Contractor shall reuse these soils at their own risk at no additional cost to the Owner.
3. In-situ granular soils (subbase, fill materials and/or glacial till) may be reused as CGF within the ZOI of footings, as foundation wall backfill, or as base/subbase material only if they meet the material requirements specified in this Section. The Engineer will observe excavated granular soils to determine whether laboratory sieve analyses are needed to confirm the acceptability of their reuse. In-situ soils shall not be reused as CGF, foundation backfill or base/subbase material without prior approval of the Engineer.

3.11 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill trenches excavated within the ZOI of footings with CGF; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 03 Section "Cast-in-Place Concrete or Miscellaneous Cast-in-Place Concrete."

D. Heating Oil Trenches under Roadways: Provide 4-inch- thick, concrete-base slab support for piping below roadways. After installing and testing, completely encase piping in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course. Concrete is specified in Division 03 Section "Cast-in-Place Concrete and Miscellaneous Cast-in-Place Concrete."

E. Trenches for Electrical and Communications: Concrete encase in accordance with electrical drawings and specifications.

F. Backfill voids with satisfactory soil while removing shoring and bracing.

G. Place and compact initial backfill of bedding material, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

H. Place and compact final backfill of satisfactory soil to final subgrade elevation.

I. Install warning tape directly above utilities, 12 inches below finished grade.

3.12 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations as specified in the Maine DOT Standard Specifications.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.13 SUBSURFACE DRAINAGE – See Division 33, Section “Subdrainage”

3.14 PROTECTION OF SUBGRADES AND FILL

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. The Contractor shall take the necessary steps to avoid disturbance of subgrade and underlying natural soils and compacted fill during excavation and filling operations. Methods of excavation and filling operations shall be revised as necessary to avoid disturbance of subgrade and underlying soils and fill including restricting the use of certain types of construction equipment and their movement over sensitive or unstable materials, dewatering, and other acceptable control measures. Disturbance shall include but is not limited to the deterioration of fill after placement and satisfactory compaction due to saturation from precipitation or surface water runoff, operation of equipment, hauling trucks, and other activities. All excavated or filled areas or subgrades that become disturbed during construction shall be removed and replaced with materials accepted by the Engineer at no additional cost to the Owner.

C. The need to use Geotextile Separation Fabric or other materials to stabilize haul road subgrades during construction shall be determined and paid for by the Contractor at no additional cost to the Owner.

D. Prevent materials below constructed foundations from freezing. Materials that become frozen shall be removed and replaced, including foundations, at no additional cost to the Owner.

E. At the completion of Work, all ground surfaces shall be left in a firm, stable, unyielding, reasonably uniform condition, free of ruts and surface irregularities, in accordance with grading requirements shown on the Drawings.

F. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.15 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Engineer.

1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 31 20 00

SECTION 31 23 16 – ROCK REMOVAL

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. The work to be done under this Section includes furnishing all labor, equipment, materials and services and performing operations required to fragment and excavate materials classified as rock utilizing controlled blasting procedures specified herein to the grades and limits indicated on Drawings, such that overbreak is minimized, rock block movement and ground heave is prevented outside the excavation limits, damage is prevented to adjacent structures, utilities, property and work, and such that resulting ground vibrations air blast overpressures are consistently maintained below the maximum levels specified in this Section.
2. Protecting existing structures (including vibration sensitive equipment), adjacent property, new construction, workers, Engineer, Owner, and the general public from damage or injury from improper handling of explosives, flyrock, excessive ground displacements, ground vibrations and/or excessive air blast overpressure levels.
3. Furnishing, installing, and implementing an audible warning system to indicate impending blasting and familiarizing workers, Engineer, Owner and the general public with the system implemented.

B. Related Work:

1. Division 02 Section “Subsurface Explorations” for existing subsurface information.
2. Division 31 Section "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
3. Division 31 Section "Earth Moving" for excavating, backfilling, site grading, and for site utilities.
4. Division 31 Section "Dewatering" for lowering and disposing of ground water during construction.
5. Division 31 Section "Lateral Support of Excavation" for shoring, bracing, and sheet piling of excavations.

1.3 UNIT PRICES

A. Work of this Section is affected by unit prices for earth moving specified in Division 01 Section "Unit Prices."

B. The Contractor shall be fully responsible for conducting investigations necessary to determine the extent and quantity of rock on the site prior to submitting his bid. Rock locations may vary from that inferred by the geotechnical data report (see Division 2 Section “Subsurface Explorations”) based upon the inherent limitations of subsurface exploration by borings.

C. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed the following. Unit prices for rock excavation include replacement with approved materials.

1. 24 inches outside of concrete forms other than at footings.
2. 12 inches outside of concrete forms at footings.
3. 6 inches outside of minimum required dimensions of concrete cast against grade.
4. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
5. 12 inches beneath bottom of concrete slabs-on-grade.
6. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.
7. 24 inches beyond outside dimensions of precast concrete utility structures.

1.4 DEFINITIONS

A. Earth: All material not classified as rock.

B. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:

1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,700 lbf and stick-crowd force of not less than 18,400 lbf with extra-long reach boom; measured according to SAE J-1179.
2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp flywheel power and developing a minimum of 47,992-lbf breakout force with a general-purpose bare bucket; measured according to SAE J-732.

C. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by a geotechnical engineer, according to ASTM D 1586.

D. Engineer: Authorized representatives of the Owner. For the scope of work covered under this Section, this term will include Haley & Aldrich, Inc. and OEST Associates, Inc., an AMEC Company.

1.5 QUALITY ASSURANCE

A. Qualifications:

1. Persons responsible for blasting shall be licensed blasters in the State of Maine and shall have had at least five years of experience in responsible charge of controlled blasting projects, and at least five similar close-in blasting projects.
2. Blast monitoring, if conducted by the Contractor, shall be conducted by persons trained in the use of a seismograph and records shall be analyzed and results reported by persons familiar with analyzing and reporting the frequency content of a seismograph record.

B. Codes, Permits and Regulations:

1. The Contractor shall comply with all applicable laws, rules, ordinances and regulations of the Federal Government, the State of Maine, the City of Portland, the City of South Portland, and all other Agencies having jurisdiction, governing the transportation, storage, handling and use of explosives. All labor, materials, equipment and services necessary to make the blasting operations comply with such requirements shall be provided without additional cost to the Owner.
2. The Contractor shall obtain and pay for all permits and licenses required to complete the work of this Section.
3. In case of conflict between regulations or between regulations and Specifications, the Contractor shall comply with the strictest applicable codes, regulations, or Specifications.

C. Blasting Limit Criteria:

1. Peak Particle Velocity Limits: The Contractor shall conduct all blasting in such a manner that the resulting peak particle velocity does not exceed 0.5 inches per second (ips) at any adjacent structures.
2. Air blast Overpressure Limit: The Contractor shall conduct all blasting activity in such a manner that the peak air blast overpressure measured at the location of the nearest above ground, occupied structure to blasts (considering wind direction) shall not exceed 0.014 psi.
3. Ground and Building Heave Limits: The Contractor shall conduct all blasting in such a manner that heave or settlement of the ground surface or adjacent existing structures does not exceed 0.25 inches and heave or settlement of adjacent utilities does not exceed 0.5 inches.

D. Blasting shall not be permitted within 40 ft of new concrete footings, slabs, or walls, unless a blast plan for the specific blasts is forwarded by the Contractor and approved by the Engineer. At locations of green concrete, maximum peak particle velocity (PPV) shall not exceed the following:

Age of Concrete	Max PPV
0 to 1 day	0.5 in/sec
1 to 7 days	2.0 in/sec
> 7 days	3.0 in/sec

E. Blast Monitoring:

1. The Engineer will monitor ground vibrations, airblast, and ground heave resulting from the blasting. The Contractor will provide access and assistance in the setting up of instrumentation. Locations shall be mutually agreed upon by the Engineer and Contractor, but will generally consist of the nearest portion of adjacent existing structures (terminal building and parking garage).
2. The Contractor may conduct additional blast monitoring as he deems necessary, but any additional blast monitoring by the Contractor shall be at no additional cost to the Owner.

F. Blast Monitoring Reports:

1. Results of each blast shall be made available to the Contractor immediately following each blast, and any vibrations close to or exceeding the specified limits will be immediately reported to the Contractor. If blast monitoring is conducted by the Contractor, he shall provide a printout of the results, including PPV and frequency data, within 4 hours of each blast, and any vibrations close to or exceeding the specified limits will be immediately reported to the Engineer.

G. Blast Monitoring Instrumentation

1. All instrumentation used on the project shall have been calibrated within the previous twelve months to a standard which is traceable to the National Institute of Standards and Technology. Characteristics of instrumentation are listed below:

    a. Measure the three mutually perpendicular components of particle velocity in directions vertical, radial and perpendicular to the vibration source.
    b. Measure and display the maximum peak particle velocity component and frequency, and airblast overpressure. These readings must be displayed and be able to be read in the field, immediately after each blast.
    c. Furnish a permanent time history record of particle velocity waveforms and airblast overpressure waveforms, so that frequency and time of maximum peak particle velocity or airblast overpressure can be determined.

H. The Contractor shall cooperate with the Engineer in permitting observation of the Contractor's drilling and loading procedures, as well as in providing detailed information on blasting operations.

I. The Contractor shall be completely responsible for any and all damages resulting from the blasting operations. The Contractor shall, as a minimum, take whatever measures are necessary to maintain peak air blast overpressure, peak particle velocities, and heave/settlement within the specified limits. Modifications to blasting and excavation

methods required to meet these requirements shall be undertaken at no additional cost to the Owner.

1.6 SUBMITTALS

A. Advance Submittal: The Contractor shall submit the following information to the Engineer at least six work days prior to commencing (or recommencing) drilling and blasting operations:

1. Sequence and schedule of blasting rounds, including the starting point for blasting and direction of developing the excavation, including lift heights.
2. Specifics of a typical blast round to be implemented at the area where blasting is intended to be started (for each phase of blasting).
3. Include the following blast round details:

    a. Diameter, spacing, burden, depth, and orientation of each blast hole for each round design.
    b. Nomenclature, type and amount (in terms of weight and number of cartridges) of explosives and distribution of charge to be used within each hole, on each delay, and the total for the blast.
    c. Nomenclature and type of detonators, and delay pattern for the round; if electric blasting, type and capacity of firing source, size type and location of safety switches and lightning gap.
    d. Type and location of stemming to be used in holes.
    e. Calculations of anticipated vibration levels at the nearest adjacent structures or utilities.

4. Methods of matting or covering of the blast area in open excavations to prevent flyrock and excessive air blast overpressure.
5. Written evidence of the licensing, experience and qualifications of the blasters who will be directly responsible for the loading of each shot and for firing it.
6. Name and qualifications of the person(s) responsible for design and directing the blasting. This submittal shall document by project lists and samples of blasting round design calculations that the person has the required experience in perimeter control blasting and in controlling open-cut blast vibrations in blasting rounds of the type required on the project.
7. If vibration monitoring is to be conducted by the Contractor, name and qualifications of the person(s) responsible for monitoring and reporting blast vibrations and overpressures.
8. If vibration monitoring is to be conducted by the Contractor, a listing of instrumentation proposed to monitor vibrations and airblast overpressure levels complete with performance specifications and user's manuals supplied by the manufacturer.
9. If vibration monitoring is to be conducted by the Contractor, recent calibration certificate(s) (within previous twelve months) for the proposed blast monitoring instrumentation. Calibration shall be over the required frequency response ranges specified for blast monitoring instrumentation and to a standard traceable to the National Institute of Standards and Technology.

10. Details of an audible advance signal system to be employed at the job site as a means of informing workers, Engineer, Owner and his representatives, and the general public that a blast is about to occur.
11. Submit a certificate of insurance documenting that blasting liability insurance coverage in an amount of $5,000,000 specifically available for this contract will be in force for the duration of blasting at the site. The Contractor shall ensure that all damage claims will be honored, pursuant to the terms of the insurance policies and/or applicable state law.
12. Submit a copy of the blasting permit(s) obtained to conduct blasting on the site, when received.

B. Progress Submittals:

1. In the event that the design round results in ground vibrations and/or airblast overpressures which exceed the blasting limit criteria specified in this Section, immediately revise the round design appropriately.
2. Report to the Engineer and Owner in writing all blasting complaints received within 24 hours of receipt. Each blast complaint report shall include the name and address of the complainant, time received, date and time of blast complained about and a description of the circumstances which led to the complaint.

C. Review by the Engineer of blast designs and techniques shall not relieve the Contractor of responsibility for the accuracy, adequacy and safety of the blasting, exercising proper supervision and field judgment and producing the results within the blasting limits required by these Specifications, and preventing damage to adjacent structures.

D. If, after review, the Engineer requires re-submission for any reason, the specified time period(s) for review shall be four workdays and shall commence upon the date of receipt of the re-submittal(s). The Contractor is responsible for scheduling specified submittal and re-submittal so as to prevent delays in the work.

E. Two copies of blasting records, together with an explanatory narrative of the blasting, shall be submitted to the Engineer.

1.7 PRE-BLAST CONDITION SURVEY

A. The Contractor shall engage the services of a qualified, independent professional consultant, acceptable to the Owner, to conduct a pre-blast condition survey of adjacent buildings, utilities and other concerned structures within 500 feet of the blast or as required by other code or permit requirements..

B. Two copies of the Contractor’s record of pre-blast condition surveys shall be submitted to the Owner.

1.8 INDEMNITY

A. Notwithstanding full compliance with these Specifications, approval of blasting plan, and successful limitation to maximum peak particle velocity, air blast overpressure, and heave noted above, the Contractor shall be solely responsible for any damage, direct or

indirect, arising from blasting and shall hold the Engineer, Owner and their consultants harmless from any costs, liens, charges, claims or suits, including the costs of defense, arising from such damage, real or alleged. The Engineer, Owner and their consultants shall be additionally-named insured on any insurance policy covering blasting carried by the Contractor, and this requirement shall also be enforced on any Subcontractor.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Explosives: As recommended by the Contractor based on seismic survey, and as permitted by NFPA 495, the Maine State Fire Marshall, City of South Portland regulations, and City of Portland regulations.

B. Delay Device: As recommended by the Contractor and as permitted by NFPA 495, and the Maine State Fire Marshall.

C. Blast Mat Materials: As recommended by the Contractor.

PART 3 - EXECUTION

3.1 EXECUTION MINIMUM SAFETY PRECAUTIONS

A. Clearing the Danger Area Before Blasting

No blasting shall be permitted until all personnel in the danger area have been removed to a place of safety. A loud, audible, warning system, devised and implemented by the Contractor, shall be sounded before each blast. The Contractor shall familiarize all personnel on the project, Engineer, Owner, and the general public with the implemented system. The danger area shall be patrolled before each blast to make certain that it has been completely cleared, and guards shall be stationed to prevent entry until the area has been cleared by the blaster following the blast.

B. Explosives shall be stored, handled and employed in accordance with federal, state, and local regulations.

C. No explosives, caps, detonators or fuses shall be stored on the site during non-working hours.

D. Blasting mats shall be used to cover all blasts in order to minimize the possibility of flyrock.

E. Sound, airblast overpressure and dust control measures shall be provided by the Contractor at all times.

F. The Contractor shall be responsible for determining any other safety requirements unique to blasting operations on this particular site so as not to endanger life, property, utility services, any existing or new constructions, or any property adjacent to the site.

G. No requirement of, or omission to require, any precautions under this Contract shall be deemed to limit or impair any responsibility or obligations assumed by the Contractor under or in connection with this Contract; and the Contractor shall at all times maintain adequate protections to safeguard the public and all persons engaged in the work, and shall take such precautions as will accomplish such end, without undue interference to the public. The Contractor shall be responsible for and pay for any damage to adjacent structures resulting from work executed under this Section.

H. All transportation, storage and handling of explosives, and all drilling and blasting operations shall be performed in accordance with M.R.S.A. Title 25, Section 2442, and all pertinent provisions of: the "Manual of Accident Prevention in Construction", issued by the Associated General Contractors of America, Inc.; the "Construction Safety Rules and Regulations", as adopted by the State Board of Construction Safety, Augusta, Maine; the Maine Department of Transportation "Safety Specifications", Section 107.12, "Use of Explosives"; and the U.S. Dept. of Interior "Blasting Guidance Manual."

I. Any site where electric blasting caps are located, or where explosive charges are being placed or have been placed, shall be designated as a "Blasting Area."

J. Bring explosives to the Work site only as needed and in small quantities.

K. A "Blasting Area" within 300 feet of any traveled way shall be marked in both directions by approved signs, with information similar to the following:

"BLASTING AREA. TURN OFF TRANSMITTERS"
and on the reverse side:
"END OF BLASTING AREA"

L. Notify each public utility company having structures in proximity to the site of the Work of the impending use of explosives, and give such notice sufficiently in advance to enable each company to take such steps as it may deem necessary to protect their property from injury. Such notice shall not relieve the Contractor of responsibility for any damage resulting from his blasting operations.

M. The Contractor shall be liable for all damages to persons or property caused by blasting or explosions, or arising from neglect to properly guard and protect the excavations and all portions of the Work, and the Contractor shall wholly indemnify the Owner against claims on such account.

3.2 GENERAL BLASTING PROCEDURES

A. Blast Scheduling:

1. The Contractor shall coordinate all individual blasts and the general blasting schedule with the Owner in accordance with the following schedule:

a. A minimum of twenty-four (24) hours in advance, the Contractor shall notify the Owner of scheduled blast rounds.
b. A minimum of four (4) hours prior to a scheduled blast, the Contractor shall notify the Owner of the scheduled time of the blast. The scheduled time of the blast shall be confirmed one-half hour prior to the blast.

2. Blasting is restricted on Saturdays and Sundays. Blasting events shall be scheduled so that they are in accordance with permissible blasting hours for the City of Portland, City of South Portland, and the Owner. Blasting may be allowed on holidays with the written approval of the Owner.

B. The Contractor shall notify the Engineer at least 48 hours before blasting operations are to commence, and at least 24 hours prior to recommencing blasting if operations are suspended for any reason.

C. The Contractor shall conduct blasting operations such that damage is prevented to adjacent structures, property and work, and such that peak particle velocity, air blast overpressure, and heave/settlement levels do not exceed the maximum specified limits at the locations specified.

D. Blasting mats shall be used on each blast round detonated to prevent the throw of flyrock.

E. Noise, air blast overpressure and dust control measures shall be provided by the Contractor at all times.

F. No free-flowing, pourable or pumpable explosives shall be used. All explosives shall be in cartridges or other semi-rigid containers.

G. Well-designed blast rounds shall be utilized with adequate relief to allow rock to move out towards a free face, away from the perimeter of the excavation. All fragmented rock from previous rounds shall be removed from the face prior to the next round to allow for full relief.

3.3 SPECIAL PERIMETER CONTROL BLASTING PROCEDURES

A. Pre-Splitting (if used)

1. Pre-split blast holes shall be loaded and fired separately before the main round to create a fracture plane along the perimeter of the excavation.
2. Pre-split holes shall be string-loaded or space-loaded with light, distributed charges and shall be thoroughly stemmed for the full length of hole with sand. The top of the hole, for a minimum of 18 inches, shall be unloaded and stemmed with tamped sand and gravel.
3. Spacing, burden, hole diameter and loading shall be maintained within the guidelines listed in Table I unless deviation from the guidelines is approved by the Engineer based on observed field performance.

TABLE I

PRE-SPLITTING GUIDELINES

Hole Diameter (in.)	Hole Spacing Charge (ft.)	Column Load Concentrations (lb./ft)
1.5 to 2.5	1.0 to 1.5	0.06 to 0.15
3.0 to 4.0	1.5 to 2.0	0.10 to 0.20

4. Use of one or more strands of 400 grain/ft PRIMA-CORD, such as manufactured by the Ensign-Bickford Company, or equivalent, as a string-loaded column charge, will meet the required low level of column charge concentrations for pre-split holes.
5. The bottom charge concentration within the bottom 1 to 3 feet of hole shall be approximately two (2) times the column charge concentration.
6. Pre-split holes shall be fired simultaneously if particle velocity and air blast considerations will permit. Otherwise, groups of pre-split holes in segments along the pre-split line shall be systematically fired with millisecond (MS) delays.
7. Pre-split holes shall not deviate more than 6 inches out of alignment over the full maximum vertical lift height.
8. Loading of the first-row-in of production holes shall be approximately 50 percent of normal production hole loading.

B. Cushion Blasting (if used)

1. If used, cushion blast holes shall be loaded and fired separately after the main round to ensure a free face and equal burden.
2. Cushion blast holes shall be string-loaded or space-loaded with light charges, and shall be thoroughly stemmed with a minimum of 18 inches of tamped sand and gravel, or other material capable of maintaining explosive gas pressures. Spacing, burden, blast hole diameter and loading shall be maintained within the guidelines listed in Table I above.
3. The first row of drill holes in from the perimeter row shall be loaded with not more than four times the charge weight indicated in the above table. Spacing and burden of first row-in holes shall be decreased sufficiently from those of other production holes to ensure that the perimeter holes have a free face and equal burden for the full depth of the round.
4. Use of one or more strands of 400 grain/ft. PRIMA-CORD, such as manufactured by the Ensign-Bickford Company, or equivalent, as a string-loaded column charge, will meet the required low level of column charge concentrations for cushion blast holes.

END OF SECTION 31 23 16

SECTION 31 23 19 - DEWATERING

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. Design, furnish, install, test, operate, monitor, maintain and remove temporary dewatering system(s) to: (1) lower groundwater levels in soils below the final excavation level, maintain excavation stability, and prevent disturbance to soils below the final excavation level; and (2) collect and remove precipitation, surface water runoff, and construction generated waste waters from excavations in accordance with the requirements specified herein.
2. As required by applicable permits, sample effluent from the temporary dewatering system, conduct laboratory testing, and report the test data to the Engineer and the authority(s) having jurisdiction over the work.
3. Design, furnish, install, maintain, and operate a treatment system to treat groundwater if necessary to comply with permit(s) and discharge criteria, including treatment (if needed) to reduce contaminant concentrations in the dewatering effluent prior to discharge.

B. Related Sections:

1. Division 01 Section "Construction Progress Documentation and Photographic Documentation" for recording preexisting conditions and dewatering system progress.
2. Division 02 Section “Subsurface Explorations” for existing subsurface information.
3. Division 31 Section "Earth Moving" for excavating, backfilling, site grading, and for site utilities.
4. Division 31 Section "Lateral Support of Excavation" for shoring, bracing, and sheet piling of excavations.
5. Division 33 Section "Subdrainage" for permanent foundation wall, underfloor, and footing drainage.

1.3 DESIGN AND PERFORMANCE CRITERIA

A. The Contractor shall be solely responsible for the design, installation, operation, performance, maintenance, and decommissioning of the temporary dewatering system.

B. The Contractor shall design temporary dewatering systems and shall employ measures to protect existing and new site improvements and off-site structures against dewatering-induced impacts.

C. The Contractor shall coordinate with the Owner for access to the site to begin installation of wells and all other components of the dewatering system.

D. The Contractor shall discharge wastewater from the temporary dewatering system into appropriate receptors in accordance with relevant permit requirements.

E. The final design of the dewatering components is the sole responsibility of the Contractor and may include sumps, drainage ditches, well points, wells or some combination of those components to meet the performance criteria outlined herein.

F. Open pumping using sumps or ditches will be prohibited if such activity results in "boil" conditions, pumping of sand or fines, softening or loss of ground, or unstable excavation subgrades and slopes.

G. Means and methods for installing dewatering wells shall be selected by the Contractor. However, use of hollow-stem augers shall not be permitted due to the potential for borehole smearing. If mud rotary drilling methods are used, use of bentonite drilling mud will not be permitted.

H. If dewatering wells are used, the wells shall be constructed such that the annular space between the well screen and the borehole wall is between 3 and 8 in.

I. Dewatering wells, if used, shall be installed with appropriate sand or gravel pack filters and well screens to prevent pumping of sand or fines, and shall be developed in accordance with the reviewed design submittal. At a minimum, the wells shall be developed by pumping and surging, alternately jetting (with water or air) and pumping, or alternative method acceptable to the Engineer, until the water clears visibly and there is no visible evidence of suspended solids, including entrained soils and drilling fluids. Sand content in the water at the conclusion of well development and throughout well operation shall be less than 5 ppm, determined using a Rossum Sand Content Tester or Imhoff cone, averaged based on at least three measurements.

J. Following well development, install pumps, motors and appurtenances, and discharge piping to a header pipe at current grades and begin pumping. A sufficient number of wells, well points, sumps, drainage ditches or some combination of these components shall be installed and operated to dewater the site and achieve the project objectives.

K. Groundwater levels shall be lowered at least 24 inches below the base of excavations. The Contractor shall achieve and maintain this criterion until construction is complete in excavations.

L. Demonstrate satisfaction of the criteria herein by installing and monitoring observation wells in accordance with the design submittal. The Contractor may elect to install additional observation wells at their own cost to demonstrate the performance of its dewatering system.

M. As the excavation progresses, excavate new sumps and drainage ditches as needed at progressively lower elevations, and cut well risers, well screens, discharge columns and associated appurtenances, and arrange for water from the dewatering components to be pumped to the discharge point(s) via a header pipe at surface grade. Wells and well points must be protected from damage by construction equipment.

N. Modify the dewatering system at no additional cost to the Owner to achieve the requirements of this Section. Modifications may include additional sump pits, drainage trenches, dewatering wells, pumps, observation wells and other elements incidental to dewatering activities.

O. Comply with federal, state, and local codes, ordinances, permits and regulations for disposal of discharge effluent and collected sediment.

P. Locate dewatering system components where they will not prohibit execution of construction activities and permanent structures.

Q. Maintain continuous and complete effectiveness of dewatering systems around-the-clock during construction. Provide backup power generation for dewatering system components and devise emergency procedures for maintaining continuous, uninterrupted dewatering operations as necessary.

R. Design and operate the dewatering systems to prevent loss-of-ground by the pumping (removal) of fines from in-situ soils.

S. Maintain the dewatering system components to address water quality conditions such as hardness, corrosivity and potential for encrustation and bio-fouling by bacterial growth. Maintenance shall include treatment and cleaning of well screens and redevelopment, as necessary, to maintain pumping rates and well efficiency.

T. Maintain total suspended solids (i.e., turbidity), pH, and other contaminants within permit requirements through the use of sedimentation tanks, bag filters (or combination thereof) and pH control systems.

U. If requested by the Engineer, the Contractor shall excavate all unsuitable soils that become disturbed due to inadequate dewatering and replace the unsuitable soils with compacted fill, to the satisfaction of the Engineer and at no additional cost to the Owner.

V. Take measures to prevent damage to existing and new improvements (both on- and off-site) during the course of the Work. Repair damage, disruption, or interference to such improvements directly or indirectly caused by the Contractor's dewatering and recharge activities at no additional cost to the Owner.

1.4 SUBMITTALS

A. General

1. The Contractor shall forward submittals to the Engineer a minimum of three weeks prior to any planned work related to the Contractor’s submittals.
2. The time period(s) for submittals are the minimum required by the Engineer to review, comment, and respond to the Contractor. The Engineer may require resubmission(s) for various reasons. The Contractor is responsible for scheduling specified submittals and resubmittals so as to prevent delays in the work.
3. The Contractor’s submittals shall be reviewed and accepted by the Engineer prior to conducting any work.
4. The Contractor’s submittals shall be prepared and stamped by a Professional Engineer licensed in the State of Maine, retained by the Contractor. The Contractor’s Professional

Engineer shall have a minimum of five years' experience in the design of temporary construction dewatering and recharge systems similar to those required for this project.

5. The Contractor shall submit the qualifications and experience of the Engineer and the subcontractor or specialty dewatering firm responsible for the design, installation and operation of the dewatering systems.
6. Acceptance of the Contractor's submittals by the Engineer does not relieve the Contractor of the responsibility for the adequacy, safety and performance of the Work.

B. Prior to installing dewatering components at the site, the Contractor shall submit a Plan providing details on the means and methods of drilling the proposed wells, details on the well screen, filter pack and materials proposed for installing the deep wells, piezometers and observation wells. In addition, details on the means, methods and schedule for the well installation and development shall be included in this submittal.

C. Shop Drawings and Engineering Calculations:

1. Drawings and supporting engineering calculations for proposed dewatering systems as outlined below.

    a. Arrangements, sizes, characteristics, capacities, locations and depths and associated instrumentation of all elements of the proposed system.
    b. Technical data sheets for well sand/gravel materials proposed for use as filter packs around dewatering wells.
    c. Descriptions of equipment, materials and procedures for installing, operating, maintaining and removing dewatering systems relative to the proposed sequence of excavation, foundation construction and backfilling.
    d. Provisions for standby equipment and standby power supply.
    e. Means of discharge, disposal of water and control of sediment.
    f. Manufacturer's technical literature for the flow meter and totalizer proposed to measure flow rate and total volume discharged in accordance with applicable permit requirements.
    g. Details regarding schedule and procedure for cleaning sedimentation tanks and bag filters.
    h. Anticipated peak and average discharge rates.

2. Schematic details, descriptions, design calculations, and supporting technical information for proposed pretreatment systems to treat the groundwater for discharge as required by the applicable Permits.
3. Flow monitoring data (rate and total volume) for dewatering systems on a weekly basis.
4. Results of effluent sampling/testing per the requirements of applicable permits (e.g., TSS, oil and grease, pH for NPDES permit requirements).
5. Groundwater level data measured in the observation wells prior to and during excavation. This information should be submitted to the Engineer and Owner at least once per week.
6. Written plan for dewatering operations including control procedures to be adopted if dewatering problems arise.

D. Qualification Data: For qualified Installer.

E. Field quality-control reports.

F. Other Informational Submittals:

1. Photographs and Videotape: Show existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by dewatering operations.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer that has experience in design of dewatering systems and dewatering work.

B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to dewatering including, but not limited to, the following:

a. Inspection and discussion of condition of site to be dewatered including coordination with temporary erosion control measures and temporary controls and protections.
b. Proposed site clearing and excavations.
c. Existing utilities and subsurface conditions.
d. Coordination for interruption, shutoff, capping, and continuation of utility services.
e. Construction schedule. Verify availability of Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
f. Testing and monitoring of dewatering system.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:

1. Notify Architect and Construction Manager no fewer than two days in advance of proposed interruption of utility.
2. Do not proceed with interruption of utility without Architect's and Construction Manager's written permission.

B. Project-Site Information: A geotechnical data report has been prepared for this Project and is available for information only (see Division 2 Section “Subsurface Explorations”). Owner will not be responsible for interpretations or conclusions drawn from this data.

1. Make additional test borings and conduct other exploratory operations necessary for dewatering.

C. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

1. During dewatering, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect and Construction Manager if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials and equipment shall be of suitable size, capacity and type to:

1. Dewater soils below the final excavation level in accordance with the requirements established herein so that the work can be conducted in-the-dry.
2. Collect and remove groundwater, groundwater seepage, precipitation, surface water runoff, and other construction generated waters from the excavation for the purpose of maintaining dry and stable working surfaces.
3. Maintain suspended solids and other contaminants below permit criteria.
4. Pump, store, manage, treat and discharge treated groundwater as necessary.

B. Materials and equipment shall be of appropriate type and maintained in good working order at all times during the course of the Work. Any leaks or spills shall be immediately fixed or cleaned.

C. Employ standard drilling equipment (mounted on a truck, tracks or skid) capable of installing dewatering and observation wells under site conditions at the planned time of installation. Under no circumstances shall use of any drilling fluids other than potable water or degradable polymer slurry be permitted. Hollow stem auger drilling methods shall not be permitted. Drilling procedures shall not result in borehole smearing.

D. For observation wells, provide Schedule 40 slotted PVC observation well screens and risers (0.010 in. openings, 2-inch minimum inside diameter).

E. Filter sand for the dewatering wells shall be #2 Morie sand or Engineer-approved equivalent.

F. Filter sand for the observation wells shall be Ottawa sand or Engineer-approved equivalent.

G. Granular bentonite shall be Enviroplug Medium, as manufactured by Wyo-Ben, Inc., Billings, MT, or Holeplug, as manufactured by Baroid Division, Petroleum Services, Inc., Houston, TX, or acceptable equivalent.

H. Provide adequate back-up equipment in the case of equipment breakdown.

I. Provide a calibrated flow meter and a totalizer to measure the discharge flow rate and the total volume of water discharged into the storm drain.

J. Provide spigots in the discharge line after sediment control tanks/ bag filters and pretreatment systems for sampling water in accordance with applicable permits.

2.2 TREATMENT SYSTEMS

A. Treatment systems shall be implemented as required to control suspended solids, pH, and other contaminants to meet permit discharge requirements. Treatment systems shall be of sufficient size and capacity to process the anticipated groundwater flows and volumes, and to reduce contaminant concentrations to levels acceptable to the applicable permits.

B. Storage units used to handle quantities of groundwater in excess of the pretreatment unit capacity shall be of sufficient size, and capacity to allow the Work to proceed without interruption at no additional cost to the Owner. The Contractor shall incorporate any non-productive time due to interruptions in depressurization and dewatering into the schedule and costs for the Work.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.

1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.
2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

C. Provide temporary grading to facilitate dewatering and control of surface water.

D. Monitor dewatering systems continuously.

E. Promptly repair damages to adjacent facilities caused by dewatering.

F. Protect and maintain temporary erosion and sedimentation controls, which are specified in Division 01 Section "Temporary Facilities and Controls" and Division 31 Section "Site Clearing" during dewatering operations.

3.2 INSTALLATION AND EXECUTION

A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.

1. Space well points or wells at intervals required to provide sufficient dewatering as shown on the approved shop drawing submittal.
2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.

B. Before excavating below groundwater level, place system into operation to lower water to specified levels. Operate system continuously until structures have been constructed and fill materials have been placed or until dewatering is no longer required.

C. Provide an adequate system to lower and control groundwater to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.

1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.

D. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.

1. Maintain piezometric water level a minimum of 24 inches below surface of excavation.

E. Provide standby equipment on site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.

F. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

3.3 OFF-SITE DISCHARGE OF EFFLUENT

A. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by the Owner and authorities having jurisdiction.

B. Manage and treat the groundwater to meet the requirements of the permit(s). The Contractor shall comply with the most stringent criteria and requirements set forth by regulatory agencies.

C. The Contractor shall provide notification of the unexpected or non-complying discharge to the permit authority(s), Engineer, Construction Manager, and Owner. The Contractor shall then adapt and modify the dewatering systems as required to the meet the requirements of all permits. Dewatering shall not be stopped without prior approval of the Engineer. The Contractor shall immediately cease discharging treated groundwater to the storm drains, route the water to on-site storage units and notify the Engineer and Construction Manager if discharge

of oil or hazardous materials is sufficient to cause a sheen or monitoring data indicates the discharge is not in compliance with permit requirements.

D. The Contractor shall pay for all fines, penalties, and other costs associated with non-compliance of the permit(s) at no additional cost to the Owner. The Contractor shall also pay all storm drain and sewer use fees in connection with off-site discharge.

E. The Contractor shall arrange for sampling and testing of dewatering effluent, shall report the test data in the required format to the permit authority(s), Engineer and Owner, and shall perform other compliance activities in accordance with all applicable permit requirements.

F. Clean and remove all sediment or other materials discharged from the system that accumulate in the storm drains, sewers or other existing and new improvements both on- and off-site to the satisfaction of the Engineer and the Owner of the improvement(s) at no additional cost to the Owner.

G. Remove from the site and legally dispose of all by-products and spent materials resulting from pretreatment system mobilization and operation.

3.4 DECOMMISSIONING

A. Decommission dewatering wells (if used) and observation wells with tremied cement grout upon completion of dewatering activities. Remove the portions of the dewatering wells to within a minimum of 5 ft of ground surface.

B. Remove and backfill other dewatering elements (such as well points, ditches and sumps) when no longer required using methods acceptable to the Engineer. Backfill any voids resulting from dewatering system removal with cement grout, concrete, or other material as directed by the Engineer to prevent potential loss of ground.

3.5 FIELD QUALITY CONTROL

A. Observation Wells: Provide, take measurements, and maintain at least the minimum number of observation wells or piezometers indicated on the approved shop drawing submittal; additional observation wells may be required by authorities having jurisdiction.

1. Observe and record daily elevation of ground water and piezometric water levels in observation wells.
2. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. In areas where observation wells are not functioning properly, suspend construction activities until reliable observations can be made. Add or remove water from observation well risers to demonstrate that observation wells are functioning properly.
3. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.

B. Provide continual observation to ensure that subsurface soils are not being removed by the dewatering operation.

END OF SECTION 31 23 19

SECTION 31 50 00 – LATERAL SUPPORT OF EXCAVATION

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. The Work specified in this Section includes design, furnishing, and installation of temporary excavation support systems as necessary to conduct the work and protect adjacent structures.

1. The temporary excavation support systems may be comprised of steel sheetpiling, drilled-in soldier piles and timber lagging or other system designed by the Contractor and accepted by the Engineer. Timber sheetpiling support of excavation systems shall not be used.
2. For proposed sanitary pump station, competent bedrock will be encountered within the excavation limits. Temporary excavation support in this location may require sheetpiling with a grout seal at the soil/rock interface.
3. Rock excavation will be required to achieve design subgrade levels for the sanitary pump station and other utilities. In these areas the sides of the excavation will consist of excavated/ blasted bedrock. These faces shall be maintained, protected and stabilized by the Contractor. Installation of rock dowels may be required to stabilize some portions of the rock faces. This work (if needed) will be included in this Section at no additional cost to the Owner.

B. Following construction, support of excavation system elements shall be removed to the requirements stated herein.

C. The system shall be designed to limit the total movement of the system, including lateral deflection. The Contractor is solely responsible for the health and safety of the work specified in this Section.

D. Geotechnical Instrumentation shall be installed by the Contractor on the excavation support system to monitor lateral and vertical movements of the system. The Contractor is responsible for installing and surveying reference points on the top of the support of excavation system.

E. Take all measures necessary to protect the occupants and operations of the existing facilities from dust, excess noise, vibrations or other impacts of the construction.

F. Related Sections:

1. Division 02 Section “Subsurface Investigation” for existing subsurface information.

2. Division 31 Section "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
3. Division 31 Section "Earth Moving" for excavating, backfilling, site grading, and for site utilities.
4. Division 31 Section "Dewatering" for lowering and disposing of ground water during construction.
5. Division 31 Section "Rock Removal" for removal of bedrock using controlled blasting techniques.

1.3 DEFINITIONS AND REFERENCES

A. American Society of Testing and Materials (ASTM):

1. A36: Standard Specification for Structural Steel.
2. A416: Specification for Uncoated Seven-Wire Stress-Relieved Steel Strand for Prestressed Concrete.
3. A722: Specification for Uncoated High-Strength Steel Bar for Prestressing Concrete.
4. A615: Standard Specifications for Deformed and Plain Billet- Steel Bars for Concrete Reinforcement.

B. American Wood-Preservers Association (AWPA) Standards.

C. American Welding Society (AWS) Code: D1.1.

D. Federal Standard, FS TT-W-S71: Wood Preservation and Treating Practices.

E. Occupational Safety and Health Administration (OSHA) Standards and Interpretations: Subpart P - Excavations, Trenching, and Shoring, current edition.

F. American Concrete Institute (ACI)

1. ACI 304: Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete

G. Engineer: Authorized representative of the Owner. For the Scope of Work covered under this Section, the term will include Haley & Aldrich, Inc. and OEST Associates, Inc., an AMEC Company.

1.4 JOB CONDITIONS

A. Refer to Division 02 Section “Subsurface Investigation” for available information on existing subsurface conditions.

B. Prior to submitting their bid, the Contractor shall review and understand the information provided herein and the information outlined in Division 02 Section “Subsurface Investigation”. The subsurface information is made available to the Contractor for information on factual data only and shall not be interpreted as a warranty of subsurface conditions whether interpreted from written text, boring logs or other data.

C. Below-Grade Utilities and Obstructions

1. The Contractor is advised that the in-situ fill soils may contain cobbles, boulders and man-made structures. These items will not be considered obstructions and shall be removed as needed at no additional cost to the Owner.
2. Cobbles and boulders within the naturally deposited soils will not be considered obstructions.
3. Refer to the Drawings for locations of utilities required to remain, to be relocated, to be removed, or to be abandoned as a result of this project.

D. Protection of Adjacent Property and Utilities:

1. The Contractor shall protect adjacent structures (above ground and buried) from damage associated with the installation and performance of the excavation support system. Damage due to installation and performance of the excavation support systems shall be repaired immediately by the Contractor at no additional cost to the Owner.

1.5 QUALITY ASSURANCE

A. Prepare design, including calculations and drawings, under the direction of a Maine Licensed Professional Engineer.

B. Qualifications of Support of Excavation System Designer:

1. Shall be a Maine Licensed Professional Engineer specializing in geotechnical construction.
2. Support of Excavation system designer shall stamp and sign all support of excavation system calculations, details, and drawings.

C. Install all support of excavation systems under the supervision of a specialist having the following qualifications:

1. Not less than five (5) years experience in the design and installation of systems of similar type and equal complexity as the proposed systems.
2. Completed five (5) successful support of excavation systems of similar type and equal complexity as the proposed system in the last five (5) years.

D. Design support of excavation systems to withstand an additional 2 feet of excavation below proposed bottom of excavation without redesign except for the addition of lagging and/or bracing.

E. Design support of excavation systems for stability of excavations through overburden soils and for safety during construction.

F. Design support of excavation systems, taking into account dewatering procedures to address groundwater flows and surcharge loading to address construction equipment loading as necessary.

G. Obtain and comply with all permits, laws, regulations and codes.

H. All welding shall be performed in accordance with AWS D1.1.

I. The Contractor shall install the reference points on the support of excavation (and obtain baseline readings) prior to the start of excavation within 50 ft of the support system. The Engineer will determine if the installed instruments are acceptable. The Contractor shall immediately replace, at no additional cost to the Owner, unsatisfactory instrumentation or instrumentation that is damaged during the project. This latter requirement applies to all instrumentation installed by the Contractor regardless of location, and all instrumentation damaged as a result of the Work.

1.6 DESIGN CRITERIA

A. The excavation support system shall be designed to support earth, water, and surcharge loads (from adjacent buildings, construction equipment and stockpiles, cranes, traffic using HS20-44 loading, and other sources) imposed on the system during the construction period. The Contractor's design shall also consider the means and methods and construction process proposed by the Contractor construct foundations and below grade structures.

B. Minimum criteria for design of the excavation support systems are outlined below. Design calculations and drawings shall be prepared and stamped by a professional engineer licensed in the State of Maine employed by the Contractor and will be reviewed by the Engineer.

1. Design each component of the excavation support system to support the maximum combination of loading (including but not limited to loading from soil, groundwater and construction surcharges) than can occur during construction.
2. Design support of excavation systems using the following soil properties:

Soil	Total Unit Weight (pcf)	Phi (degrees)	s_u (psf)
Fill	125	30	not applicable
Marine Clay	115	not applicable	600
Glacial Till	120	32	not applicable

3. Rankine active and passive lateral earth pressure coefficients shall be used to design the support of excavation system.
4. Static groundwater level at El. 62 shall be used for the sanitary pump station location.
5. A minimum lateral surcharge pressure of 100 psf for surcharge loads due to construction equipment shall be used for design, and distributed as a uniform pressure over the height of excavation. The Contractor shall increase the surcharge loads based on localized construction equipment and staging requirements.

1.7 SUBMITTALS

A. Submit the following:

1. All qualifications as listed below. Include with all job/project references the name of the project and the names, current addresses and telephone numbers of persons in charge of representing such projects' owner or the owner at the time of excavation.

a. Support of Excavation System Designer's qualifications.
b. Support of Excavation System Supervisor's qualifications.

2. List of all applicable laws, regulations, rules, and codes to which support of excavation system design conforms.
3. Shop Drawings: Submit a plan showing location and details of the proposed temporary excavation support system, including bracing, stamped and signed by a licensed professional engineer in the State of Maine. The Contractor shall be solely responsible for the adequacy and safety of the means, methods and sequencing of construction. This submittal shall include the following items as a minimum:

    a. Show plan limits of proposed earth excavation support system(s), depth of proposed system(s), location and extent of differing types of bracing systems relative to existing features and the permanent structures to be constructed.
    b. Elevations, sections and profiles showing bearing elevations, and maximum excavation levels.
    c. Construction details including materials, sizes, dimensions, connections and methods and sequence of excavation support installation, pile installation, permanent structure installation, and excavation backfilling, and excavation support system removal.
    d. Plan showing the location and designation of reference points to be installed at the tops of the support systems, and the location of any additional settlement points and other instrumentation proposed by the Contractor.
    e. Provide weekly lateral and vertical survey data from the reference points installed on the top of the support systems. The data shall be provided to the Engineer within 48 hours of completion of each survey and shall be tabularized showing at a minimum the following information for each survey: reference point designation, date surveyed, and vertical and horizontal survey data.

4. Tolerable support of excavation system movements for each proposed support of excavation system.
5. Complete set of design calculations for all support of excavation systems including assumptions and all parameters used in design.
6. Verification that heavy structural timber used on the job has been treated with wood preservatives (if used).
7. Rock Doweling (if required): Submit shop drawings, calculations, details, materials and written sequence indicating the Contractor's proposed scheme, plan limits and sequencing of rock doweling. Include a plan showing the plan and profile limits of the proposed rock dowel locations, inclinations, lengths. This submittal shall be prepared and stamped by a Professional Engineer licensed in the State of Maine, employed by or retained by the Contractor.

1.8 DELIVERY, STORAGE AND HANDLING

A. Store soldier piles and bracing materials to prevent sagging which would produce permanent deformation. Keep concentrated loads which occur during stacking or lifting below the level which would produce permanent deformation of the material.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Structural steel shall conform to the current edition of "AISC Specifications for the Design and Erection of Structural Steel for Buildings". All welding shall conform to the latest addition of AWS D1.1.

B. If used, provide timber lagging conforming to the following requirements:

1. Moisture content shall not exceed 19 percent.
2. Provide sound, well-seasoned timber such as Douglas Fir, Southern Pine, Cedar or equal.
3. Preservation wood treatment in accordance with FS TT-W-571.
4. Allowable working stress of not less than 1200 psi.
5. Nominal thickness of not less than 3 inches.

C. Survey Reference Points on Support of Excavation System: Chisel mark or welded survey hub on the top of the excavation support wall. Survey marks shall be clearly identified using fluorescent spray paint and the individual reference point designations shall be clearly displayed in permanent ink or paint.

PART 3 - EXECUTION

3.1 EXECUTION

A. Perform the support of excavation program in such a manner as to prevent undermining or disturbing foundations of existing structures or of Work ongoing or previously completed.

B. Begin no excavation involving support of excavation until all support of excavation submittals have been reviewed by the Owner and the Engineer.

C. Control surface water and groundwater.

D. Review of the Contractor's design by the Owner and Engineer will in no way relieve the Contractor of responsibility for the successful performance of construction or any method of protection for adjoining property. Contractor shall correct any failure, damages, subsidence, upheaval or cave-ins as a result of improper installation, maintenance, or design at no additional cost to the Owner. Contractor shall resolve all claims, costs and damages that arise as a result of the Work performed at no additional cost to the Owner. Protect all existing utilities affected by construction from damage.

E. Expose active utilities by hand, where they lie within Work area.

F. Notify utility owners if existing utilities interfere with the support of excavation system. Modify the existing utility with the utility owner's permission or have the utility owner make the modifications at no additional cost to the Owner.

G. Do not splice elements of the support of excavation system.

H. Excavations shall not proceed more than 2 feet below any bracing level prior to the installation and loading of the brace.

I. Install survey reference points along top of the excavation support wall to monitor vertical and lateral movements of the wall. The maximum spacing between points shall not exceed 25 ft along the length of the excavation support wall.

3.2 SOLDIER PILES AND LAGGING

A. Install pile tips to embedment elevations shown on accepted shop drawings. It is likely that the some of the soldier piles will need to be drilled and grouted into bedrock. Grout in the annular space between the drill hole and pile section shall be placed by tremie methods.

B. Install lagging with openings (gaps) between boards to retain the material type encountered in the excavation while allowing free draining of water. As the installation progresses, backpack the voids between the excavation face and the lagging with sandpack or existing fill to establish a tight contact. Pack openings between lagging with hay or other porous material to allow free draining for water without loss of retained soil or sandpack. A maximum height of unlagged face shall not exceed 3 ft. Coordinate the excavation with lagging placement. Reduce the maximum height of unlagged face if water is flowing from the face of the excavation, or if soil to be retained moves toward the excavation.

C. If running sand and silt is encountered, secure the lagging to the soldier piles to avoid shifting or movement of the lagging and pack opening between lagging with additional porous material to contain the leaking material.

D. If very fine sand and/or silt are encountered, take measures to retain the material in place and prevent loss of ground and/or movements which may cause damage to adjacent buildings, structures or utilities.

3.3 STEEL SHEET PILES

A. Do not drive sheetpiling within 100 feet of concrete less than seven (7) days old.

B. Drive sheetpiling in plumb position such that each pile installed is continuously interlocked with adjacent piles along the entire length. Use templates or other temporary alignment facilities to maintain sheeting on line.

C. Drive sheeting to the depths shown on shop drawings. Do not overdrive sheeting or otherwise cause damage to sheetpile (tops, tips, or interlocks).

D. After driving, sheeting shall be in direct contact with material to be retained.

3.4 MAINTENANCE OF SOIL SUPPORTS

A. Maintain steel members for bracing and replacement lagging on hand throughout lagging and bracing Work and other support of excavation operations to protect the Work and for use in case of accident or emergency.

B. Seal leaks uncovered in the walls as excavation progress.

3.5 REMOVAL OF SUPPORT OF EXCAVATION SYSTEM

A. Remove the support of excavation system without endangering the construction, under this or other Contracts, other structures, utilities, or property.

B. Immediately backfill all voids left or caused by withdrawal of support of excavation systems with crushed stone, granular fill, or controlled low-strength material as specified in Division 31 Section “Earth Moving” by tamping with tools specifically adapted for that purpose.

C. Conduct survey of the locations and final cut-off elevations of the top of all support of excavation systems left in place and submit to the Owner.

3.6 MOVEMENT CONTROL

A. Maintain the lateral movement of the excavation support system below the tolerable movements provided in the support system submittal.

B. The Contractor shall notify the Engineer if measured movements exceed anticipated tolerable movements. The Contractor shall take immediate steps to control further movement by revising his procedures, providing supplemental bracing or other measures (working 24 hours per day and temporarily terminating work in the area of movement if necessary).

C. If movement of the excavation support system reaches or exceeds the anticipated tolerable value, the Engineer, based on his/her judgment and review of the movement monitoring data, may require that the Contractor temporarily terminate the work in the area where such movement is occurring and implement all necessary mitigation measures which are satisfactory to the Engineer to arrest the movements at no additional cost to the Owner.

D. These criteria are intended to establish a minimum basis for the Contractor’s design and procedures and in no way relieve the Contractor of his/her sole responsibility for preventing detrimental movements and damage to adjacent existing and new site improvements.

END OF SECTION 31 50 00

SECTION 32 12 16 - ASPHALT PAVING

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. Hot-mix asphalt patching.
2. Hot-mix asphalt paving.
3. Asphalt surface treatments.
4. Pavement-marking paint.

B. Related Sections:

1. Division 31 Section "Earth Moving" for aggregate subbase and base courses and for aggregate pavement shoulders.

1.3 DEFINITION

A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms and Maine DOT Standard Specifications.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

1. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.

B. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

C. Qualification Data: For qualified Installer.

D. Material Certificates: For each paving material, from manufacturer.

E. Material Test Reports: For each paving material.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by the Maine DOT.

B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.

C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of of Maine DOT for asphalt paving work.

1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

D. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:

a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
b. Review condition of subgrade and preparatory work.
c. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
d. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:

1. Tack Coat: Minimum surface temperature of 60 deg F.
2. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
3. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials to 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

B. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.

C. Fine Aggregate: ASTM D 1073 or AASHTO M 29, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.

1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

D. Mineral Filler: ASTM D 242 or AASHTO M 17, rock or slag dust, hydraulic cement, or other inert material.

2.2 ASPHALT MATERIALS

A. Asphalt Binder: Shall conform to requirements as specificed in the Maine DOT Standard Specifications.

B. Asphalt Cement: Shall conform to requirements as specificed in the Maine DOT Standard Specifications.

C. Tack Coat: Shall conform to requirements as specificed in the Maine DOT Standard Specifications.

D. Water: Potable.

2.3 AUXILIARY MATERIALS

A. Joint Sealant: Shall conform to requirements as specificed in the Maine DOT Standard Specifications..

B. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than three minutes.

1. Color: As indicated on the plans.

C. Glass Beads: AASHTO M 247, Type 1.

2.4 MIXES

A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction and complying with the following requirements:

1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
2. Base Course: As specified in the Maine DOT Standard Specifications.
3. Surface Course: specified in the Maine DOT Standard Specifications.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

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

D. Verify that utilities, traffic loop detectors, and other items requiring a cut and installation beneath the asphalt surface have been completed and that asphalt surface has been repaired flush with adjacent asphalt prior to beginning installation of imprinted asphalt.

3.2 PATCHING

A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd.

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

C. Patching: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

3.3 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.

C. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.4 HOT-MIX ASPHALT PLACING

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
2. Place hot-mix asphalt surface course in single lift.
3. Spread mix at minimum temperature of 250 deg F.
4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.5 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
3. Offset transverse joints, in successive courses, a minimum of 24 inches.
4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints as shown on Drawings.
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.6 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 96 percent of reference laboratory density according to ASTM D 6927 or AASHTO T 245, but not less than 94 percent nor greater than 100 percent.
2. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.7 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2 inch.
2. Surface Course: Plus 1/4 inch, no minus.

B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. Base Course: As specified in the Maine DOT Standard Specifications.
2. Surface Course: As specified in the Maine DOT Standard Specifications.
3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.8 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow paving to age for 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

1. Broadcast glass beads uniformly into wet pavement markings at a rate of 6 lb/gal..

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according tMaine DOT Standard Specifications.

1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.

    a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
    b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

E. Replace and compact hot-mix asphalt where core tests were taken.

F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.10 DISPOSAL

A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

END OF SECTION 32 12 16

SECTION 32 13 13 - CONCRETE PAVING

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. Precast concrete curbs or cast-in-place slip form curbs.
2. Walks.
3. Islands.

B. Related Sections:

1. Division 03 Section "Cast-in-Place Concrete or Miscellaneous Cast-in-Place Concrete" for general building applications of concrete.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:

1. Product Data for Credit MR 4.1: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.
2. Design Mixtures for Credit ID 1.1: For each concrete mixture containing fly ash as a replacement for portland cement or other portland cement replacements. For each design mixture submitted, include an equivalent concrete mixture that does not contain portland cement replacements, to determine amount of portland cement replaced.

C. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

D. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color selection.

E. Other Action Submittals:

1. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

F. Material Certificates: For the following, from manufacturer:

1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Admixtures.
4. Curing compounds.
5. Applied finish materials.
6. Bonding agent or epoxy adhesive.
7. Joint fillers.

G. Material Test Reports: For each of the following:

1. Aggregates.

H. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

B. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

C. Concrete Testing Service: Engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures.

D. ACI Publications: Comply with ACI 301 unless otherwise indicated.

E. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to concrete paving, including but not limited to, the following:

a. Concrete mixture design.
b. Quality control of concrete materials and concrete paving construction practices.

2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:

    a. Contractor's superintendent.
    b. Independent testing agency responsible for concrete design mixtures.
    c. Ready-mix concrete manufacturer.
    d. Concrete paving subcontractor.

1.6 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less. Do not use notched and bent forms.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.2 STEEL REINFORCEMENT

A. Recycled Content: Provide steel reinforcement with an average recycled content of steel so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. Epoxy-Coated Welded Wire Reinforcement: ASTM A 884/A 884M, Class A, plain steel.

C. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M or ASTM A 934/A 934M; with ASTM A 615/A 615M, Grade 60 deformed bars.

D. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A coated, plain.

E. Epoxy-Coated, Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60, plain-steel bars.

F. Tie Bars: ASTM A 615/A 615M, Grade 60, deformed.

G. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports

according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:

1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

H. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating, compatible with epoxy coating on reinforcement.

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source throughout Project:

1. Portland Cement: ASTM C 150, gray portland cement Type I/II. Supplement with the following:

   a. Fly Ash: ASTM C 618, Class C or Class F.
   b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

2. Blended Hydraulic Cement: ASTM C 595, Type IS, portland blast-furnace slag or Type IP, portland-pozzolan cement.

B. Normal-Weight Aggregates: ASTM C 33, uniformly graded. Provide aggregates from a single source with documented service-record data of at least 10 years' satisfactory service in similar paving applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: Potable and complying with ASTM C 94/C 94M.

D. Air-Entraining Admixture: ASTM C 260.

E. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.4 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry or cotton mats.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Axim Italcementi Group, Inc.; Caltexol CIMFILM.
b. BASF Construction Chemicals, LLC; Confilm.
c. ChemMasters; Spray-Film.
d. Conspec by Dayton Superior; Aquafilm.
e. Dayton Superior Corporation; Sure Film (J-74).
f. Edoco by Dayton Superior; BurkeFilm.
g. Euclid Chemical Company (The), an RPM company; Eucobar.
h. Kaufman Products, Inc.; VaporAid.
i. Lambert Corporation; LAMBCO Skin.
j. L&M Construction Chemicals, Inc.; E-CON.
k. Meadows, W. R., Inc.; EVAPRE.
l. Metalcrete Industries; Waterhold.
m. Nox-Crete Products Group; MONOFILM.
n. Sika Corporation, Inc.; SikaFilm.
o. SpecChem, LLC; Spec Film.
p. Symons by Dayton Superior; Finishing Aid.
q. TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM.
r. Unitex; PRO-FILM.
s. Vexcon Chemicals Inc.; Certi-Vex EnvioAssist.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Anti-Hydro International, Inc.; A-H Curing Compound #2 DR WB.
b. ChemMasters; Safe-Cure Clear.
c. Conspec by Dayton Superior.
d. Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).
e. Edoco by Dayton Superior.
f. Euclid Chemical Company (The), an RPM company; Kurez W VOX.
g. Kaufman Products, Inc.; Thinfilm 420.
h. Lambert Corporation; AQUA KURE - CLEAR.
i. L&M Construction Chemicals, Inc.; L&M CURE R.

j. Meadows, W. R., Inc.; 1100-CLEAR SERIES.
k. Nox-Crete Products Group; Resin Cure E.
l. SpecChem, LLC; PaveCure Rez.
m. Symons by Dayton Superior; Resi-Chem Clear.
n. Tamms Industries, Inc., Euclid Chemical Company (The); TAMMSCURE WB 30C.
o. TK Products, Division of Sierra Corporation.
p. Vexcon Chemicals Inc.; Certi-Vex Enviocure 100.

2.5 RELATED MATERIALS

A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork in preformed strips.

B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881/C 881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Chemical Surface Retarder: Water-soluble, liquid, set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. ChemMasters; Exposee.
b. Conspec by Dayton Superior; Delay S.
c. Dayton Superior Corporation; Sure Etch (J-73).
d. Edoco by Dayton Superior; True Etch Surface Retarder.
e. Euclid Chemical Company (The), an RPM company; Surface Retarder Formula S.
f. Kaufman Products, Inc.; Expose.
g. Meadows, W. R., Inc.; TOP-STOP.
h. Metalcrete Industries; Surftard.
i. Nox-Crete Products Group; CRETE-NOX TA.
j. Scofield, L. M. Company; LITHOTEX Top Surface Retarder.
k. Sika Corporation, Inc.; Rugasol-S.
l. SpecChem, LLC; Spec Etch.
m. TK Products, Division of Sierra Corporation; TK-6000 Concrete Surface Retarder.
n. Unitex; TOP-ETCH Surface Retarder.

o. Vexcon Chemicals Inc.; Certi-Vex Envioset.

F. Rock Salt: Sodium chloride crystals, kiln dried, coarse gradation with 100 percent passing 3/8-inch sieve and 85 percent retained on a No. 8 sieve.

2.6 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that meet or exceed requirements.

B. Proportion mixtures to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 4500 psi.
2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.50.
3. Slump Limit: 5 inches, plus or minus 1 inch.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

1. Air Content: 4-1/2 percent plus or minus 1.5 percent for 1-1/2-inch nominal maximum aggregate size.
2. Air Content: 4-1/2 percent plus or minus 1.5 percent for 1-inch nominal maximum aggregate size.
3. Air Content: 5 percent plus or minus 1.5 percent for 3/4-inch nominal maximum aggregate size.

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use in concrete as required for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

F. Cementitious Materials: Limit percentage by weight of cementitious materials other than portland cement according to ACI 301 requirements as follows:

1. Fly Ash or Pozzolan: 25 percent.
2. Ground Granulated Blast-Furnace Slag: 50 percent.
3. Combined Fly Ash or Pozzolan, and Ground Granulated Blast-Furnace Slag: 50 percent, with fly ash or pozzolan not exceeding 25 percent.

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M. Furnish batch certificates for each batch discharged and used in the Work.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For concrete batches of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For concrete batches larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

2.8 PRECAST CONCRETE CURB

A. Precast concrete curb meeting the following requirements:

1. Concrete 8000 psi at 28 days.
2. Reinforcing with two #4 rebars.
3. Approximate weight 130 lbs/lf.
4. Radii larger than 60 feet are formed from straight sections.
5. Coat with a clear sealer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Division 31 Section "Earth Moving."

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

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M.

3.5 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.

2. Provide tie bars at sides of paving strips where indicated.
3. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 30 feet unless otherwise indicated.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.

    a. Tolerance: Ensure that grooved joints are within 3 inches either way from centers of dowels.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

    a. Tolerance: Ensure that sawed joints are within 3 inches either way from centers of dowels.

3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.

B. Remove snow, ice, or frost from subbase surface and steel reinforcement if installed before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement dowels and joint devices.

H. Screed paving surface with a straightedge and strike off.

I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

J. Slipform Curbs: Use design mixture for automatic machine placement. Produce curbs to required cross section, lines, grades, finish, and jointing.

K. Cold-Weather Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

L. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.7 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
2. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.
3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3.8 DETECTABLE WARNINGS

A. Blockouts: Form blockouts in concrete for installation of detectable warning devices as specified on the Plans.

1. Tolerance for Opening Size: Plus 1/4 inch, no minus.

3.9 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound or a combination of these as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas that have been subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

3.10 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:

1. Elevation: 3/4 inch.
2. Thickness: Plus 3/8 inch, minus 1/4 inch.
3. Surface: Gap below 10-foot- long, unleveled straightedge not to exceed 1/2 inch.
4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
5. Lateral Alignment and Spacing of Dowels: 1 inch.
6. Vertical Alignment of Dowels: 1/4 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
8. Joint Spacing: 3 inches.
9. Contraction Joint Depth: Plus 1/4 inch, no minus.
10. Joint Width: Plus 1/8 inch, no minus.

3.11 PRECAST CONCRETE CURB

A. Install in accordance with MDOT specifications.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or 5000 sq. ft. or fraction thereof of each concrete mixture placed each day.

    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.

    a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

G. Concrete paving will be considered defective if it does not pass tests and inspections.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

I. Prepare test and inspection reports.

3.13 REPAIRS AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 13 13

SECTION 32 14 00 - UNIT PAVING

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. This Section includes the following:

1. Granite stone curbs.

B. Related Sections include the following:

1. Division 31 Section "Earth Moving" for excavation and compacted subgrade.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Granite stone curbs.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain granite stone curbs from one source with resources to provide materials and products of consistent quality in appearance and physical properties.

B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store granite curb in an orderly manner and in locations to avoid damage from construction equipment.

1.6 PROJECT CONDITIONS

A. Cold-Weather Protection: Do not build on frozen subgrade or base gravel.

PART 2 - PRODUCTS

2.1 GRANITE CURB

A. Granite Stone Curbs: Gray granite stone per MDOT Specifications Section 712.04, minimum length 48 inches. Pink granite curb is not allowed on this project.

1. Varieties and Sources: Provide from same source except for removal and resetting of existing curb.
2. Granite Color and Grain: Light gray with medium grain.
3. Top Width: 5 inches.
4. Face Height or reveal: 7 inches.
5. Total Height: 18 inches.
6. Top Finish: Sawed.
7. Face Finish: Split.

B. Joint Backer: Geotextile fabric Mirafi 140N or equivalent.

2.2 AGGREGATE SETTING-BED MATERIALS

A. Graded Aggregate for Base: Sound, crushed stone or gravel complying with requirements in Division 31 Section "Earth Moving" for base course.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas indicated to receive granite stone curbs, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

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

3.2 PREPARATION

A. Remove substances from concrete substrates that could impair installation.

B. Proof-roll prepared subgrade according to requirements in Division 31 Section "Earth Moving" to identify soft pockets and areas of excess yielding. Proceed with granite stone curbs installation only after deficient subgrades have been corrected and are ready to receive base course for unit pavers.

3.3 INSTALLATION, GENERAL

A. Install in accordance with MDOT Specifications Section 609.

B. Do not use granite stone curbs with chips, cracks, voids, discolorations, and other defects that might be visible in finished work.

C. Cut granite stone curbs with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.

3.4 REPAIRING, POINTING, AND CLEANING

A. Remove and replace granite stone curbs that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

END OF SECTION 32 14 00

SECTION 32 31 13 - CHAIN LINK FENCES AND GATES

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. Chain-link fences.

B. Related Sections:

1. Division 03 Section for cast-in-place concrete post footings.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design chain-link fences and gates, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Chain-link fence and gate framework shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7:

1. Minimum Post Size: Determine according to ASTM F 1043 for framework up to 12 feet high, and post spacing not to exceed 10 feet.
2. Minimum Post Size and Maximum Spacing: Determine according to CLFMI WLG 2445, based on mesh size and pattern specified and on the following:

a. Wind Loads: 100 MPH
b. Exposure Category: C.
c. Fence Height: As noted on Drawings.
d. Material Group: IA, ASTM F 1043, Schedule 40 steel pipe.

C. Lightning Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for chain-link fences and gates.

1. Fence posts, rails, and fittings.
2. Chain-link fabric, reinforcements, and attachments.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show accessories, hardware, and grounding.

C. Samples for Initial Selection: For components with factory-applied color finishes.

D. Samples for Verification: Prepared on Samples of size indicated below:

1. Polymer-Coated Components: In 6-inch lengths for components and on full-sized units for accessories.

E. Delegated-Design Submittal: For chain-link fences indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

F. Qualification Data: For qualified factory-authorized service representative.

G. Product Certificates: For each type of chain-link fence from manufacturer.

H. Product Test Reports: For framing strength according to ASTM F 1043.

I. Field quality-control reports.

J. Operation and Maintenance Data: For the following to include in maintenance manuals:

1. Polymer finishes.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing fence grounding. Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

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 application.

C. Preinstallation Conference: Conduct conference at Project site.

1. Inspect and discuss electrical roughing-in, equipment bases, and other preparatory work specified elsewhere.
2. Review required testing, inspecting, and certifying procedures.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer and Installer agrees to repair or replace components of chain-link fences that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with CLFMI Product Manual and with requirements indicated below:

1. Fabric Height: As indicated on Drawings.
2. Steel Wire Fabric: Wire with a diameter of 0.192 inch.

a. Mesh Size: 2 inches.
b. Zinc-Coated Fabric: ASTM A 392, Type II, Class 2, 2.0 oz./sq. ft. with zinc coating applied after weaving with polymer finish over metallic coating.

1) Color: Black or As selected by Architect from manufacturer's full range, complying with ASTM F 934.

c. Coat selvage ends of fabric that is metallic coated before the weaving process with manufacturer's standard clear protective coating.

3. Selvage: Twisted top and knuckled bottom.

2.2 FENCE FRAMING

A. Posts and Rails: Comply with ASTM F 1043 for framing, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 based on the following:

1. Fence Height: As indicated on Drawings.

2. Heavy Industrial Strength: Material Group IA, round steel pipe, Schedule 40.

    a. Line Post: 2.375 inches in diameter.
    b. End, Corner and Pull Post: 2.875 inches in diameter.

3. Horizontal Framework Members: top and bottom rails complying with ASTM F 1043.

    a. Top Rail: 1.66 inches in diameter.

4. Brace Rails: Comply with ASTM F 1043.
5. Metallic Coating for Steel Framing:

    a. Type A, consisting of not less than minimum 2.0-oz./sq. ft. average zinc coating per ASTM A 123/A 123M.

6. Polymer coating over metallic coating.

    a. Color: Black, as selected by Architect from manufacturer's full range, complying with ASTM F 934.

2.3 TENSION WIRE

A. Metallic-Coated Steel Wire: 0.177-inch- diameter, marcelled tension wire complying with ASTM A 817 and ASTM A 824, with the following metallic coating:

1. Type II, zinc coated (galvanized) by hot-dip or electrolytic process, with the following minimum coating weight:

    a. Matching chain-link fabric coating weight.

B. Polymer-Coated Steel Wire: 0.177-inch-diameter, tension wire complying with ASTM F 1664, Class 1 over zinc-coated steel wire.

1. Color: Match chain-link fabric Black or as selected by Architect from manufacturer's full range, complying with ASTM F 934.

2.4 FITTINGS

A. General: Comply with ASTM F 626.

B. Post Caps: Provide for each post.

1. Provide line post caps with loop to receive tension wire or top rail.

C. Rail and Brace Ends: For each gate, corner, pull, and end post.

D. Rail Fittings: Provide the following:

1. Top Rail Sleeves: Pressed-steel or round-steel tubing not less than 6 inches long.

2. Rail Clamps: Line and corner boulevard clamps for connecting intermediate and bottom rails in the fence line-to-line posts.

E. Tension and Brace Bands: Pressed steel.

F. Tension Bars: Steel, length not less than 2 inches shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.

G. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.

H. Tie Wires, Clips, and Fasteners: According to ASTM F 626.

1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:

a. Hot-Dip Galvanized Steel: 0.148-inch-diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.

I. Finish:

1. Metallic Coating for Pressed Steel or Cast Iron: Match that of posts and fabric.

a. Polymer coating over metallic coating.

2.5 GROUT AND ANCHORING CEMENT

A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.

B. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended in writing by manufacturer, for exterior applications.

2.6 FENCE GROUNDING

A. Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.

1. Material above Finished Grade: Copper.
2. Material on or below Finished Grade: Copper.
3. Bonding Jumpers: Braided copper tape, 1 inch wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.

B. Connectors and Grounding Rods: Comply with UL 467.

1. Connectors for Below-Grade Use: Exothermic welded type.
2. Grounding Rods: Copper-clad steel, 5/8 by 96 inches.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.

1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

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

3.2 PREPARATION

A. Stake locations of fence lines and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 INSTALLATION, GENERAL

A. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements indicated.

3.4 CHAIN-LINK FENCE INSTALLATION

A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

    a. Concealed Concrete: Top 2 inches below grade or as indicated on Drawings to allow covering with surface material.
    b. Posts Set into Voids in Concrete: Form or core drill holes not less than 5 inches deep and 3/4 inch larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.

C. Terminal Posts: Locate terminal end and corner posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of as indicated on Drawings.

D. Line Posts: Space line posts uniformly at 10 feet o.c.

E. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end posts and at both sides of corner and pull posts.

1. Locate horizontal braces at midheight of fabric 72 inches or higher, on fences with top rail and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.

F. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch- diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:

1. As indicated.

G. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

H. Intermediate and Bottom Rails: Install and secure to posts with fittings.

I. Chain-Link Fabric: Apply fabric to security side of enclosing framework. Leave 2 inches between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

J. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches o.c.

K. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.

1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.

L. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side.

3.5 GROUNDING AND BONDING

A. Fence Grounding: Install at maximum intervals of 1500 feet except as follows:

1. Fences within 100 Feet of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet.

    a. Other Fence Openings: Ground fence on each side of opening.

        1) Bond metal gates to gate posts.
        2) Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches below finished grade.

B. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet on each side of crossing.

C. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2 unless otherwise indicated.

D. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at the grounding location, including the following:

1. Make grounding connections to each barbed wire strand with wire-to-wire connectors designed for this purpose.
2. Make grounding connections to each barbed tape coil with connectors designed for this purpose.

E. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.

F. Connections: Make connections to minimize possibility of galvanic action or electrolysis. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

G. Bonding to Lightning Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning protection down conductor or lightning protection grounding conductor complying with NFPA 780.

3.6 FIELD QUALITY CONTROL

A. Grounding-Resistance Testing: Contractor shall engage a qualified testing agency to perform tests and inspections.

1. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance no fewer than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.
2. Excessive Grounding Resistance: If resistance to grounding exceeds specified value, notify Architect promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.
3. Report: Prepare test reports certified by a testing agency of grounding resistance at each test location. Include observations of weather and other phenomena that may affect test results.

END OF SECTION 32 31 13

SECTION 32 31 21 -ALUMINUM LOUVER FENCING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Ornamental fixed louver modular fencing panels fabricated with extruded aluminum louvers and flat aluminum bars including extruded aluminum fence posts and aluminum louver gates.

B. Related sections:

1. Section 03 30 00 - Cast-in-Place Concrete: Concrete footings for support of fence posts.

1.2REFERENCES

A. American Society for Testing and Materials (ASTM) Publications:

1. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.

2. ASTM B221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.

3. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.

4. ASTM D822 - Tests on Paint and Related Coatings Using Filtered Open-Flame Carbon-Arc Exposure Apparatus.

5. ASTM D2794 - Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

6. ASTM D3363 - Test Method for Film Hardness by Pencil Test.

1.3 SUBMITTALS

A. Provide in accordance with Section 01 33 00 - Submittal Procedures:

1. Product data for components and accessories.

2. Shop drawings showing layout, dimensions, spacing of components, and anchorage and installation details.

3. Sample: 8 by 10 inches minimum size sample of fence panel illustrating design, fabrication workmanship, and selected color coating.

4. Copy of warranty specified in Paragraph 1.4 for review by Architect.

B. Submittals for LEED-NC:

1. Completed "LEED Criteria Worksheet," for each material of the product, assembly, or used in the installation of Work of this Section. Refer to Division 01 Section "Sustainable Design Requirements."
2. Credit MR 4.1, Recycled Content: For products having recycled content, documentation indicating percentages by weight of post-consumer and pre-consumer recycled content. Include a statement indicating costs for each product having recycled content.
3. Credit MR 5.1, Local/Regional Materials: Product Data indicating location of material manufacturer and point of extraction for regionally extracted, processed, and manufactured materials.

    a. If only a fraction of the material is extracted and manufactured locally, indicate the percentage by weight.
    b. Include a printed statement of cost for each regionally extracted, processed, and manufactured material.

1.4WARRANTY

A. Provide in accordance with Section 01 77 00 - Closeout Procedures:

    1. 10 years warranty for factory finish against cracking, peeling, and blistering under normal use.

PART 2 - PRODUCTS

2.1ACCEPTABLE MANUFACTURERS

A. Ametco Manufacturing Corporation, 4326 Hamann Parkway, P.O. Box 1210, Willoughby, Ohio 44096; 800-362-1360.

B. Requests to use equivalent products of other manufacturers shall be submitted in accordance with Section 01 25 13 - Product Substitution Procedures.

2.2MATERIALS

A. Extruded aluminum: ASTM B221, Alloy 6063, Temper T-6.

B. Sheet aluminum: ASTM B209 6063, Temper T-6.

C. Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, and water reducing and plasticizing additives.

2.3FENCE SYSTEM (PANEL WITHIN SWINGING GATE FRAME)

A. Type: Ornamental fencing system consisting of horizontal, fixed louver, modular fence panels fabricated with extruded aluminum framing bars and supported by extruded aluminum fence posts; Phoenix Aluminum Fixed Louver Fencing as manufactured by Ametco Manufacturing Corporation.

B. Fence panel:

1. Fixed louver blades: Extruded tubular aluminum louver blades, inclined at 45 degrees, and spaced at 2.83 inches and to provide 100 percent direct visual screening.

    a. Size: 1/2 by 4 inches

    b. Material thickness: 0.09 inch

2. Framing bars: Extruded aluminum flat bars welded to ends of louvers.

3. Panel height: As indicated on Drawings.

4. Panel width: As indicated on Drawings.

C. Posts:

1. Type: 4 by 4 inches extruded tubular aluminum sections with solid aluminum caps.]

2. Length: As indicated on Drawings.

2.4GATES

A. Provide gates of type and size indicated on Drawings. Equip gates with manufacturer's standard hardware as required for complete functional operation.

B. Type: Hinged swinging double gate.

1. Construction: Welded frame fabricated from extruded aluminum tubing with aluminum fixed louver panels to match fencing material. Frame size per manufacturer’s written recommendation.

2. Hardware:

    a. Hinges: Size and type as determined by manufacturer. Provide 2 hinges for each leaf up to 6 feet high and 1 additional hinge for each additional 24 inches in height or fraction thereof.

    b. Latch: 3/4 inch diameter slide bolt to accommodate padlock.

    c. For double gates provide padlockable, 5/8 inch diameter center cane bolt assembly and strike.

2.5ACCESSORIES

A. Fasteners: Stainless steel bolts of type, size, and spacing as recommended by fence manufacturer for specific condition.

B. Provide anti-intruder bolts consisting of cup head bolt and nut with clamping hexagon such that tightening shears hexagon and render bolt impossible to release.

2.6FACTORY FINISH

A. Aluminum fence panels and posts shall receive polyester powder coating. [Large gate panels shall be coated with 2-part polyurethane coating.]

B. Polyester powder coating: Electrostatically applied colored polyester powder coating heat cured to chemically bond finish to metal substrate.

2. Minimum hardness measured in accordance with ASTM D3363: 2H.

3. Direct impact resistance tested in accordance with ASTM D2794. Withstand 160 inch-pounds.

4. Salt spray resistance tested in accordance with ASTM B117: No undercutting, rusting, or blistering after 500 hours in 5 percent salt spray at 95 degrees F and 95 percent relative humidity and after 1000 hours less than [3/16 inch] [5 mm] undercutting.

5. Weatherability tested in accordance with ASTM D822: No film failure and 88 percent gloss retention after 1 year exposure in South Florida with test panels tilted at 45 degrees.

C. Color: Selected by Architect from manufacturer's standard range.

PART 3 - EXECUTION

3.1PREPARATION

A. Prior to fabrication, field verify required dimensions.

B. Cast concrete footings in accordance with Section 03 30 00 - Cast-in-Place Concrete as detailed on Drawings and approved shop drawings.

1. Minimum footing diameter:

a. Terminal and gate posts: 12 inches

b. Intermediate line posts: 10 inches

2. Allow 8 inches minimum embedment of posts.

3. Allow 6 inches minimum concrete beneath post bottom.

C. Provide setting holes for embedment of fence posts. Hole shall be 2 inches minimum greater than post width.

3.2INSTALLATION

A. Install fencing in accordance with manufacturer's installation instructions and approved shop drawings.

B. Install fence posts plumb and level by setting post in hole cast in concrete and grouting solid.

Temporarily brace fence posts with 2 by 4 wood supports until grout is set.

C. Do not install bent, bowed, or otherwise damaged panels. Remove damaged components from site and replace.

D. Secure fence panels with stainless steel anti-intruder bolts to fence posts.

E. Gates:

1. Install gates and adjust hardware for smooth operation.

2. Provide concrete center foundation depth and drop rod retainers at center of double swinging gate openings

3. After installation, test gate. Open and close a minimum of five times. Correct deficiencies and adjust.

F. Touch-up damaged finish with paint supplied by manufacturer and matching original coating.

END OF SECTION

SECTION 32 92 00 - TURF AND GRASSES

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. Seeding.
2. Erosion-control material(s).

B. Related Sections:

1. Division 31 Section "Site Clearing" for topsoil stripping and stockpiling.
2. Division 31 Section "Earth Moving" for excavation, filling and backfilling, and rough grading.
3. Division 32 Section "Plants" for border edgings.
4. Division 33 Section "Subdrainage" for subsurface drainage.

1.3 DEFINITIONS

A. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

B. Finish Grade: Elevation of finished surface of planting soil.

C. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

D. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

E. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

F. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

G. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.

H. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

I. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

1. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to this Project.

B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

1. Certification of each seed mixture for turfgrass sod. Include identification of source and name and telephone number of supplier.

C. Qualification Data: For qualified landscape Installer.

D. Product Certificates: For soil amendments and fertilizers, from manufacturer.

E. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of turf during a calendar year. Submit before expiration of required initial maintenance periods.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful turf establishment.

1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
2. Experience: Three to Five years' experience in turf installation in addition to requirements in Division 01 Section "Quality Requirements."
3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
4. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network:

a. Certified Landscape Technician - Exterior, with installation, maintenance specialty area(s), designated CLT-Exterior.

b. Certified Turfgrass Professional of Cool Season Lawns, designated CTP-CSL.

5. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.
6. Pesticide Applicator: State licensed, commercial.

B. Soil-Testing Laboratory Qualifications: An independent laboratory or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

C. Soil Analysis: For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of the soil.

1. Testing methods and written recommendations shall comply with USDA's Handbook No. 60.
2. The soil-testing laboratory shall oversee soil sampling, with depth, location, and number of samples to be taken per instructions from Architect. A minimum of three representative samples shall be taken from varied locations for each soil to be used or amended for planting purposes.
3. Report suitability of tested soil for turf growth.

a. Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. or volume per cu. yd. for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
b. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk fertilizers, lime, and soil amendments with appropriate certificates.

1.7 PROJECT CONDITIONS

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of planting completion.

1. Spring Planting: April 15th or as recommended by Maine DEP BMPs'.
2. Fall Planting: September 15th or as recommended by Maine DEP BMPs'.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

1.8 MAINTENANCE SERVICE

A. Initial Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable turf is established but for not less than the following periods:

1. Seeded Turf: 60 days from date of planting completion.

a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.

PART 2 - PRODUCTS

2.1 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species: Seed of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:

1. Full Sun: Kentucky bluegrass (Poa pratensis), a minimum of three cultivars.

2. Sun and Partial Shade: Proportioned by weight as follows

a. 50 percent Kentucky bluegrass (Poa pratensis).
b. 30 percent chewings red fescue (Festuca rubra variety).
c. 10 percent perennial ryegrass (Lolium perenne).
d. 10 percent redtop (Agrostis alba).

3. Shade: Proportioned by weight as follows:

a. 50 percent chewings red fescue (Festuca rubra variety).
b. 35 percent rough bluegrass (Poa trivialis).

c. 15 percent redtop (Agrostis alba).

2.2 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: T, with a minimum of 99 percent passing through No. 8 sieve and a minimum of 75 percent passing through No. 60 sieve.
2. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through No. 60 sieve.
3. Provide lime in form of ground dolomitic limestone, calcitic limestone or mollusk shells.

B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, and with a minimum of 99 percent passing through No. 6 sieve and a maximum of 10 percent passing through No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 sieve.

G. Sand: Clean, washed, natural or manufactured, and free of toxic materials.

H. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.

I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.3 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 3/4-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 to 60 percent of dry weight.
2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or of granular texture, with a pH range of 3.4 to 4.8.

C. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent.

D. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.

1. In lieu of decomposed wood derivatives, mix partially decomposed wood derivatives with ammonium nitrate at a minimum rate of 0.15 lb/cu. ft. of loose sawdust or ground bark, or with ammonium sulfate at a minimum rate of 0.25 lb/cu. ft. of loose sawdust or ground bark.

E. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

2.4 FERTILIZERS

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 20 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

2.5 PLANTING SOILS

A. Planting Soil: ASTM D 5268 topsoil, with pH range of 5.5 to 7, a minimum of 4 percent organic material content; free of stones 1 inch or larger in any dimension and other extraneous materials harmful to plant growth. Mix ASTM D 5268 topsoil with soil amendments and fertilizers in quantities to produce planting soil as recommended by the Maine DEP BMP's and the Standard Specifications of MDOT.

B. Planting Soil: Existing, native surface topsoil formed under natural conditions with the duff layer retained during excavation process and stockpiled on-site. Verify suitability of native surface topsoil to produce viable planting soil. Clean soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.

1. Supplement with another specified planting soil when quantities are insufficient.
2. Mix existing, native surface topsoil with the following soil amendments and fertilizers in the following quantities to produce planting soil as recommended by the Maine DEP BMP's and the Standard Specifications of MDOT.

C. Planting Soil: Imported topsoil or manufactured topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from agricultural land, bogs or marshes.

1. Additional Properties of Imported Topsoil or Manufactured Topsoil: Screened and free of stones 1 inch or larger in any dimension; free of roots, plants, sod, clods, clay lumps, pockets of coarse sand, paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials harmful to plant growth; free of obnoxious weeds and invasive plants including quackgrass, Johnsongrass, poison ivy, nutsedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel, and bromegrass; not infested with nematodes, grubs, other pests, pest eggs, or other undesirable organisms and disease-causing plant pathogens; friable and with sufficient structure to give good tilth and aeration. Continuous, air-filled, pore-space content on a volume/volume basis shall be at least 15 percent when moisture is present at field capacity. Soil shall have a field capacity of at least 15 percent on a dry weight basis.
2. Mix imported topsoil or manufactured topsoil with soil amendments and fertilizers in quantities to produce planting soil as recommended by the Maine DEP BMP's and the Standard Specifications of MDOT.

2.6 MULCHES

A. Sphagnum Peat Mulch: Partially decomposed sphagnum peat moss, finely divided or of granular texture, and with a pH range of 3.4 to 4.8.

B. Muck Peat Mulch: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent.

C. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve; soluble salt content of 2 to 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 to 60 percent of dry weight.
2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

D. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

E. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

F. Asphalt Emulsion: ASTM D 977, Grade SS-1; nontoxic and free of plant-growth or germination inhibitors.

2.7 PESTICIDES

A. General: Pesticide, registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

2.8 EROSION-CONTROL MATERIALS

A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches long.

B. Erosion-Control Fiber Mesh: Biodegradable burlap or spun-coir mesh, a minimum of 0.92 lb/sq. yd., with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches long.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.

3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.

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

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
2. Protect grade stakes set by others until directed to remove them.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 TURF AREA PREPARATION

A. Limit turf subgrade preparation to areas to be planted.

B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 4 inches. Remove stones larger than 1-1/2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Apply superphosphate fertilizer directly to subgrade before loosening.
2. Thoroughly blend planting soil off-site before spreading.

    a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
    b. Mix lime with dry soil before mixing fertilizer.

3. Spread planting soil to a depth of 4 inches but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.

    a. Spread approximately 1/2 the thickness of planting soil over loosened subgrade. Mix thoroughly into top 2 inches of subgrade. Spread remainder of planting soil.
    b. Reduce elevation of planting soil to allow for soil thickness of sod.

C. Unchanged Subgrades: If turf is to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface soil as follows:

1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.

2. Loosen surface soil to a depth of at least 6 inches. Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 4 inches of soil. Till soil to a homogeneous mixture of fine texture.

    a. Apply superphosphate fertilizer directly to surface soil before loosening.

3. Remove stones larger than 1-1/2 inches in any dimension and sticks, roots, trash, and other extraneous matter.
4. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.

D. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.

E. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

F. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 PREPARATION FOR EROSION-CONTROL MATERIALS

A. Prepare area as specified in "Turf Area Preparation" Article.

B. For erosion-control mats, install planting soil in two lifts, with second lift equal to thickness of erosion-control mats. Install erosion-control mat and fasten as recommended by material manufacturer.

C. Fill cells of erosion-control mat with planting soil and compact before planting.

D. For erosion-control blanket or mesh, install from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.

E. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.5 SEEDING

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.

1. Do not use wet seed or seed that is moldy or otherwise damaged.
2. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

B. Sow seed at a total rate of 3 to 4 lb/1000 sq. ft..

C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.

D. Protect seeded areas with slopes exceeding 1:4 with erosion-control blankets and 1:6 with erosion-control fiber mesh installed and stapled according to manufacturer's written instructions.

E. Protect seeded areas with erosion-control mats where shown on Drawings; install and anchor according to manufacturer's written instructions.

F. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.

1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.

G. Protect seeded areas from hot, dry weather or drying winds by applying planting soil within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch, and roll surface smooth.

3.6 TURF RENOVATION

A. Renovate existing turf.

B. Renovate existing turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.

1. Reestablish turf where settlement or washouts occur or where minor regrading is required.
2. Install new planting soil as required.

C. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.

D. Remove topsoil containing foreign materials such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.

E. Mow, dethatch, core aerate, and rake existing turf.

F. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.

G. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.

H. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches.

I. Apply soil amendments and initial fertilizers required for establishing new turf and mix thoroughly into top 4 inches of existing soil. Install new planting soil to fill low spots and meet finish grades.

J. Apply seed and protect with straw mulch as required for new turf.

K. Water newly planted areas and keep moist until new turf is established.

3.7 TURF MAINTENANCE

A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.

C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:

1. Mow to a height of 1-1/2 to 2 inches.

D. Turf Postfertilization: Apply fertilizer after initial mowing and when grass is dry.

1. Use fertilizer that will provide actual nitrogen of at least 1 lb/1000 sq. ft. to turf area.

3.8 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Architect:

1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.

B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

3.9 MEADOW

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.

1. Do not use wet seed or seed that is moldy or otherwise damaged.

B. Sow seed at a total rate of 6 oz./1000 sq. ft.

C. Brush seed into top 1/16 inch of soil, roll lightly, and water with fine spray.

D. Protect seeded areas from hot, dry weather or drying winds by applying peat or compost mulch within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch, and roll surface smooth.

E. Water newly planted areas and keep moist until meadow is established.

3.10 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents in accordance with requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

3.11 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

C. Remove nondegradable erosion-control measures after grass establishment period.

END OF SECTION 32 92 00

SECTION 32 93 00 - PLANTS

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. Plants.
2. Planting soils.
3. Tree stabilization.

B. Related Sections:

1. Division 01 Section "Temporary Tree and Plant Protection" for protecting, trimming, pruning, repairing, and replacing existing trees to remain that interfere with, or are affected by, execution of the Work.
2. Division 31 Section "Site Clearing" for protection of existing trees and plantings, topsoil stripping and stockpiling, and site clearing.
3. Division 31 Section "Earth Moving" for excavation, filling, and rough grading and for subsurface aggregate drainage and drainage backfill materials.
4. Division 32 Section "Turf and Grasses" for turf (lawn) and meadow planting, hydroseeding, and erosion-control materials.
5. Division 33 Section "Subdrainage" for below-grade drainage of landscaped areas, paved areas, and wall perimeters.

1.3 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with ball size not lesssizes indicated; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.

C. Balled and Potted Stock: Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter sizes indicated.

D. Bare-Root Stock: Plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than minimum root spread according to ANSI Z60.1 for type and size of plant required.

E. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.

F. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

G. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of plant.

H. Finish Grade: Elevation of finished surface of planting soil.

I. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

J. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

K. Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

L. Planting Area: Areas to be planted.

M. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

N. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.

O. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

P. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

Q. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

R. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

S. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated, including soils.

1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
2. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to the Project.

B. Samples for Verification: For each of the following:

1. Trees and Shrubs: Three samples of each variety and size delivered to the site for review. Maintain approved samples on-site as a standard for comparison.
2. Organic Compost Mulch: 1-quart volume of each organic mulch required; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.
3. Mineral Mulch: 2 lb of each mineral mulch required, in sealed plastic bags labeled with source of mulch. Sample shall be typical of the lot of material to be delivered and installed on the site; provide an accurate indication of color, texture, and makeup of the material.
4. Weed Control Barrier: 12 by 12 inches.
5. Root Barrier: Width of panel by 12 inches.

C. Qualification Data: For qualified landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.

D. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:

1. Manufacturer's certified analysis of standard products.
2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

E. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before start of required maintenance periods.

F. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful establishment of plants.

1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
2. Experience: Five years' experience in landscape installation in addition to requirements in Division 01 Section "Quality Requirements."

3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
4. Personnel Certifications: Installer's field supervisor shall have certification in all of the following categories from the Professional Landcare Network:

    a. Certified Landscape Technician - Exterior, with installation, maintenance specialty area(s), designated CLT-Exterior.
    b. Certified Landscape Technician - Interior, designated CLT-Interior.
    c. Certified Ornamental Landscape Professional, designated COLP.

5. Pesticide Applicator: State licensed, commercial.

B. Soil-Testing Laboratory Qualifications: An independent or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

C. Soil Analysis: For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of the soil.

1. Testing methods and written recommendations shall comply with USDA's Handbook No. 60.
2. The soil-testing laboratory shall oversee soil sampling; with depth, location, and number of samples to be taken per instructions from Landscape Architect. A minimum of three representative samples shall be taken from varied locations for each soil to be used or amended for planting purposes.
3. Report suitability of tested soil for plant growth.

    a. Based upon the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. or volume per cu. yd. for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
    b. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.

D. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.

1. Selection of plants purchased will be made by Architect, who will tag plants at their place of growth before they are prepared for transplanting.

E. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.

1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container grown stock. Measure main body of tree or shrub for height and spread; do not

measure branches or roots tip to tip. Take caliper measurements 6 inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.

2. Other Plants: Measure with stems, petioles, and foliage in their normal position.

F. Plant Material Observation: Landscape Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Landscape Architect retains right to observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.

1. Notify Architect of sources of planting materials seven days in advance of delivery to site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws if applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk fertilizers, lime, and soil amendments with appropriate certificates.

C. Deliver bare-root stock plants freshly dug. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting.

D. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

E. Handle planting stock by root ball.

F. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F until planting.

G. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.

1. Heel-in bare-root stock. Soak roots that are in dry condition in water for two hours. Reject dried-out plants.
2. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
3. Do not remove container-grown stock from containers before time of planting.
4. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly-wet condition.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

B. Interruption of Existing Services or Utilities: Do not interrupt services or utilities to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary services or utilities according to requirements indicated:

1. Notify Construction Manager no fewer than 4 days in advance of proposed interruption of each service or utility.
2. Do not proceed with interruption of services or utilities without Architect's [**Owner's**] written permission.

C. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.

1. Spring Planting: April 15th or as recommended by the Standard Specifications of MDOT.
2. Fall Planting: September 15th or as recommended by the Standard Specifications of MDOT.

D. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

E. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.

1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

1.8 WARRANTY

A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner, or incidents that are beyond Contractor's control.
b. Structural failures including plantings falling or blowing over.
c. Faulty performance of tree stabilization.
d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Periods from Date of Planting Completion:

a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
b. Ground Covers, Biennials, Perennials, and Other Plants: 12 months.

3. Include the following remedial actions as a minimum:

a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
c. A limit of one replacement of each plant will be required except for losses or replacements due to failure to comply with requirements.
d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

1.9 MAINTENANCE SERVICE

A. Initial Maintenance Service for Trees and Shrubs: Provide maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below.

1. Maintenance Period: 12 months from date of planting completion.

B. Initial Maintenance Service for Ground Cover and Other Plants: Provide maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below.

1. Maintenance Period: Six months from date of planting completion.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant Schedule or Plant Legend shown on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated

when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots will be rejected.
2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.

B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.

C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

D. Labeling: Label each plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant as shown on Drawings.

E. If formal arrangements or consecutive order of plants is shown on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.

2.2 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: T, with a minimum of 99 percent passing through No. 8 sieve and a minimum of 75 percent passing through No. 60 sieve.
2. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through No. 60 sieve.
3. Provide lime in form of ground dolomitic limestone.

B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent sulfur, with a minimum of 99 percent passing through No. 6 sieve and a maximum of 10 percent passing through No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 sieve.

G. Sand: Clean, washed, natural or manufactured, and free of toxic materials.

H. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.

I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.3 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch - 3/4-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 to 60 percent of dry weight.
2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or granular texture, with a pH range of 3.4 to 4.8.

C. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent.

D. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.

1. In lieu of decomposed wood derivatives, mix partially decomposed wood derivatives with ammonium nitrate at a minimum rate of 0.15 lb/cu. ft. of loose sawdust or ground bark, or with ammonium sulfate at a minimum rate of 0.25 lb/cu. ft. of loose sawdust or ground bark.

E. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, debris, and material harmful to plant growth.

2.4 FERTILIZERS

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 20 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

E. Planting Tablets: Tightly compressed chip type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.

1. Size: 5-gram tablets.
2. Nutrient Composition: 20 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.

F. Chelated Iron: Commercial-grade FeEDDHA for dicots and woody plants, and commercial-grade FeDTPA for ornamental grasses and monocots.

2.5 PLANTING SOILS

A. Planting Soil: ASTM D 5268 topsoil, with pH range of 5.5 to 7, a minimum of 4 percent organic material content; free of stones 1 inch or larger in any dimension and other extraneous materials harmful to plant growth. Mix ASTM D 5268 topsoil with soil amendments and fertilizers in quantities to produce planting soil as recommended by the Standard Specifications of MDOT.

B. Planting Soil: Existing, native surface topsoil formed under natural conditions with the duff layer retained during excavation process and stockpiled on-site. Verify suitability of native surface topsoil to produce viable planting soil. Clean soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.

1. Supplement with another specified planting soil when quantities are insufficient.
2. Mix existing, native surface topsoil with soil amendments and fertilizers in quantities to produce planting soil as recommended by the Standard Specifications of MDOT.

C. Planting Soil: Imported topsoil or manufactured topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from agricultural land, bogs, or marshes.

1. Additional Properties of Imported Topsoil or Manufactured Topsoil: Screened and free of stones 1 inch or larger in any dimension; free of roots, plants, sod, clods, clay lumps, pockets of coarse sand, paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials harmful to plant growth; free of

obnoxious weeds and invasive plants including quackgrass, Johnsongrass, poison ivy, nutsedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel, and bromegrass; not infested with nematodes; grubs; or other pests, pest eggs, or other undesirable organisms and disease-causing plant pathogens; friable and with sufficient structure to give good tilth and aeration. Continuous, air-filled pore space content on a volume/volume basis shall be at least 15 percent when moisture is present at field capacity. Soil shall have a field capacity of at least 15 percent on a dry weight basis.

2. Mix imported topsoil or manufactured topsoil with soil amendments and fertilizers in to produce planting soil as recommended by the Standard Specifications of MDOT.

2.6 MULCHES

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:

1. Type: Ground or shredded bark.
2. Size Range: 3 inches maximum, 1/2 inch minimum.
3. Color: Natural.

2.7 WEED-CONTROL BARRIERS

A. Nonwoven Geotextile Filter Fabric: Polypropylene or polyester fabric, 3 oz./sq. yd. minimum, composed of fibers formed into a stable network so that fibers retain their relative position. Fabric shall be inert to biological degradation and resist naturally-encountered chemicals, alkalis, and acids.

B. Composite Fabric: Woven, needle-punched polypropylene substrate bonded to a nonwoven polypropylene fabric, 4.8 oz./sq. yd..

2.8 PESTICIDES

A. General: Pesticide registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

2.9 TREE STABILIZATION MATERIALS

A. Stakes and Guys:

1. Upright and Guy Stakes: Rough-sawn, sound, new hardwood, free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal by length indicated, pointed at one end.
2. Wood Deadmen: Timbers measuring 8 inches in diameter and 48 inches long, treated with specified wood pressure-preservative treatment.
3. Flexible Ties: Wide rubber or elastic bands or straps of length required to reach stakes or compression springs.
4. Guys and Tie Wires: ASTM A 641/A 641M, Class 1, galvanized-steel wire, two-strand, twisted, 0.106 inch in diameter.
5. Tree-Tie Webbing: UV-resistant polypropylene or nylon webbing with brass grommets.
6. Guy Cables: Five-strand, 3/16-inch- diameter, galvanized-steel cable, with zinc-coated turnbuckles, a minimum of 3 inches long, with two 3/8-inch galvanized eyebolts.
7. Flags: Standard surveyor's plastic flagging tape, white, 6 inches long.
8. Proprietary Staking-and-Guying Devices: Proprietary stake and adjustable tie systems to secure each new planting by plant stem; sized as indicated and per manufacturer's written recommendations.

    a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

        1) Arborbrace; ArborBrace Tree Guying System.
        2) Decorations for Generations, Inc.; Reddy Stake or Mega Stake System.

2.10 MISCELLANEOUS PRODUCTS

A. Root Barrier: Black, molded, modular panels manufactured with 50 percent recycled polyethylene plastic with ultraviolet inhibitors, 85 mils thick, with vertical root deflecting ribs protruding 3/4 inch out from panel, and each panel 24 inches wide.

B. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.

C. Burlap: Non-synthetic, biodegradable.

D. Mycorrhizal Fungi: Dry, granular inoculant containing at least 5300 spores per lb of vesicular-arbuscular mycorrhizal fungi and 95 million spores per lb of ectomycorrhizal fungi, 33 percent hydrogel, and a maximum of 5.5 percent inert material.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive plants for compliance with requirements and conditions affecting installation and performance.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel,

paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.

2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.

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

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.

D. Lay out plants at locations directed by Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

E. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.

1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.

F. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.

3.3 PLANTING AREA ESTABLISHMENT

A. Loosen subgrade of planting areas to a minimum depth of 12 inches. Remove stones larger than 1-1/2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Apply superphosphate fertilizer directly to subgrade before loosening.
2. Thoroughly blend planting soil off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.

a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
b. Mix lime with dry soil before mixing fertilizer.

3. Spread planting soil to a depth of 12 inches but not less than required to meet finish grades after natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.

a. Spread approximately one-half the thickness of planting soil over loosened subgrade. Mix thoroughly into top 4 inches of subgrade. Spread remainder of planting soil.

B. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

C. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 EXCAVATION FOR TREES AND SHRUBS

A. Planting Pits and Trenches: Excavate circular planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are not acceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.

1. Excavate approximately three times as wide as ball diameter for balled and burlapped, balled and potted, container-grown, fabric bag-grown stock.
2. Excavate at least 12 inches wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
3. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
4. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
5. Maintain required angles of repose of adjacent materials as shown on the Drawings. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
6. Maintain supervision of excavations during working hours.
7. Keep excavations covered or otherwise protected when unattended by Installer's personnel.
8. If drain tile is shown on Drawings or required under planting areas, excavate to top of porous backfill over tile.

B. Obstructions: Notify Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

1. Hardpan Layer: Drill 6-inch- diameter holes, 24 inches apart, into free-draining strata or to a depth of 10 feet, whichever is less, and backfill with free-draining material.

C. Drainage: Notify Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.

D. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

3.5 TREE, SHRUB, AND PERENNIAL PLANTING

A. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.

B. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

C. Set balled and burlapped stock plumb and in center of planting pit or trench with root flare 2 inches above adjacent finish grades.

1. Use planting soil for backfill.
2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.
5. Continue backfilling process. Water again after placing and tamping final layer of soil.

D. Set balled and potted, container-grown stock plumb and in center of planting pit or trench with root flare 2 inches above adjacent finish grades.

1. Use planting soil for backfill.
2. Carefully remove root ball from container without damaging root ball or plant.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.
5. Continue backfilling process. Water again after placing and tamping final layer of soil.

E. Set and support bare-root stock in center of planting pit or trench with root flare 1 inch above adjacent finish grade.

1. Use planting soil for backfill.
2. Spread roots without tangling or turning toward surface, and carefully work backfill around roots by hand. Puddle with water until backfill layers are completely saturated.

Plumb before backfilling, and maintain plumb while working backfill around roots and placing layers above roots.

3. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside soil-covered roots about 1 inch from root tips; do not place tablets in bottom of the hole or touching the roots.
4. Continue backfilling process. Water again after placing and tamping final layer of soil.

F. When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

3.6 MECHANIZED TREE SPADE PLANTING

A. Trees may be planted with an approved mechanized tree spade at the designated locations. Do not use tree spade to move trees larger than the maximum size allowed for a similar field-grown, balled-and-burlapped root-ball diameter according to ANSI Z60.1, or larger than the manufacturer's maximum size recommendation for the tree spade being used, whichever is smaller.

B. When extracting the tree, center the trunk within the tree spade and move tree with a solid ball of earth.

C. Cut exposed roots cleanly during transplanting operations.

D. Use the same tree spade to excavate the planting hole as was used to extract and transport the tree.

E. Plant trees as shown on Drawings, following procedures in "Tree, Shrub, and Vine Planting" Article.

F. Where possible, orient the tree in the same direction as in its original location.

3.7 TREE, SHRUB, AND PERENNIAL PRUNING

A. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Landscape Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.

B. Do not apply pruning paint to wounds.

3.8 TREE STABILIZATION

A. Install trunk stabilization as follows unless otherwise indicated:

1. Upright Staking and Tying: Stake trees of 2- through 5-inch caliper. Stake trees of less than 2-inch caliper only as required to prevent wind tip out. Use a minimum of two

stakes of length required to penetrate at least 18 inches below bottom of backfilled excavation and to extend to the dimension shown on Drawings above grade. Set vertical stakes and space to avoid penetrating root balls or root masses.

2. Use two stakes for trees up to 12 feet high and 2-1/2 inches or less in caliper; three stakes for trees less than 14 feet high and up to 4 inches in caliper. Space stakes equally around trees.
3. Support trees with bands of flexible ties at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.
4. Support trees with two strands of tie wire, connected to the brass grommets of tree-tie webbing at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.

B. Root-Ball Stabilization: Install at- or below-grade stabilization system to secure each new planting by the root ball unless otherwise indicated.

1. Wood Hold-Down Method: Place vertical stakes against side of root ball and drive them into subsoil; place horizontal wood hold-down stake across top of root ball and screw at each end to one of the vertical stakes.

    a. Install stakes of length required to penetrate at least to the dimension shown on Drawings below bottom of backfilled excavation. Saw stakes off at horizontal stake.
    b. Install screws through horizontal hold-down and penetrating at least 1 inch into stakes. Predrill holes if necessary to prevent splitting wood.
    c. Install second set of stakes on other side of root trunk for larger trees as indicated.

2. Proprietary Root-Ball Stabilization Device: Install root-ball stabilization system sized and positioned as recommended by manufacturer unless otherwise indicated and according to manufacturer's written instructions.

3.9 ROOT-BARRIER INSTALLATION

A. Install root barrier where trees are planted within 60 inches of paving or other hardscape elements, such as walls, curbs, and walkways unless otherwise shown on Drawings.

B. Align root barrier vertically and run it linearly along and adjacent to the paving or other hardscape elements to be protected from invasive roots.

C. Install root barrier continuously for a distance of 60 inches in each direction from the tree trunk, for a total distance of 10 feet Insert distance per tree. If trees are spaced closer, use a single continuous piece of root barrier.

1. Position top of root barrier per manufacturer's recommendations.
2. Overlap root barrier a minimum of 12 inches at joints.
3. Do not distort or bend root barrier during construction activities.
4. Do not install root barrier surrounding the root ball of tree.

3.10 PLANTING AREA MULCHING

A. Install weed-control barriers before mulching according to manufacturer's written instructions. Completely cover area to be mulched, overlapping edges a minimum of 12 inches and secure seams with galvanized pins.

B. Mulch backfilled surfaces of planting areas and other areas indicated.

1. Trees and Tree-like Shrubs in Turf Areas: Apply organic mulch ring of 3-inch average thickness, with 36-inch radius around trunks or stems. Do not place mulch within 6 inches of trunks or stems.
2. Organic Mulch in Planting Areas: Apply 3-inch average thickness of organic mulch extending 12 inches beyond edge of individual planting pit or trench and over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 6 inches of trunks or stems.

3.11 PLANT MAINTENANCE

A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.

B. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.

C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated past management practices whenever possible to minimize the use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

3.12 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Pre-Emergent Herbicides (Selective and Non-Selective): Apply to tree, shrub, and ground-cover areas in accordance with manufacturer's written recommendations. Do not apply to seeded areas.

C. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

3.13 CLEANUP AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.

B. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

C. After installation and before Substantial Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

3.14 DISPOSAL

A. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION 32 93 00

SECTION 33 05 00 - COMMON WORK RESULTS FOR UTILITIES

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. This Section includes the following:

1. Piping joining materials.
2. Transition fittings.
3. Dielectric fittings.
4. Sleeves.
5. Identification devices.
6. Grout.
7. Flowable fill.
8. Piped utility demolition.
9. Piping system common requirements.
10. Equipment installation common requirements.
11. Painting.
12. Concrete bases.
13. Metal supports and anchorages.

1.3 DEFINITIONS

A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.

B. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

C. ABS: Acrylonitrile-butadiene-styrene plastic.

D. CPVC: Chlorinated polyvinyl chloride plastic.

E. PE: Polyethylene plastic.

F. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Dielectric fittings.
2. Identification devices.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Steel Piping Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

B. Coordinate installation of identifying devices after completing covering and painting if devices are applied to surfaces.

C. Coordinate size and location of concrete bases. Formwork, reinforcement, and concrete requirements are specified in Division 03.

PART 2 - PRODUCTS

2.1 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness, unless otherwise indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

F. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

G. Solvent Cements for Joining Plastic Piping:

1. ABS Piping: ASTM D 2235.
2. CPVC Piping: ASTM F 493.
3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
4. PVC to ABS Piping Transition: ASTM D 3138.

H. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.2 TRANSITION FITTINGS

A. Transition Fittings, General: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

B. Transition Couplings NPS 1-1/2 and Smaller:

1. Underground Piping: Manufactured piping coupling or specified piping system fitting.
2. Aboveground Piping: Specified piping system fitting.

C. AWWA Transition Couplings NPS 2 and Larger:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Cascade Waterworks Mfg. Co.
   b. Dresser, Inc.; DMD Div.
   c. Ford Meter Box Company, Inc. (The); Pipe Products Div.
   d. JCM Industries.
   e. Smith-Blair, Inc.
   f. Viking Johnson.

2. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.

D. Plastic-to-Metal Transition Fittings:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Spears Manufacturing Co.

2. Description: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint or threaded end.

E. Plastic-to-Metal Transition Unions:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Colonial Engineering, Inc.
   b. NIBCO INC.
   c. Spears Manufacturing Co.

2. Description: MSS SP-107, CPVC and PVC four-part union. Include brass or stainless-steel threaded end, solvent-cement-joint or threaded plastic end, rubber O-ring, and union nut.

F. Flexible Transition Couplings for Underground Nonpressure Drainage Piping:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Cascade Waterworks Mfg. Co.
   b. Fernco, Inc.
   c. Mission Rubber Company.
   d. Plastic Oddities.

2. Description: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

2.3 DIELECTRIC FITTINGS

A. Dielectric Fittings, General: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Capitol Manufacturing Co.
b. Central Plastics Company.
c. Epco Sales, Inc.
d. Hart Industries, International, Inc.
e. Watts Water Technologies, Inc.
f. Zurn Plumbing Products Group; Wilkins Div.

2. Description: Factory fabricated, union, NPS 2 and smaller.

a. Pressure Rating: 150 psig minimum at 180 deg F.
b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded ferrous.

C. Dielectric Flanges:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Capitol Manufacturing Co.
b. Central Plastics Company.
c. Epco Sales, Inc.
d. Watts Water Technologies, Inc.

2. Description: Factory-fabricated, bolted, companion-flange assembly, NPS 2-1/2 to NPS 4 and larger.

a. Pressure Rating: 150 psig minimum.
b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Kits:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Advance Products & Systems, Inc.
    b. Calpico, Inc.
    c. Central Plastics Company.
    d. Pipeline Seal and Insulator, Inc.

2. Description: Nonconducting materials for field assembly of companion flanges, NPS 2-1/2 and larger.

    a. Pressure Rating: 150 psig minimum.
    b. Gasket: Neoprene or phenolic.
    c. Bolt Sleeves: Phenolic or polyethylene.
    d. Washers: Phenolic with steel backing washers.

E. Dielectric Couplings:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Calpico, Inc.
    b. Lochinvar Corporation.

2. Description: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining, NPS 3 and smaller.

    a. Pressure Rating: 300 psig at 225 deg F.
    b. End Connections: Threaded.

F. Dielectric Nipples:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Perfection Corporation.
    b. Precision Plumbing Products, Inc.
    c. Victaulic Company.

2. Description: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining.

    a. Pressure Rating: 300 psig at 225 deg F.
    b. End Connections: Threaded or grooved.

2.4 SLEEVES

A. Mechanical sleeve seals for pipe penetrations are specified in Division 22 Section "Common Work Results for Plumbing."

B. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

C. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized, plain ends.

D. Cast-Iron Sleeves: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

E. Molded PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.

G. Molded PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.5 IDENTIFICATION DEVICES

A. General: Products specified are for applications referenced in other Division 33 Sections. If more than single type is specified for listed applications, selection is Installer's option.

B. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
2. Location: Accessible and visible.

C. Stencils: Standard stencils prepared with letter sizes complying with recommendations in ASME A13.1. Minimum letter height is 1-1/4 inches for ducts, and 3/4 inch for access door signs and similar operational instructions.

1. Material: Brass.
2. Stencil Paint: Exterior, oil-based, alkyd-gloss black enamel, unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, oil-based, alkyd enamel in colors according to ASME A13.1, unless otherwise indicated.

D. Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.

E. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, color-coded, pressure-sensitive-vinyl type with permanent adhesive.

F. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers, extending 360 degrees around pipe at each location.

G. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers, at least three times letter height and of length required for label.

H. Lettering: Manufacturer's standard preprinted captions as selected by Architect.

I. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.

1. Arrows: Either integrally with piping system service lettering to accommodate both directions of flow, or as separate unit on each pipe marker to indicate direction of flow.

J. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive vinyl tape, at least 3 mils thick.

1. Width: 1-1/2 inches on pipes with OD, including insulation, less than 6 inches; 2-1/2 inches for larger pipes.
2. Color: Comply with ASME A13.1, unless otherwise indicated.

K. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch sequenced numbers. Include 5/32-inch hole for fastener.

1. Material: 0.032-inch- thick, polished brass or aluminum.
2. Material: 0.0375-inch- thick stainless steel.
3. Material: 3/32-inch- thick plastic laminate with 2 black surfaces and a white inner layer.
4. Material: Valve manufacturer's standard solid plastic.
5. Size: 1-1/2 inches in diameter, unless otherwise indicated.
6. Shape: As indicated for each piping system.

L. Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.

M. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.

1. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.
2. Thickness: 1/16 inch, unless otherwise indicated.
3. Thickness: 1/16 inch, for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.
4. Fasteners: Self-tapping, stainless-steel screws or contact-type permanent adhesive.

N. Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:

1. Green: Cooling equipment and components.
2. Yellow: Heating equipment and components.
3. Brown: Energy reclamation equipment and components.
4. Blue: Equipment and components that do not meet criteria above.
5. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.
6. Terminology: Match schedules as closely as possible. Include the following:

a. Name and plan number.
b. Equipment service.
c. Design capacity.
d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.

7. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.

O. Plasticized Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with mat finish suitable for writing.

1. Size: 3-1/4 by 5-5/8 inches.
2. Fasteners: Brass grommets and wire.
3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.

P. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in piped utility identification with corresponding designations indicated. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of piped utility systems and equipment.

1. Multiple Systems: Identify individual system number and service if multiple systems of same name are indicated.

2.6 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.7 FLOWABLE FILL

A. Description: Low-strength-concrete, flowable-slurry mix.

1. Cement: ASTM C 150, Type I, portland.
2. Density: 115- to 145-lb/cu. ft..
3. Aggregates: ASTM C 33, natural sand, fine and crushed gravel or stone, coarse.
4. Aggregates: ASTM C 33, natural sand, fine.
5. Admixture: ASTM C 618, fly-ash mineral.
6. Water: Comply with ASTM C 94/C 94M.
7. Strength: 100 to 200 psig at 28 days.

PART 3 - EXECUTION

3.1 PIPED UTILITY DEMOLITION

A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping. Fill abandoned piping with flowable fill, and cap or plug piping with same or compatible piping material.
3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.
5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 DIELECTRIC FITTING APPLICATIONS

A. Dry Piping Systems: Connect piping of dissimilar metals with the following:

1. NPS 2 and Smaller: Dielectric unions.
2. NPS 2-1/2 to NPS 12: Dielectric flanges or dielectric flange kits.

B. Wet Piping Systems: Connect piping of dissimilar metals with the following:

1. NPS 2 and Smaller: Dielectric couplings or dielectric nipples.
2. NPS 2-1/2 to NPS 4: Dielectric nipples.
3. NPS 2-1/2 to NPS 8: Dielectric nipples or dielectric flange kits.
4. NPS 10 and NPS 12: Dielectric flange kits.

3.3 PIPING INSTALLATION

A. Install piping according to the following requirements and Division 33 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping to permit valve servicing.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Select system components with pressure rating equal to or greater than system operating pressure.

I. Sleeves are not required for core-drilled holes.

J. Permanent sleeves are not required for holes formed by removable PE sleeves.

K. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of equipment areas or other wet areas 2 inches above finished floor level.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

a. PVC or Steel Pipe Sleeves: For pipes smaller than NPS 6.
b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.

L. Verify final equipment locations for roughing-in.

M. Refer to equipment specifications in other Sections for roughing-in requirements.

3.4 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 33 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

G. Grooved Joints: Assemble joints with grooved-end pipe coupling with coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

H. Soldered Joints: Apply ASTM B 813 water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B 32.

I. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

J. Pressure-Sealed Joints: Assemble joints for plain-end copper tube and mechanical pressure seal fitting with proprietary crimping tool to according to fitting manufacturer's written instructions.

K. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
5. PVC Nonpressure Piping: Join according to ASTM D 2855.
6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

L. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

M. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

N. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End PE Pipe and Fittings: Use butt fusion.
2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.

O. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.5 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Install dielectric fittings at connections of dissimilar metal pipes.

3.6 EQUIPMENT INSTALLATION

A. Install equipment level and plumb, unless otherwise indicated.

B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.

C. Install equipment to allow right of way to piping systems installed at required slope.

3.7 PAINTING

A. Painting of piped utility systems, equipment, and components is specified in Division 09 painting Sections.

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.8 IDENTIFICATION

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.

1. Stenciled Markers: According to ASME A13.1.
2. Plastic markers, with application systems. Install on insulation segment if required for hot noninsulated piping.
3. Locate pipe markers on exposed piping according to the following:

    a. Near each valve and control device.
    b. Near each branch, excluding short takeoffs for equipment and terminal units. Mark each pipe at branch if flow pattern is not obvious.
    c. Near locations where pipes pass through walls or floors or enter inaccessible enclosures.
    d. At manholes and similar access points that permit view of concealed piping.
    e. Near major equipment items and other points of origination and termination.

B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment.

1. Lettering Size: Minimum 1/4 inch high for name of unit if viewing distance is less than 24 inches, 1/2 inch high for distances up to 72 inches, and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
2. Text of Signs: Provide name of identified unit. Include text to distinguish among multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

C. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

3.9 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete"

3.10 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor piped utility materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.11 GROUTING

A. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 33 05 00

SECTION 33 41 00 - STORM UTILITY DRAINAGE PIPING

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. Pipe and fittings.
2. Nonpressure transition couplings.
3. Backwater valves.
4. Cleanouts.
5. Drains.
6. Manholes.
7. Channel drainage systems.
8. Catch basins.
9. Stormwater inlets.
10. Stormwater detention structures.
11. Pipe outlets.
12. Stormwater disposal systems.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. Manholes: Include plans, elevations, sections, details, frames, and covers.
2. Catch basins. Include plans, elevations, sections, details, frames, covers, and grates.
3. Stormwater Detention Structures: Include plans, elevations, sections, details, frames, covers, design calculations, and concrete design-mix reports.

C. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

D. Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet and vertical scale of not less than 1 inch equals 5 feet. Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.

E. Field quality-control reports.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic pipe and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written rigging instructions.

D. Handle catch basins according to manufacturer's written rigging instructions.

1.5 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Architect, Construction Manager or Owner no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Architect's, Construction Manager's or Owner's written permission.

PART 2 - PRODUCTS

2.1 PE PIPE AND FITTINGS

A. Corrugated PE Drainage Pipe and Fittings NPS 3 to NPS 10: AASHTO M 252M, Type S, with smooth waterway for coupling joints.

1. Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings.
2. Soiltight Couplings: AASHTO M 252M, corrugated, matching tube and fittings.

B. Corrugated PE Pipe and Fittings NPS 12 to NPS 60: AASHTO M 294M, Type S, with smooth waterway for coupling joints.

1. Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.
2. Soiltight Couplings: AASHTO M 294M, corrugated, matching pipe and fittings.

2.2 PVC PIPE AND FITTINGS

A. PVC Type PSM Sewer Piping:

1. Pipe: ASTM D 3034, SDR 35, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.

2. Fittings: ASTM D 3034, PVC with bell ends.
3. Gaskets: ASTM F 477, elastomeric seals.

B. PVC Gravity Sewer Piping:

1. Pipe and Fittings: ASTM F 679, T-1 wall thickness, PVC gravity sewer pipe with bell-and-spigot ends and with integral ASTM F 477, elastomeric seals for gasketed joints.

2.3 NONPRESSURE TRANSITION COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:

1. For Concrete Pipes: ASTM C 443, rubber.
2. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
3. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
4. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

C. Unshielded, Flexible Couplings:

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Dallas Specialty & Mfg. Co.
b. Fernco Inc.
c. Logan Clay Pipe.
d. Mission Rubber Company; a division of MCP Industries, Inc.
e. NDS Inc.
f. Plastic Oddities; a division of Diverse Corporate Technologies, Inc.

3. Description: Elastomeric sleeve with corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Shielded, Flexible Couplings:

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Cascade Waterworks Mfg.
b. Dallas Specialty & Mfg. Co.

c. Mission Rubber Company; a division of MCP Industries, Inc.

3. Description: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

E. Ring-Type, Flexible Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Fernco Inc.
b. Logan Clay Pipe.
c. Mission Rubber Company; a division of MCP Industries, Inc.

3. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

2.4 BACKWATER VALVES

A. Rubber Backwater Valves:

1. Basis-of-Design Product: Tide Flex Series TF-1. Provide as indicated on Drawings as manufactured by Tide Flex Technologies or approved equal.

2. Description: Horizontal type; with elastomer body, slip on type with stainless steel clamps.

2.5 DRAINS

A. Trench Drains:

1. Basis-of-Design Product: High density polyethelene structural composite drain channel with heavy-duty ductile iron frame and grate, 12 inches wide, pre-sloped trench drain system – Acodrain K100S load class or approved equal.

2.6 MANHOLES

A. Standard Precast Concrete Manholes:

1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: 48 inches minimum unless otherwise indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.

4. Base Section: 6-inch minimum thickness for floor slab and 5-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
5. Riser Sections: 5-inch minimum thickness, and lengths to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
9. Steps: Individual FRP steps; FRP ladder; or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches].
10. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
11. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Manhole Frames and Covers:

1. Description: Ferrous; 24-inch ID by 5-inch riser with 4-inch- minimum width flange and 24-inch- diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
2. Material: ASTM A 48/A 48M, Class 35 gray iron unless otherwise indicated.

2.7 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.

a. Invert Slope: 1 percent through manhole.

2. Benches: Concrete, sloped to drain into channel.

a. Slope: 4 percent.

D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

2.8 CATCH BASINS

A. Standard Precast Concrete Catch Basins:

1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Base Section: 6-inch minimum thickness for floor slab and 5-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
3. Riser Sections: 5-inch minimum thickness, 48-inch diameter, and lengths to provide depth indicated.
4. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
5. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
6. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
7. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch- diameter frame and grate.
8. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.

B. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include flat grate with small square or short-slotted drainage openings.

1. Size: As indicated on Drawings.
2. Grate Free Area: Approximately 50 percent unless otherwise indicated.

2.9 STORMWATER INLETS

A. Curb Inlets: Made with vertical curb opening, of materials and dimensions according to utility standards.

B. Gutter Inlets: Made with horizontal gutter opening, of materials and dimensions according to utility standards. Include heavy-duty frames and grates.

C. Combination Inlets: Made with vertical curb and horizontal gutter openings, of materials and dimensions according to utility standards. Include heavy-duty frames and grates.

D. Frames and Grates: Heavy duty, according to utility standards.

2.10 PIPE OUTLETS

A. Riprap Basins: Broken, irregularly sized and shaped, graded stone according to NSSGA's "Quarried Stone for Erosion and Sediment Control."

1. Average Size: NSSGA No. R-3, screen opening 2 inches.
2. Average Size: NSSGA No. R-4, screen opening 3 inches.
3. Average Size: NSSGA No. R-5, screen opening 5 inches.

B. Filter Stone: According to NSSGA's "Quarried Stone for Erosion and Sediment Control," No. FS-2, No. 4 screen opening, average-size graded stone.

C. Energy Dissipaters: According to NSSGA's "Quarried Stone for Erosion and Sediment Control," No. A-1, 3-ton average weight armor stone, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping pitched down in direction of flow.
2. Install piping as specified on the plans.
3. Install PE corrugated sewer piping according to ASTM D 2321.
4. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
5. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping according to the following:

1. Join corrugated PE piping according to ASTM D 3212 for push-on joints.
2. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasketed joints.
3. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
4. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.4 BACKWATER VALVE INSTALLATION

A. Install horizontal-type backwater valves on piping where indicated.

3.5 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer drain pipes to cleanouts at grade. Install piping so cleanouts open in direction of flow in sewer pipe.

B. Set cleanout frames and covers as specified on the plans.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.6 TRENCH DRAIN INSTALLATION

A. Install type of drains in locations indicated.

B. Embed drains in concrete around bottom and sides.

C. Fasten grates to drains if indicated.

D. Set drain frames and covers with tops flush with pavement surface.

E. Assemble trench sections with flanged joints.

F. Embed trench sections in concrete around bottom and sides.

3.7 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 891.

C. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.

D. Set tops of frames and covers flush 1/8 inch below finished surface of manholes that occur in pavements. Set tops flush with finished surface elsewhere unless otherwise indicated.

3.8 CATCH BASIN INSTALLATION

A. Construct catch basins to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.9 STORMWATER INLET AND OUTLET INSTALLATION

A. Construct riprap of outlet protection, as indicated.

3.10 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Division 22 Section "Facility Storm Drainage Piping."

B. Make connections to piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections.
2. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
3. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

C. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure piping unless otherwise indicated.

a. Unshielded and Shielded flexible couplings for same or minor difference OD pipes.
b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

3.11 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated that are to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:

1. Close open ends of piping with at least 8-inch- thick, brick masonry bulkheads.

2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:

1. Remove manhole or structure and close open ends of remaining piping.

C. Backfill to grade according to Division 31 Section "Earth Moving."

3.12 IDENTIFICATION

A. Materials and their installation are specified in Division 31 Section "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.

1. Use warning tape or detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.13 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:

a. Alignment: Less than full diameter of inside of pipe is visible between structures.
b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
d. Infiltration: Water leakage into piping.
e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

3.14 CLEANING

A. Clean interior of structures and piping of dirt and superfluous materials. Flush with potable water.

END OF SECTION 33 41 00

SECTION 334600 - SUBDRAINAGE

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. This Section includes subdrainage systems for the following:

1. Foundations.
2. Underslab areas.
3. Plaza decks.
4. Retaining walls.
5. Landscaped areas.

B. Related Sections include the following:

1. Division 07 Section “Waterproofing Sections” for Bituminous Sheet Waterproofing.
2. Division 31 Section “Earth Moving’ for excavating, backfilling, site grading and site utilities.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. HDPE: High-density polyethylene plastic.

C. PE: Polyethylene plastic.

D. PP: Polypropylene plastic.

E. PS: Polystyrene plastic.

F. PVC: Polyvinyl chloride plastic.

G. Subdrainage: Drainage system that collects and removes subsurface or seepage water.

H. Engineer: Authorized representatives of the Owner. For the scope of work covered under this Section, this term will include Haley & Aldrich, Inc. and OEST Associates, Inc., an AMEC Company.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Perforated-wall pipe and fittings.
2. Solid-wall pipe, fittings and cleanouts.
3. Drainage conduits.
4. Drainage panels.
5. Geotextile filter fabrics.
6. Cleanout fittings.

B. Approval of waterproofing manufacturer's service agent for use of drainage panels against and for waterproofing membrane protection.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to the "Piping Applications" Article in Part 3 for applications of pipe, tube, fitting, and joining materials.

2.3 PERFORATED-WALL PIPES AND FITTINGS

A. Perforated PE Pipe and Fittings:

1. NPS 6 and Smaller: ASTM F 405 or AASHTO M 252, Type CP; corrugated, for coupled joints.
2. NPS 8 and Larger: ASTM F 667; AASHTO M 252, Type CP; or AASHTO M 294, Type CP; corrugated; for coupled joints.
3. Couplings: Manufacturer's standard, band type.

B. Perforated PVC Sewer Pipe and Fittings: ASTM D 2729, bell-and-spigot ends, for loose joints.

C. Perforated Clay Pipe and Fittings: ASTM C 700, Standard- and Extra-Strength classes, unglazed, socket-and-spigot ends, for gasketed joints.

1. Gaskets: ASTM C 425, rubber.

D. Perforated Concrete Pipe and Fittings: ASTM C 444, Type 1, and applicable requirements in ASTM C 14, Class 2, socket-and-spigot ends for gasketed joints.

1. Gaskets: ASTM C 443, rubber.

2.4 SOLID-WALL PIPES AND FITTINGS

A. ABS Sewer Pipe and Fittings: ASTM D 2751.

1. Solvent Cement: ASTM D 2235.
2. Gaskets: ASTM F 477, elastomeric seal.

B. Cast-Iron Soil Pipe and Fittings: ASTM A 74, Service and Extra-Heavy classes, hub-and-spigot ends, gray, for gasketed joints.

1. Gaskets: ASTM C 564, rubber, of thickness matching class of pipe.

C. PE Drainage Tubing and Fittings: AASHTO M 252, Type S, corrugated, with smooth waterway, for coupled joints.

1. Couplings: AASHTO M 252, corrugated, band type, matching tubing and fittings.

D. PE Pipe and Fittings: AASHTO M 294, Type S, corrugated, with smooth waterway, for coupled joints.

1. Couplings: AASHTO M 294, corrugated, band type, matching tubing and fittings.

E. PVC Sewer Pipe and Fittings: ASTM D 3034, SDR 35, bell-and-spigot ends, for gasketed joints.

1. Gaskets: ASTM F 477, elastomeric seal.

2.5 SPECIAL PIPE COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant metal tension band and tightening mechanism on each end.

1. Sleeve Materials:

a. For Concrete Pipes: ASTM C 443, rubber.
b. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
c. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
d. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

2. Unshielded Flexible Couplings: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant metal tension band and tightening mechanism on each end.

3. Shielded Flexible Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant metal tension band and tightening mechanism on each end.

2.6 CLEANOUTS

A. Steel handhole and cover: Round-flanged, steel housing; and secured, scoriated, Medium-Duty Loading class, steel cover.

B. PVC Plugs/Fittings: ASTM D 3034, PVC cleanout threaded plug and threaded pipe hub.

2.7 SOIL MATERIALS

A. Backfill, drainage course, impervious fill, and satisfactory soil materials are specified in Division 31 Section "Earth Moving."

2.8 ROOFING FELTS

A. ASTM D 226, Type I, asphalt or ASTM D 227, coal-tar-saturated roofing felt.

2.9 GEOTEXTILES

A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft. when tested according to ASTM D 4491.

1. Structure Type: Nonwoven, needle-punched continuous filament or woven, monofilament or multifilament.
2. Style(s): Flat and sock.

2.10 PREFABRICATED SHEET DRAINAGE BOARD

A. Description: Two-part prefabricated sheet drain consisting of formed polystyrene core covered with a non-woven, needle-punched polypropylene filter fabric on the dimple side of core (AMERDRAIN 200 sheet drains or approved equivalent). The drainage board shall have a minimum transmissivity of 0.0024 gal/min/ft, and shall be installed against the retained-earth side of finished foundation walls as shown on the Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.

B. If subdrainage is required for landscaping, locate and mark existing utilities, underground structures, and aboveground obstructions before beginning installation and avoid disruption and damage of services.

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

3.2 EARTHWORK

A. Excavating, trenching, and backfilling requirements adjacent to/above subdrainage elements are specified in Division 31 Section "Earth Moving."

3.3 PIPING APPLICATIONS

A. Underground Subdrainage Piping:

1. Perforated PE pipe and fittings, couplings, and coupled joints.
2. Perforated PVC sewer pipe and fittings for loose, bell-and-spigot joints.

B. Foundation/Underslab Subdrainage Piping:

1. Perforated HDPE pipe and fittings, couplings, and coupled joints.
2. Perforated PVC sewer pipe and fittings and loose, bell-and-spigot joints.

C. Header Piping:

1. ABS pipe and fittings, gaskets, and gasketed and solvent-cemented joints.
2. Cast-iron soil pipe and fittings, Service class; gaskets; and gasketed joints.
3. PVC sewer pipe and fittings, couplings, and coupled joints.

3.4 CLEANOUT APPLICATIONS

A. In Underground Subdrainage Piping:

1. At Grade in Earth: Steel or cast-iron cleanouts.
2. At Grade in Concrete/Paved Areas: Steel or cast-iron cleanouts.

B. In Underslab Subdrainage Piping:

1. In Equipment Rooms and Unfinished Areas: Steel or cast-iron cleanout cover.
2. In Finished Areas: Copper-alloy cleanout cover, as approved by Architect and Engineer.

3.5 FOUNDATION AND UNDERSLAB DRAINAGE INSTALLATION

A. Prior to backfilling any system components, foundation and underslab drainage system shall be inspected by the Engineer.

B. Install perimeter and underslab drainage system at locations shown on the Drawings. Pipe shall be laid flat with the invert positioned above the bottom of footing bearing level and at least 12

in. below the adjacent lowest level floor slab surface, at invert elevations shown on the Drawings.

C. Perimeter drainage pipe shall be completely surrounded by a minimum of 6-inches of 3/4-in. crushed stone, fully wrapped with geotextile filter fabric, with edges overlapping by at least 4 inches. Pipe shall be placed with joints tightly closed in accordance with manufacturer's recommendations so that flow lines conform to required grades. For perforated collector pipe, lay pipe with perforations down. Perimeter drains (piping, crushed stone and fabric) shall extend a minimum of 12 inches outside of the outside edge of the footings.

D. Underslab drainage pipe shall be embedded mid-height in a minimum 12 in. layer of 3/4-in. crushed stone directly below slabs where shown on the Drawings. A continuous layer of geotextile filter fabric shall be placed over the approved slab subgrade surface prior to placement of ¾-in. crushed stone, overlapping edges at least 4 inches. Pipe shall be placed with joints tightly closed in accordance with manufacturer's recommendations so that flow lines conform to required grades. For perforated collector pipe, lay pipe with perforations down. Install drainage piping as indicated in Part 3 "Piping Installation" Article for foundation subdrainage.

E. Provide wall through penetrations at locations shown on the Drawings to allow connection of the perimeter and underslab drain piping. Coordinate wall through penetrations with appropriate waterproofing and structural details. Perimeter and underslab drain pipes shall be installed at the same invert elevation.

F. Prefabricated vertical drainage boards shall be installed along the backfilled side of foundation walls at locations shown on Drawings. The drainage board shall be applied from the top of the footing up to within 1 ft below proposed finished grade. Install vertical drainage board as follows:

1. Coordinate placement with other drainage materials.
2. Lay perforated drainage pipe at location shown on Drawings. Install as indicated in Part 3 "Piping Installation" Article. Do not install aggregate.
3. Attach board to wall at horizontal mark and at beginning of pipe. Place core side of panel against wall. Use concrete nails with washers through product cylinders to attach panel to wall. Place nails from 2 to 6 inches below top of panel, approximately 48 inches apart. Construction adhesives, metal stick pins, or double-double-sided tape may be used instead of nails. Do not penetrate waterproofing. Before using adhesives, discuss with waterproofing manufacturer.
4. If additional panels are required on same row, cut away 4 inches of installed panel core, install new panel against installed panel, and overlap new panel with installed panel fabric.
5. If additional rows of panels are required, overlap lower panel with 4 inches of fabric.
6. Cut panel as necessary to keep top 12 inches below finish grade.
7. For inside corners, bend panel. For outside corners, cut core to provide 3 inches for overlap.

G. Any sections of piping that are not true to lines and grades, or that show any undue settlement after being laid, or are damaged shall be removed and re-laid or replaced at no additional cost to the Owner.

H. Test or check lines before backfilling to assure free flow. Remove obstructions, replace damaged components, and retest system until satisfactory.

3.6 RETAINING-WALL DRAINAGE INSTALLATION

A. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

B. Place supporting layer of drainage course over compacted subgrade to compacted depth of not less than 4 inches.

C. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.

D. Install drainage piping as indicated in Part 3 "Piping Installation" Article for retaining-wall subdrainage.

E. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.

F. After satisfactory testing, cover drainage piping to width of at least 6 inches on side away from footing and above top of pipe to within 12 inches of finish grade.

G. Place drainage course in layers not exceeding 3 inches in loose depth; compact each layer placed and wrap top of drainage course with flat-style geotextile filter fabric.

H. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches.

I. Fill to Grade: Place satisfactory soil fill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish grade.

J. Alternative drainage details may be provided by the Contractor for design-build site retaining walls. Drainage details shall be included as part of a design submittal that is reviewed by the Engineer prior to retaining wall construction.

3.7 LANDSCAPING DRAINAGE INSTALLATION

A. Provide trench width to allow installation of drainage conduit. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.

B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.

D. Install drainage conduits as indicated in Part 3 "Piping Installation" Article for landscaping subdrainage with horizontal distance of at least 6 inches between conduit and trench walls.

Wrap drainage conduits without integral geotextile filter fabric with flat-style geotextile filter fabric before installation. Connect fabric sections with adhesive or tape.

E. Add drainage course to top of drainage conduits.

F. After satisfactory testing, cover drainage conduit to within 12 inches of finish grade.

G. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.

H. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches.

I. Fill to Grade: Place satisfactory soil fill material over drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish grade.

3.8 PIPING INSTALLATION

A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.

1. Foundation and Underslab Subdrainage: Install piping laid flat, with 45-degree elbows to facilitate changes in invert levels as shown on the Drawings.
2. Plaza Deck Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 1.0 percent.
3. Retaining Wall Subdrainage: When water discharges at end of wall into stormwater piping system, install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 36 inches, unless otherwise indicated. However, when water discharges through wall weep holes, pipe may be installed with a minimum slope of zero percent.
4. Landscaping Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 36 inches, unless otherwise indicated.
5. Lay perforated pipe with perforations down.
6. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.

B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.

C. Install ABS piping according to ASTM D 2321.

D. Install PE piping according to ASTM D 2321.

E. Install PVC piping according to ASTM D 2321.

F. Install clay piping according to ASTM C 12 and NCPI's "Clay Pipe Engineering Manual."

G. Install concrete piping according to ACPA's "Concrete Pipe Handbook."

3.9 PIPE JOINT CONSTRUCTION

A. Cast-Iron Soil Pipe and Fittings: Hub and spigot, with rubber compression gaskets according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook." Use gaskets that match class of pipe and fittings.

B. Join ABS pipe and fittings according to ASTM D 2751.

C. Join PE pipe, tubing, and fittings with couplings for soil-tight joints according to AASHTO's "Standard Specifications for Highway Bridges," Division II, Section 26.4.2.4, "Joint Properties."

D. Join perforated, PE pipe and fittings with couplings for soil-tight joints according to AASHTO's "Standard Specifications for Highway Bridges," Division II, Section 26.4.2.4, "Joint Properties"; or according to ASTM D 2321.

E. Join PVC pipe and fittings according to ASTM D 3034 with elastomeric seal gaskets according to ASTM D 2321.

F. Join perforated PVC pipe and fittings according to ASTM D 2729, with loose bell-and-spigot joints.

G. Join perforated clay pipe and fittings with gaskets according to ASTM C 425.

H. Join perforated concrete pipe and fittings with gaskets according to ASTM C 443.

I. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

3.10 CLEANOUT INSTALLATION

A. Cleanouts for Foundation/Underslab Drainage System:

1. Install cleanouts and riser extensions from piping to top of slab. Locate cleanouts at locations shown on the drawings. Install fittings so cleanouts open in direction of flow in piping.
2. Use NPS 4 steel or cast-iron soil pipe and fittings and riser extensions to cleanout flush with top of slab or pavement.

B. Cleanouts for Retaining Wall and Landscaping Subdrainage:

1. Install cleanouts from piping to grade. Locate cleanouts at beginning of piping run and at changes in direction, or as shown on the Drawings. Install fittings so cleanouts open in direction of flow in piping.
2. In vehicular-traffic areas, use NPS 4 cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 18 by 18 by 12 inches in depth. Set top of cleanout flush with grade. Cast-iron pipe may also be used for cleanouts in nonvehicular-traffic areas.

3. In nonvehicular-traffic areas, use NPS 4 cast-iron or PVC pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 12 by 12 by 4 inches in depth. Set top of cleanout plug 1 inch above grade.

3.11 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect low elevations of subdrainage system to building's solid-wall-piping storm drainage system.

C. Where required, connect low elevations of foundation or underslab subdrainage to stormwater sump pumps.

3.12 IDENTIFICATION

A. Materials and their installation are specified in Division 31 Section "Earth Moving." Arrange for installation of green warning tapes directly over piping.

1. Install PE warning tape or detectable warning tape over ferrous piping.
2. Install detectable warning tape over nonferrous piping and over edges of underground structures.

3.13 FIELD QUALITY CONTROL

A. Testing: After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

3.14 CLEANING

A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION 334600

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BAGGAGE HANDLING SYSTEM

PART I - GENERAL SPECIFICATIONS

1.01 RELATED DOCUMENTS.

A. General

1. These written Specifications, in conjunction with the accompanying Contract Drawings, constitute the Contract Documents for the Project. If there are any discrepancies between these written Specifications and the Contract Drawings, the more stringent requirement shall apply as interpreted by the Owner or his representative.

2. These Contract Documents are confidential and are not to be distributed or copied, in part or in whole, without the written consent of an authorized representative of the Owner or BNP Associates, Inc.

3. Portions of this project must comply with The American Recovery and Reinvestment Act of 2009, Pub.L.111-5 along with all of the ARRA Standard Terms and Conditions.

B. Drawings

1. Specification Drawings (Ref. Drawing B00.01 for listing), Architectural Drawings, Communications/Network Layout Drawings, Fire Protection System Drawings, MEP (Mechanical, Electrical and Plumbing) Drawings, Structural Drawings, Overall Program Phasing Plans, Contract Provisions, Special Provisions and Supplementary Provisions apply to the work of this Section.

2. The Architectural, MEP and Structural drawings that have been prepared under a separate package, define the facility modifications that will be performed to accommodate the Baggage Handling System. These drawings shall be used for bidding purposes and preparation of design/engineering documents.

3. It shall be the BHS Contractor's responsibility to request and obtain existing conditions drawings, architectural drawings, MEP (Mechanical, Electrical and Plumbing) drawings, Structural drawings and Project Phasing Plans applicable to the BHS from the Owner or his representative.

C. Special Related Documents

1. Division 00 – Contract Requirements

2. Division 01 – General Requirements

3. Division 26 – Electrical Requirements

4. EDS Supplier Reference Documents – L3 Communications eXaminer 3DX Explosive Detection System (EDS) to Baggage Handling System (BHS) Integration Guide

5. TSA Independent Verification and Validation (IV&V) Checked Baggage Inspection System Performance and Commissioning requirements.

6. Planning Guidelines and Design Standards (PGDS) for Checked Baggage Inspection Systems, Version 2.0, dated 30 January 2009.

7. Site Specific Test Plan (SSTP) for the Checked Baggage Inspection System (CBIS) Performance and Commissioning Requirements. The actual site specific document for the project will be generated by the TSA and will be given to the Contractor after contract award and prior to the specified acceptance test requirements.

8. Assume the responsibility to contact the appropriate firm or supplier to request the necessary documents that would be required for coordination, testing, interface and reference purposes.

9. Portland International Jetport BHS Basis of Design Report including Appendices

D. Other Related Documents

1. Existing Portland International Jetport Terminal Baggage Handling Systems – Operations and Maintenance

Manuals (copies can be obtained from the Owner)

2. Existing Portland International Jetport Terminal Baggage Handling Systems – As-Built Drawings (mechanical/electrical) (copies can be obtained from the Owner).

3. Existing Portland International Jetport Baggage Handling Systems – PLC/BHC Codes (as applicable) (copies can be obtained from the Owner).

1.02 SUMMARY

A. General

1. This Baggage Handling System Specification is divided into four (4) parts as follows:

a. Part I specifies general administrative and procedural requirements for a BHS installation as specified herein and in the accompanying drawings.

b. Part II specifies product information including approved equipment requirements.

c. Part III specifies execution requirements for the BHS installation and demolition that are required.

d. Part IV specifies quality control requirements

2. The BHS Specification and accompanying Contract Drawings are intended to outline the work, define functional requirements, and establish minimum standards of quality for the Project. The BHS Contractor shall assume full responsibility that the BHS, when completed, meets all local, state and federal laws, codes and safety standards and assures a safe and efficient system for all personnel who operate, maintain or have access to it.

3. New security requirements have been mandated by the Transportation Security Administration (TSA) for all outbound passenger checked baggage to be screened for explosive materials. The Jetport Expansion will facilitate an In-Line automated checked baggage security screening system as illustrated on the accompanying drawings. In addition to the changes to the conveyor system, other EDS-related modifications shall be made to the facility space to allow the TSA staff to provide security-screening services.

4. The laws of the City of Portland, the State of Maine, and the United States of America (USA) shall apply and govern the Contract.

5. All references to sums of money shall be in United States Dollars (USD), the currency of the United States of America (USA).

B. Scope of Work

1. Provide a complete, operable, maintainable and safe system on a "turnkey basis", including all supports, header steel, hangers, anchors, framing, trim, electrical power to the BHS systems from the sources indicated on the BHS Plan Drawings (such as but not limited to disconnect, wiring, and conduits), motors, motor starters, disconnects, controls, push buttons, conduit, wiring, cabinets, platforms, ladders, stairs, crossovers and all other components, whether specifically shown and described, or implied in the plans and specifications or wherever required to effectively accomplish the intended functions of the BHS. In all cases where a device or part of the equipment is herein referred to in the singular number, it is intended that such reference shall apply to as many such devices as are required to satisfactorily complete the installation.

2. Furnish all labor, materials, and equipment required for implementing the BHS as defined by these specifications, including but not limited to installation, all required acceptance testing (including required support and participation for the TSA's SAT, Pre-IV&V/TRR, formal TRR and IV&V), all necessary wiring between BHS components, necessary protection of conveyor equipment and screening equipment that is under construction, materials, new conveyor equipment with all related components, provision of new BHS PLCs, PLC Networks, and other applicable components/devices, all as required, for implementing the new In-Line EDS defined by these specifications.

3. Assume the responsibility to coordinate with the TSA's Contractor the site planning, the BHS Phased-in Implementation, required BHS testing based upon the SSTP (i.e., SAT, Pre-IV&V/TRR, formal TRR and IV&V) and all interface requirements between the security screening equipment (i.e., EDS Level 1 machines) and the BHS for all of the conveyor lines as they relate to this Project. In order to successfully accomplish the intended operation described herein, the details of all required interface(s) between the BHS and EDS machines shall be fully coordinated with the special systems contractor. The special systems contractor will be responsible for all

cabling between the EDS machines and the related workstations for data and voice. The BHS contractor shall be responsible for the interconnection of all BHS related PLC and data highway connections from the BHS to the EDS machines that are required to accommodate the interfaces between the two systems (hard-wired I/O, data interface cabling and software driven).

4. Furnish implementation schedules and associated phasing plan documentation with the operating and maintenance documentation to the Owner or his representative, including required manuals, equipment parts lists and shop drawings - all in strict accordance with the specifications and applicable drawings, and subject to the terms and conditions of the Contract.

5. Contractor shall provide a BHS simulation which validates the processing and throughput capacity of the system. The Contractor shall submit their design assumptions and proposed data for the simulation for review and approval prior to the CBIS Contractor performing the simulation. After the simulation is performed the CBIS Contractor shall provide a simulation report consisting of their design assumptions, the raw data input to and output from the simulation model, and a review of the simulation results as well as any recommendations determined by the Simulation.

6. Provide all hardware, software, and construction supervision to insure that the BHS equipment operates on a fully integrated “Turnkey” basis.

7. Cooperate with the Architect and other contractors for coordination of the building fire zones to confirm the number and location of the BHS associated fire/security doors and number of conveyors, which require emergency power.

8. The Contract Drawings are intended to generally outline the conveyor system configuration and function desired. Pertinent building dimensions are noted along with some specified conveyor dimensions and elevations. An attempt has been made to present approximate conveyor length and right-of-ways, but these shall necessarily be determined by review and inspection of building construction drawings and verified by actual field measurements by the BHS Contractor prior to preparing shop and erection drawings. An attempt has also been made to present the number, size and locations of the BHS Motor Control Panels (MCPs); it shall be the BHS Contractors responsibility to verify the final number of panels with related cabinet sizes and locations based on their electrical shop drawings within 30 days of contract award.

9. Coordinate with the TSA Contractor as required to coordinate the details of the required interface(s) between the BHS and EDS systems in order to successfully accomplish the intended operation described herein. The BHS contractor shall, in all cases, be responsible for any wiring between the BHS and EDS systems that are required for these interfaces (hard-wired I/O, data interface cabling and software driven).

10. Preserve all mechanical and electrical right of ways for all deferred equipment depicted on the Contract Drawings.

11. Identify all building interface requirements necessary to install the BHS over and above those shown on the contract drawings in the bid documents. Verify as-built conditions and notify the Owner or his representative of conflicts. Any additional building modifications or alterations not so identified in the contract bid shall be borne by the BHS Contractor.

12. Assume the responsibility to coordinate the BHS maintenance platform design with the sprinkler system design, to permit the installation of the sprinkler pipes below the proposed platforms or areas where they are projecting below adjacent conveyors. The coordination between the sprinkler system design and the BHS equipment/platforms shall ensure the sprinkler pipes do not interfere with the BHS operation or related maintenance access.

13. Submit to the Owner or his representative any request for information, clarification of specification, and variance from the specifications as a Request For Information (RFI).

14. Obtain and pay for all permits, inspection fees, and certificates relative to all phases of BHS construction.

15. Be responsible for all employee badges as required by the Jetport Authority for this project. The Owner shall not provide escort services for employees on the ATO and AOA side of the facility.

16. Submit all structural attachment detail/computations and electrical drawings signed and sealed by a Professional Engineer licensed in the State of Maine.

17. Provide any and all temporary power and lighting that may be required for and during the course of the

installation and testing of the BHS.

18. Perform all work within the hours designated for the appropriate work areas. Coordinate work hours with the Owner and user Airlines to prevent any impact to the Airlines' operation during the Work. Generally, work may occur at all times in the Terminal Expansion area, and during non operational hours (to be coordinated with the Owner and user Airlines) in the existing Terminal.

19. Cooperate and coordinate with the Owner and their Architect for the location of all Mechanical, Plumbing, Electrical, Right-of-Ways and access/egress between the BHS platforms and the building to confirm the final number and locations of the BHS associated stairs/ladders, conveyor maintenance crossovers, maintenance platforms, and all other BHS platforms and ladders over and above those shown on the contract drawings.

20. Emergency power will be provided for specific portions of the baggage handling equipment including fire / security shutters, their immediate upstream and downstream conveyors, the entire originating Oversize Conveyor Subsystem and the fire & security shutters (and controls) associated with the Oversize Clear Bag Chute.

21. Develop detailed sequencing plans for each subsystem designated for modification after discussions and coordination with the Construction Manager to determine the availability of the respective Baggage Handling System Area. The BHS Contractor at no additional cost shall perform these tasks.

22. It should be noted that the structural requirements of this project are critical given the structural design of Portland International Jetport Terminal Expansion baggage handling areas. All BHS components that require overhead support shall utilize structural steel. No attachment to the upper level deck will be allowed in the new Terminal Expansion area. Intermediate header steel shall be utilized for conveyor equipment support. Conveyors and related equipment that are mounted to the ceiling within the existing Terminal portion shall utilize the new structural steel (ref. Structural Dwgs)**.** The Structural Attachment submission will be carefully scrutinized and evaluated. All temporary conveyor support structures for the BHS including but not limited to columns, beams, and header steel shall be provided by the BHS Contractor and shall be coordinated with the overall project implementation schedules.

23. Assume responsibility to take down existing supports and existing conveyor line segments with associated conduits, junction boxes, control stations, and other electrical and control components as required to accommodate the planned relocation, reconfiguration, and demolition that is required as part of the overall construction/installation sequenced plan. This includes but is not limited to the areas that are illustrated on drawing numbers B00.60 through B00.64 detailing the Terminal BHS.

24. All temporary and final conveyor equipment supports shall be designed, engineered and installed so as not to infringe on the Jetport or the Owner's operational areas, drive aisles or cart staging areas.

25. After installation of the BHS, the BHS Contractor shall demonstrate its operating capability. The BHS Contractor prior to the start of the Systems Acceptance Testing should have accomplished all "debugging" and internal testing. In addition, the BHS Contractor shall carry out a "dry test run" of all Acceptance Tests prior to conducting such tests with the Owner or his representative to ensure that tests conducted with the Owner or his representative are successful. The BHS Contractor shall make available to the Owner on a daily basis any and all records of internal testing and debugging (with corrective action) performed prior to Acceptance Testing.

26. Assume the responsibility for the required coordination with all relative on-site disciplines/contractors, including the IV&V Contractor, for all required interfaces to the BHS. The BHS contractor shall also coordinate and work closely with the TSA's EDS provider (L3) and the Owner's and their representative for all BHS integration testing, including but not limited to providing the necessary support/participation and system demonstrations for the TSA's mandated certification testing, such as the Pre-IV&V/TRR, the formal TRR and IV&V. The BHS Contractor, prior to the start of the System's Acceptance Testing, the Pre-IV&V/TRR and formal TRR should have accomplished all "debugging" and internal testing. In addition, the BHS Contractor shall carry out a "dry test run" of all Acceptance Tests and Pre-IV&V/TRR prior to conducting such tests with the Owner and the TSA or their representatives, to ensure that tests conducted with the TSA and the Owner or their representatives are successful. The BHS Contractor shall provide the Owner or his representative on daily basis any and all records of internal testing and debugging (with corrective action) performed prior to Acceptance Testing.

27. Upon completion of the BHS installation, all related programming and internal testing/debugging, the BHS Contractor shall be responsible to demonstrate the system's operating capability to the Owner and his representatives for acceptance and for Pre-IV&V/TRR to confirm compliance with the specified requirements. The BHS Contractor shall provide all labor and test material as specified elsewhere in this document, including

service technicians and test material handlers for the BHS Acceptance Testing, the Pre-IV&V/TRR and formal IV&V/TRR period. These test demonstrations shall be carried out per the following requirements, as part of the base contract:

a. The BHS Test Plans that shall be prepared by the CBIS contractor in compliance with the specified requirements herein (Testing and Acceptance) as well as the specified requirements of the TSA's Planning Guidelines and Design Standards (PGDS) document.

b. The Site Specific Test Plans (SSTP) for the CBIS performance and commissioning requirements, which will be prepared by the TSA's representative (IV&V Contractor) and shall be followed by the CBIS contractor in order to pass the Independent Verification and Validation (IV&V). The CBIS Contractor shall meet with the owner, the TSA and their representative, at the Jetport or other location as requested by the Owner, to review the SSTP and obtain a copy from the Owner, for use in the upcoming test procedures that are outlined below, to ensure the completed CBIS meets all the protocols and requirements contained within, prior to the TSA IV&V(s).

1.) Local Acceptance Testing - All Pre-IV&V/TRR testing (and retesting of failed tests) shall be carried out by the CBIS Contractor, and witnessed by the Owner, local TSA and their representatives, using the BHS approved test plans – per Part 3, Section 3.15 (Testing and Acceptance) of this specification, as well as the requirements of the PGDS - and the SSTP to certify that the CBIS satisfactorily passed per the pass/fail requirements of the test plans and is ready for a formal TRR by the TSA's CTO representative. All testing data and related Pre-IV&V/TRR documentation that results from these tests, when passed, will be distributed by the Owner to the TSA's CTO representative, for review and approval, along with a request for a formal TRR.

2.) Formal TRR - Upon successful completion of the above referenced local acceptance testing and Pre-IV&V/TRR, the TSA's CTO representative will be invited by the Owner to witness a formal TRR, which shall be demonstrated by the CBIS contractor. The tests that will be performed during this period will be selected (from previous SSTPs that were performed during the Pre-IV&V/TRR) by the TSA's CTO representative and those tests shall be demonstrated by the CBIS contractor, under the direction of the TSA's CTO representative.

3.) IV&V - Upon successful completion of the formal TRR to the TSA's CTO representative, a TRR report will be issued by the TSA's CTO to the TSA or their representative (IV&V Contractor) and the Owner will submit a letter of concurrence to the TSA regarding successful Pre-IV&V demonstration, to schedule the TSA or their representative (IV&V Contractor's) on-site visit for the IV&V. It is anticipated that the TSA or their representative (IV&V Contractor) will provide all test personnel and testing material for the IV&V. However, the CBIS Contractor shall also provide the necessary manpower/labor and material, as necessary, similar to previous tests performed with the Owner and local TSA, to support the TSA or their representative in performing the mandated Independent Verification and Validation (IV&V) for the CBIS.

28. It is recommended to visit the project site prior to bidding, to thoroughly be acquainted with the scope of work and installation restrictions directly associated with the existing area of the facility. The BHS Contractor shall coordinate a pre-bid walk-through with the Owner or his representative. The following requirements associated with the existing BHS modifications should be reviewed and surveyed during this site visit.

a. Existing conveyor line demolition

b. Existing electrical and controls demolition

c. TSA Security System requirements such as staffing locations, support rooms, monitoring systems, and other TSA requirements, which may impact the new BHS equipment installation.

C. System Description

1. The Baggage Handling System (BHS) to be provided is illustrated on the accompanying Drawing Package (Ref. Drawing Number B00.01 for a complete listing of drawings).

2. The proposed modifications to the existing Baggage Handling System for Portland International Jetport are as follows:

a. Inbound subsystem at column line 1Z in zone 4 shall be removed.

b. The remaining existing system will not be altered until after Phase 2, in which most of the new BHS will be built, tested and commissioned for operation before demolition of the existing system.

c. Existing Ticket Counter, Curbside and make-up piers will be demolished after the new In-line EDS is fully operational.

d. The remaining conveyor equipment shall be tied into the operating EDS/BHS without affecting the operations of the BHS.

e. No manual baggage transportation is anticipated as part of the installation phasing plan. However, if required as a contingency for cutover or other installation efforts that do not proceed according to the phasing plan, the BHS Contractor shall provide all required manual baggage handling labor to ensure that the baggage handling operation is uninterrupted.

3. Summary of the proposed baggage handling system by subsystem

a. Ticket Counter Subsystems

1.) Three (3) Ticket Counter (TC2, TC3 and TC4) subsystems will be load points for the new BHS.

2.) TC2, TC3 & TC4 are in the main check-in area in Zone 5.

3.) TC2 is the outbound mainline that feed the EDS matrix.

b. Oversize bag processing

1.) Oversize bags checked-in at the main check-in area will be transported to the oversize bag conveyor line manually by airline agent near to Y2 and entered into the system. The oversized conveyor will then route baggage from the check-in area to the centrally located screening area for oversized screening.

2.) The TSA will remove the bag from the oversized conveyor and place the bag on a stainless steel table that is provided as part of the BHS Contractor's scope. ETD operations will take place on this table; this process shall be determined by the local TSA. After the bags have been cleared they will be placed onto an oversized chute, which has enough width to accommodate multiple oversize bags and a lip to catch the bag where it will be removed by a ramp handling agent.

3.) Contractor to furnish and install all overhead fire and/or security shutters for the processing of Oversize bags.

4.) Contractor shall provide rotating beacon which indicates that there is a bag awaiting pickup at the oversize clear bag chute.

c. Checked Baggage Inspection System (CBIS)

1.) TC2 feeds the CBIS Matrix (ED1, ED2, ED3).

2.) TC2 has multiple High speed vertical paddle diverters (HSVPD's) directing baggage into the L3 3DX 6600 feed lines for each of the EDS machines.

3.) Bag ID tracking shall start at the BMA/ATR machine, however, the associated Baggage Measuring Array (BMA) / Automatic Tag Reader (ATR) for EDS matrix shall provide a bar code IATA tag number and a unique pseudo tracking ID to the control system, allowing a decision to be made in order to properly route each bag to an appropriate screening subsystem. The functionality and exact locations of tracked conveyors shall be coordinated with TSA for purposes of certification testing during the development of the SSTP. If a bag is within the specified dimensions of the L3 3DX 6600 EDS devices, the bags will be diverted off the TC lines onto the ED line. Bags that are out-of-gauge (OOG) will continue from the TC2 to the SS1 subsystem and routed to the ETD.

4.) Bags on the EDS matrix will continue on ED Subsystem to a Level 1 decision Vertical Sorter. Suspect bags will continue on the upper conveyor (SB1, SB2, SB3) based upon machine automatic decision. Clear bags will be diverted to the lower conveyor (CB1, CB2, CB3), which continues to the sortation mainline ML1.

5.) Level 1 suspect baggage will continue to the decision point and shall be given a minimum of 45 seconds for a Level 2 decision. The OSR operators will review the bag images during this 45 second period. The status change will be sent to the BHS to update the bag ID with status.

6.) Level 1 suspect bags will continue on the SB1 subsystem to the Level 2 decision Vertical Sorter. Suspect bags will continue on the lower conveyor (SB1) to be Level 3 screened in the CBRA. Clear bags will be diverted to the upper conveyor CB4 which merges with CB1, which continues to the sortation mainline ML1.

7.) Bags that are cleared in the CBRA will be loaded onto the CB5 line which will merge with CB1 at a point downstream.

8.) Baggage tracking is required throughout the CBIS to ensure that baggage arrives at the proper destination based upon its security status. Baggage tracking is also required on the sortation mainline for proper baggage sortation.

9.) A reinsertion line from the CBRA to the TC2 mainline prior to screening is provided. This subsystem shall allow a TSA agent to re-input a bag for screening as allowed by TSA protocol.

10.) Bags that are measured to be out of gage shall be bypass the ED HSVPD's and be directed to the CBRA automatically.

d. Sortation System

1.) CB1 will transport clear bags to the sortation mainline (ML1) where an Automatic Tag Reader (ATR) shall scan the bag tag. Along with that information, the control system shall then direct the bag to the proper make-up unit.

2.) If a bag is lost in tracking or is not read by the ATR, the bag shall continue on the ML1 line to the Manual Encode area (ME1). Here the bag shall be manually scanned or have the information keyed into the console to transport the bag to the proper make-up unit. The manual encoding area shall be equipped with a rotating beacon which indicates that there is a bag awaiting encoding within the manual encoding area. This beacon shall be visible within the bag make-up area.

3.) Each make-up carousel shall be equipped with a stack lamp indicator consisting of a minimum of three independently colored stacked lights. The first light shall indicate if there is a bag awaiting at the manual encoding area. The second light shall indicate if there is a bag awaiting removal at the oversize clear bag conveyor and the third light shall indicate if there is a bag at the 'dump' carousel which either lost tracking or required manual encoding. BHS contractor shall provide all equipment and controls associated with these functions. Reset of the stack lamps shall be achieved via 'Reset' button located with the makeup area near to Manual Encoding, Oversize Clear Bag Chute, and Dump Carousel respectively.

4. Summary of General EDS and BHS Requirements

a. Provision of all new conveyors with related components (primary inputs and outputs to/from the three (3) Level 1 EDS machines).

b. Provision of High speed vertical paddle diverters for sortation, load balancing and redundancy on the EDS input lines, and subsequent decision points.

c. Provision for Level 1 screening of outbound bags, with associated input / output conveyors and all required interfaces between the BHS and EDS. The uncrating, leveling, calibration and final installation of the EDS machines in their permanent locations is NIC.

d. Integration of the EDS machines (L3 3DX 6600) - Level 1 (quantity of 3) into the system configuration.

e. Transport conveyors between Level 1 and Level 3 (including all necessary bag tracking, sortation and Level 2 interface requirements).

f. Installation of high-speed diverters and vertical sorters to provide segregation of bags between Level 1 and Level 2, and level 2 and Level 3 ETD and for the "cleared bag" lines (e.g., input to the ATR and sortation system).

g. Conveyors as required for transport of suspect/alarmed bags from the Level 1 decision vertical sorter and conveyor lines to the Level 2 decision point vertical sorter.

h. Conveyors as required for transport of suspect/alarmed bags from the Level 2 processing conveyor lines to the Level 3 ETD area.

i. Conveyors between the Level 3 ETD inspection area (staffed by TSA) to provide return transport of cleared bags to the sortation system and make-up device(s).

j. Re-input conveyor from the CBRA to the outbound mainline prior to the BMA/ATR and screening matrix.

k. Oversize conveyor from the ticketing area to the CBRA and stainless steel clear bag slide from the CBRA to the make-up area.

l. Conveyors locally equipped with 4" high sideguards at locations upstream and downstream of the EDS machines to assist TSA personnel in performing "IQTK" Test Bag Testing of the EDS machines. Conveyors required to have this type of sideguard are indicated in the contract drawings. Assume responsibility to coordinate input sideguard locations with tunnel locations, control station layouts, crossovers, to devise the best possible location of these sideguards by providing a "mock-up" of the first EDS installation for review and approval by Owner and TSA.

m. New electrical components shall be provided on the conveyor sections located at the input/output ends of the EDS machines with "quick-disconnect" type connections to aid in the removal of conveyor segments/components in the event of EDS machine replacement. Conveyors required to have this type of equipment shall also be provided with lockable caster wheels on the respective conveyor's floor support legs, to assist in the removal/maneuvering of the conveyors segments; these conveyor segments are indicated in the contract drawings. This requirement also applies to conveyor equipment that requires relocation in order to accommodate the removal or replacement of any EDS device.

n. New control systems shall be provided, including MCPs, PLCs, MDS, Sort Controllers and MIS database servers as required, to accommodate the specified functionality.

o. Provide additional components, equipment and systems as required and specified to fulfill the scope of work as described herein.

5. Fire/Security Doors

a. Provide, install and integrate all BHS fire/security doors as illustrated on the contract drawings. Contractor shall confirm the fire / security zones and furnish and install doors at all separation points between fire/security zones. Also, provide and install all draft curtains at the new fire/security door locations.

6. Maintenance Platforms

a. Assume the responsibility to provide and install all BHS related maintenance platforms, ladders and cross-overs to ensure the function listed herein and ensure proper equipment maintenance. An attempt has been made in the contract drawings to provide the locations that maintenance platform is required. The contractor shall confirm the maintenance platform requirements and submit detailed layouts as a portion of their submittals.

7. New In-Line EDS and ETD Equipment Installation and Testing

a. The units shall be located in an In-Line configuration with the BHS conveyor equipment. The transportation of the EDS units (i.e., L3 3DX 6600) between the truck dock or storage facility and their final location shall be coordinated with the Owner and the TSA is performed by others. This scope shall be performed under close coordination and "Supervision" with the supplier's (i.e., L3 Communications) recommendations and assistance in all aspects of this work, including rigging of each EDS unit. Uncrating, leveling and calibration and rigging of each unit will be performed on site by the TSA's supplier. The location of these units shall be in compliance with all applicable regulations/requirements of the TSA and the respective supplier (i.e., L3 Communications).

b. It shall be the TSA's responsibility to obtain TSA certification upon completion of this work for all the new, modified and relocated EDS units.

c. Assume the responsibility to coordinate with the TSA's Contractor the site planning, Phased Implementation, required testing (i.e., SAT and IV&V) and all interface requirements between the security screening equipment (i.e., EDS Level 1 machines, Level 2 workstations and ETD stations) and the BHS for all of the conveyor lines as they relate to this project.

d. The new EDS and ETD equipment, which will be provided by the TSA, shall be installed (e.g., EDS internal system wiring, networking and related controls) at their permanent location by the TSA's contractor.

e. Successfully perform internal testing according to the Site Specific Test Plan (SSTP) prior to indication to the appropriate parties that the system is ready for the required certification testing. Give sufficient notice to the Owner and allow their representative(s) to witness the internal testing. Provide all labor and materials for this internal testing. Provide all labor and materials necessary to successfully demonstrate the system operation and performance to the TSA and/or their representative, the details of which shall be coordinated during the development of the SSTP.

8. TSA Satellite MDS Station

a. In addition to the centralized redundant MDS and the remote MCP door-mounted Touch Screen Terminals, provide a new satellite MDS station and associated printer for the TSA to monitor the Outbound BHS functions. This satellite station shall be located within the TSA's EDS Level 2 screening area, adjacent to the supervisor's workstation, and shall function similar to the new maintenance diagnostics computers, which are located in the BHS Control Room. This Satellite Computer shall serve as a third Maintenance Diagnostics Computer and shall be connected to the main BHS Computer Workstation via an Ethernet connection, which shall be provided and installed as part of the scope for this project.

b. The satellite MDS station for the TSA shall display all graphics, alarms, alarm text and any messages that are associated with the outbound BHS subsystems, including the In-Line EDS equipment.

c. The satellite MDS controls functionality shall be identical to control room MDS graphics and text displays, including the zoom-in capability.

d. The satellite MDS workstation shall not be capable of any modifications to sort system, flight schedules, make-up assignments, and HSVPDs.

e. The satellite MDS workstation shall provide read access to the daily alarm logs. This access shall also allow the user to save the alarm log data to a CSV (Comma Separated Variable) file onto a CD/DVD and Hard Drive in the remote workstation.

f. The method of connection between the centralized MDS, which is located in the BHS Control Room and the new satellite MDS workstation in the TSA's EDS Level-2 Workstation Area shall be such that the remote MDS station shall be operational at all times the centralized MDS is operational.

g. The satellite MDS station shall consist of, as a minimum, a redundant PC with 21" monitors and appropriate Graphics Card, CD-RW/DVD+RW120 GB Hard Drive, 1024 MB RAM, with its own printer, an audible Alarm similar to the MDS with both an alarm silence and a means to enable/disable this feature. All software to support the functions associated with the use as a satellite MDS. Additionally, provide and install a single copy of Microsoft Excel.

h. The satellite MDS workstation shall be password protected, similar to the centralized MDS and require login to perform any functions other than view the display (i.e., anything to do with the alarm logs).

1.03 DEFINITIONS

A. Abbreviations

1. ACS shall mean Access Control System
2. ANS shall mean American National Standards
3. ANSI shall mean American National Standards Institute
4. ASCII shall mean American Standard Code for Information Interchange
5. AOA shall mean Airport Operations Area
6. ATO shall mean Airline Ticket Office
7. ATR shall mean Automatic Tag Reader
8. BCR shall mean Baggage Control Room
9. BHS shall mean Baggage Handling System
10. BHS Contractor shall mean Baggage Handling System Contractor and be synonymous with CBIS Contractor

11. BNP shall mean BNP Associates, Inc., the Baggage Handling System Consultant/Engineer.
12. BMA shall mean Baggage Measuring Array, which shall be synonymous with BDD (Baggage Dimensioning Device)
13. BMTT shall mean Bag Maximum Travel Time
14. BPM shall mean Baggage Processing Message
15. BSM shall mean Baggage Source Message. Message sent from airline computer system to BHS computers.
16. BSO shall mean Baggage Service Office
17. BUM shall mean Baggage Unload Message
18. BVS shall mean Baggage Viewing Stations.
19. CB shall mean Clear Bag
20. CBS shall mean Checked Baggage Screening
21. CBIS shall mean Checked Baggage Inspection System
22. CBIS Contractor shall mean Checked Baggage Inspection System Contractor and be synonymous with BHS Contractor
23. CEMA shall mean Conveyor Equipment Manufactures Association
24. CM shall mean Construction Manager
25. COF shall mean Coefficient of Friction
26. Cold Back-up shall mean that redundancy is based on the removal of a failed primary component (e.g. PLC) and subsequent replacement with a fully programmed component (PLC).
27. CRT shall mean Cathode Ray Tube – Video Display Terminal
28. CT shall mean Computed Tomography
29. CTO shall mean the TSA's Chief Technology Office
30. CTX shall mean Computer Tomography Examiner
31. CUTE shall mean Common User Terminal Equipment
32. DCH shall mean Data Communication Highway. Communication line between PLCs, peripheral devices and computer systems.
33. DID shall mean Directional Input Device
34. EDS Shall mean Explosive Detection System (Computer Tomography)
35. EIA shall mean Electronic Industry Association
36. EPROM shall mean Erasable Programmable Read Only Memory
37. EOD shall mean Explosives Ordinance Disposal
38. ETD shall mean Explosive Trace Detection
39. FAA shall mean Federal Aviation Administration
40. FAT shall mean Factory Acceptance Test
41. FLA shall mean Full Load Ampacity or Full Load Amperes
42. FPM shall mean Feet Per Minute
43. GC shall mean General Contractor - a firm or person other than the BHS Contractor who shall enter or has entered into a Contract with the Owner and who shall be identified by the Construction Manager for work at the Jetport relating to this contract

44. Gensler shall mean Architects of record.
45. GOVT shall mean Guaranteed Operator View Time
46. GSE shall mean Ground Service Equipment
47. HBS shall mean Hold Bag Screening
48. HDD shall mean Hard Disk Drive
49. HMI shall mean Human Machine Interface.
50. Hot Back-up shall mean that in the event of a failure of the primary component (e.g. PLC, sortation computer or other redundant component) the hot back up component shall retain the latest current status of the related system (i.e. tracking information) and shall assume full operation automatically. Hot back up of components shall provide bumpless and seamless transfer of information. All tracking sortation of baggage shall continue without interruption
51. HSVPD shall mean High speed vertical paddle diverter
52. HVAC shall mean Heating, Ventilating and Air Conditioning
53. IATA shall mean International Airline Transportation Association
54. ID shall mean Identification
55. IEC shall mean International Electromechanical Commission
56. I/O Module shall mean Input/Output Module
57. IV&V shall mean Independent Verification and Validation– A full bank of tests detailed in the TSA's Site Specific Test Plan; testing will be conducted by the IV&V Contractor and shall be supported by the BHS Contractor.
58. LAN shall mean Local Area Network
59. LCD shall mean Liquid Crystal Display
60. LED shall mean Light Emitting Diode
61. MCP shall mean Motor Control Panel. The MCP contains the electrical control and power circuit devices for the control of the baggage system(s).
62. MDS shall mean Maintenance Diagnostics System
63. ME shall mean Manual Encoding
64. MEC shall mean Manual Encoding Console used to manually enter baggage data into the BHS sortation computer, and shall include a hand-held scanner gun at each station
65. MEP shall mean Mechanical, Electrical and Plumbing System
66. MIS shall mean Maintenance Information System
67. MTBF shall mean - Mean Time Between Failures
68. NEC shall mean National Electrical Code
69. NEMA shall mean National Electrical Manufacturers' Association
70. NFPA shall mean National Fire Protection Association
71. NIC shall mean Not In Contract
72. NRT shall mean Near Real Time
73. NTP shall mean Notice-to-Proceed.
74. O & M shall mean Operations and Maintenance
75. OEM shall mean Original Equipment Manufacturer

76. OOG shall mean Out of Gauge
77. ORT shall mean Operational Readiness Test (for EDS Equipment)
78. OSHA shall mean Occupational Safety and Health Administration
79. OSR shall mean On-Screen Resolution
80. Owner shall mean Portland International Jetport
81. PAX shall mean Passenger
82. PDP shall mean Power Distribution Point
83. PE shall mean Professional Engineer
84. PGDS shall mean Planning Guidelines and Design Standards for Checked Baggage Inspection Systems, Version 2.0, dated 30 January 2009, as prepared by the TSA.
85. PLC shall mean Programmable Logic Controller, which controls BHS operation.
86. PM shall mean Project or Program Manager
87. PSI shall mean Pounds per Square Inch
88. PTRI shall mean Passive Threat Resolution Interface
89. PWM shall mean Portland International Jetport.
90. RFI shall mean Request For Information
91. ROW shall mean Right of Way
92. RT shall mean Real Time
93. SAC shall mean sortation allocation computer
94. SAT shall mean Site Acceptance Testing (for EDS Equipment)
95. SB shall mean Suspect Bag
96. SFS shall mean Secure Flight Selectee
97. SSTP shall mean Site Specific Test Plan, prepared by the TSA's representative
98. TCU shall mean Threat Containment Unit
99. TOB shall mean Top of Belt
100. TRI shall mean Threat Resolution Interface
101. TRT shall mean Threat Resolution Tools
102. TRR shall mean Test Readiness Review – shall be performed by the CBIS contractor in conjunction and in coordination with the Jetport's Security, the TSA's CTO and local TSA representatives to demonstrate that the system meets all of the requirements of the TSA/IV&V Contractor CBIS performance and commissioning requirements, per the TSA's PGDS, as well as the intent of the TSA's Site Specific Test Plan (SSTP).
103. TSA shall mean Transportation Security Administration
104. UL shall mean Underwriters Laboratories
105. UPS shall mean Uninterrupted Power Supply
106. USS shall mean Uniform Symbology Specification
107. User Airline shall mean those airlines that use the Baggage Handling System(s) related to this contract
108. VCR shall mean Video Cassette Recorder
109. VOM shall mean Volt Ohm Meter
110. VSC shall mean Vertical Sort Conveyor

111. WAN shall mean Wide Area Network

112. Warm Back-up shall mean that in the event of a primary component failure (e.g. PLC) the warm back up has to be manually switched to become the primary component.

B. Authorized Representative

1. The Owner may designate by written notice to BHS Contractor or by provision elsewhere in this Contract one or more persons, firms or corporation to act as its Authorized Representative in connection with the administration of this Contract. Except as otherwise provided in such written notice or elsewhere herein, such Authorized Representative shall have the authority to act for the Owner with respect to the performance of this Contract by the BHS Contractor with the objective of achieving full compliance by the BHS Contractor of the terms and provisions of the Contract.

2. The BHS Contractor shall accept and comply with instructions from such Authorized Representative as though such instructions had been given by the Owner and the BHS Contractor shall deal directly with such Authorized Representative in all matters arising under this Contract, including but not limited to matters involving Contract interpretation, disputes and arbitration procedures. However, such Authorized Representative is authorized to act in connection with this Contract solely as the representative of the Owner and not as principal hereunder.

C. General

1. Baggage Handling System (BHS) shall mean all components, installation materials, interfaces and other components, all necessary hardware, software, installation coordination and construction supervision of computers/PLC, controls and control hardware and software, management and support services required to implement the work and supply a fully functioning system as described by the Contract Documents.

2. Baggage Handling System Contractor shall be synonymous with Equipment Contractor, Equipment Supplier, Baggage Contractor, BHS Contractor, Supplier and Contractor and shall mean the firm or company that is responsible for the design, engineering, manufacture, and installation of the conveyor equipment and systems required to implement the work and supply a fully functioning system as described by the Contract Documents.

3. In these written Specifications and on the Contract Drawings (unless inconsistent with the content or subject matter or unless a contrary intention otherwise appears) the following clarifications/definitions shall apply:

a. As Built shall encompass all elements of the term As Executed.

b. Bill of Quantities shall mean a document named therein as a Bill of Quantities issued to bidders by or on behalf of the Owner, stating quantities of work to be carried out.

c. Completion shall mean:

1.) That stage of the execution of the Work under the Contract when the Works are completed and all other things, which are required by the Contract to be performed by the Contractor before completion, have been performed and accepted.

2.) Where contract or specifications provide a period of time for completion, the last day of the period.

3.) However, if the Owner grants an extension of time for completion, it means the date resulting from the extension of time.

d. Contract means this Deed of Agreement between the Owner and the Contractor for the performance of the Works, together with all schedules, attachments, annexure and other documents incorporated into this Contract.

e. Construction Manager shall mean a firm or person or such other manager as may be appointed by the Owner for the purpose of managing the Contract and, in so far as it concerns the functions exercisable by the Construction Manager, includes his nominated representatives.

f. Contract Sum means:

1.) Where the Owner accepted a lump sum, the lump sum.

2.) Where the Owner accepted rates, the sum ascertained by adding the products of the rates and the corresponding quantities in the Schedule of Rates.

3.) Where the Owner accepted a lump sum and rates, the aggregate of the sums referred to in paragraphs 1

and 2 above.

g. Date for Completion shall mean:

1.) Where contract provides a date for completion that date.

2.) Where contract or specifications provide a period of time for completion, the last day of the period.

3.) However, if the Owner grants an extension of time for completion, it means the date resulting from the extension of time.

4.) The date certified by the Owner in a Certificate of Completion to be the date upon which the Works have reached completion.

h. Day means a calendar day.

i. Diversion Point shall mean the point at which a bag will either be routed into the BHS for final sortation or routed to the next level of security screening for further processing.

j. Other Contractor or Other shall mean a firm or person other than the BHS Contractor who shall enter or has entered into a Contract with the Owner.

k. Project shall mean the construction of the Terminal Expansion - BHS project at the Portland International Jetport, as described in these written Specifications and on the Contract Drawings.

l. Schedule of Rates shall mean any schedule included in the Contract, which, in respect of any section or item of work to be carried out, shows the rate or respective rates of payment for execution of that work, and which may also include provisional items, provisional sums, quantities and prices. The schedules of rates are fixed sums for the duration of the Contract with the Owner.

m. Site means the lands and other places made available or to be made available to the Contractor by the Owner for the purpose of the Contract.

n. Specifications means the Specification for the Works included in the Contract and any modification of such Specification thereafter.

o. Subsystem shall mean a set conveyor segments and it's related field elements (e.g., control stations, consoles, scanners, and the like), which is a system itself, and a part of the whole system

p. Temporary Work shall mean any work required in the execution of the Contract but not forming part of the Works.

q. The Contract Drawings shall mean the drawings referred to in these written Specifications or The Contract; the Owner may from time to time supply modifications/revisions of such drawings and other drawings to the Contractor for the purposes of the Contract.

r. The Works shall mean the whole of the work to be executed in accordance with the Contract, including variations provided for by the Contract.

s. Words importing the singular include plural and words importing the plural include the singular.

t. Words importing persons include a partnership and a body corporate.

u. Words importing the masculine gender include the feminine and neuter genders.

v. Work Under The Contract shall mean any work the BHS Contractor is or may be required to execute under the Contract and includes variations, remedial work and Temporary Work.

1.04 BHS EQUIPMENT IDENTIFICATION

A. General

1. The item numbering system and format used for physical identification of new conveyors and associated equipment and in all documentation shall be consistent with the subsystem identification detailed on the contract documents. The equipment shall be numbered in consecutive order.

B. Equipment Identification

1. The item numbering system and format used for physical identification of conveyors and associated equipment and in all documentation shall be the same as that indicated on the Contract Drawings. The equipment in each subsystem shall be numbered in consecutive order.
2. The following is a listing of the subsystem abbreviations utilized in the contract drawings:
    a. CB means Clear Bag subsystem(s)
    b. ED means Explosive Detection subsystem(s)
    c. ME means Manual Encoding subsystem(s)
    d. MF means Make-up feed(s)
    e. ML means Mainline subsystem(s)
    f. MU means Make-Up device(s)
    g. OS means Oversized subsystem
    h. RI means Re-Input subsystem
    i. SB means Suspect Bag subsystem(s)
    j. SS means Suspect Security subsystem
    k. TC means Ticket Counter subsystem(s)

1.05 SUBMITTALS

A. General
1. All submittals shall be in accordance with the Conditions of the Contract.
2. Submit the following documentation at the time specified during the course of the work, and in accordance with the following Submittal Deadlines.
3. Prepare all documents in the English language.

B. Bid Proposal Submissions
1. The BHS Contractor is deemed to have studied the system design and requirements presented in the drawings and specification respectively and accepted the design and requirements as suitable and appropriate to safely accomplish the functions and processes described herein. The BHS Contractor shall identify in the bid submission any design aspect or specification requirement that is believed to be inappropriate or inadequate and shall propose alternate solutions to alleviate the perceived problem but shall, in all cases, include in the bid submittal pricing for the base system presented in the drawings. Any alternate designs, developed by the BHS Contractor must meet or exceed the design criteria as listed in the specifications.
2. Include in the proposal submission the following items
    a. System Price Schedule per Appendix A
    b. Unit Price Schedule per Appendix A
    c. Any exceptions to these specifications or contract terms in a separate section titled “Exceptions”.
    d. Type and duration of the proposed training program if different to the minimum requirements as listed in Part III of these contract documents
    e. Allowance to purchase items from the Estimated Spare parts list as detailed in the contract documents
    f. Identification of any special environmental requirements more stringent than what is shown in the Specifications (if any).
    g. Notification of any perceived safety hazard with specified design of system or its components.
    h. Notification if an adjustment is required to the Contractor's Submittal Deadlines.
    i. Proposed equipment of non-standard design and equipment substitutions.

j. Define the technical support to be provided during testing, conditional acceptance phase and after Final Acceptance has been granted.

k. The BHS Contractors requirements for lay down areas include line item cost if off site storage facility has to be rented.

l. Project schedule outline for the phased-in implementation of the BHS (indicate number of weeks for completion of work after NTP).

m. Related project list references (indicate client, location of project, type of work, year performed/completed and overall cost).

n. Provide listing of staff with resumes and qualifications that shall be working on the project. Indicate project manager's name, names and number of programmers, technicians, instructors/ training personnel, and all other required information. Include on-site and off-site participating staff and the percent of anticipated participation on this project. In addition, provide training instructors professional qualifications. The Owner reserves the right to approve or reject key personnel from the list.

o. Provide a line item cost for the price of two (2) laptop computers, fully loaded/configured with all applicable software programs to interface with the Baggage Dimensioning Device, ATR Scanner Arrays for collection and processing of individual scanner head results, as they relate to their respective device. The laptop computers shall also include all applicable PLC program ladder logic required to maintain the BHS system.

p. Provide a line item cost for all BHS related acceptance testing including all required IV&V, SAT testing. This should clearly identify the types and quantities of required testing material as well as manpower.

q. Provide a line item cost for any additional on site support should it be required after final acceptance.

r. Provide a line item cost for recommended spare parts for a two year and five year period after the warranty period.

C. Drawings Submitted for Review

1. Submit for review three (3)-blue line copies and an electronic copy of each shop and installation drawing.

2. The Owner or his representative shall review the drawings and return them for revision and re-submittal within 21 days, where re-submittals are required. Revise and re-submit drawings for final review by the Owner or his representative within 14 days. Any corrections or changes indicated on Shop Drawings shall not be considered as an extra work order. Do not start fabrication until receipt of the Owner or his representative's approval.

3. The comments from the Owner or his representative shall not be taken to imply that the arrangement has been checked in detail. The BHS Contractor shall be fully responsible for the suitability, adequacy, integrity, durability and practicality of the arrangement or assembly, components and systems as set out in the drawings, specifications and other information submitted for acceptance by the Owner or his representative including all subsequent amendments. In no case shall the Owner's or his representative's review or comments relieve the Contractor in any way of his responsibility of ensuring that the equipment supplied complies with all specification and functions in accord with the wording and the intent of the applicable Specifications.

4. Do not submit drawings, which are not in full compliance with the specifications unless an Engineering Change Order Request (ECR) requesting a variable from the specifications accompanies the submittal. In this case the Owner or his representative will endeavor to respond within 21 days, but shall be under no obligation to do so.

5. The BHS Contractor shall have approved shop drawings at the site at all times for use in the construction of the work. Failure of the BHS Contractor to supply such drawings will be deemed sufficient cause to delay the work until such drawings are available for field use and reference.

6. Prepare a drawing log that contains a complete list of all anticipated installation and shop drawings and submit an updated copy with each drawing submission.

D. Submittal Deadlines

1. Listed below are the submittals and dates referred to in the applicable sections. (Indicate in the proposal submission if an adjustment to these dates is required (days indicated are working days)).

Submittal Item	Deadline

Safety Program Manual	10 days after NTP
Project Management Team	10 days after NTP
Quality Control Manual	20 days after NTP
Configuration Management Plan	30 days after NTP
Detailed Master Schedule	30 days after NTP
Phasing Schedule	30 days after NTP
Structural Attachment Details	30 days after NTP
Environmental Requirements	30 days after NTP
Catalog Cuts and Equipment Specifications	20 days after NTP
System Power Requirements and MCP Sizes	30 days after NTP
BHS Equipment - Combined Heat Output Figures	90 days after NTP
Emergency Stop Zone Drawings	60 days after NTP
Controls System Description and BHS Redundancy Schematic Diagrams	90 days after NTP
Control Room Equipment & Owner Finishes	90 days after NTP
Shop Detail Drawings	60 days prior to fabrication
Motor Schedule	During tender submittal
Installation Drawings	60 days prior to fabrication
Revise & Re-issue Drawing Period	21 days
Owner Re-review Period	14 days
Training Program	90 days prior to testing
Estimated Parts List	90 days prior to testing
Functional Specification	60 days prior to testing
Inspection and Test Program	60 days prior to testing
System Endurance and Stability Test	60 days prior to test
Factory Acceptance Test	20 days prior to installation on site
Final Parts List	30 days prior to testing
Bag Tag Verification	30 days after NTP
Work Activities Bulletin	14 days prior to each activity
Test Reports	15 days after completion of testing
Certificate of Testing Compliance	
System Reliability Calculations	30 days after completion of testing
Certificate of Installation Compliance	15 days after completion of installation
As-Built Drawings	30 days after acceptance of equipment
List of Lubricants	60 days prior to start-up
O & M Manual – Draft for Owner Review	60 days prior to start-up
Periodic Maintenance Inspection and Lubrication Chart	60 days prior to start-up
O & M Manual – Final	15 days prior to start-up
Weekly Report	Last day of each week
Submittal Log	With each submittal or as required by the project.
Computer/Software/Hardware Inventory	At Conditional Acceptance / Updated as required at Final Acceptance

Computer Log	To be kept during Conditional Acceptance period and officially submitted at Final Acceptance

E. Detailed Master Schedule

1. Submit a detailed Master Schedule as specified below for review and approval by the Owner or his representative before commencing with any work. Display schedule in graphic form, large and spacious enough to be updated directly on the original submittal during the course of the project. Show the principal dates and commensurate activity times for each entry. Include in the schedule:

   a. Beginning and ending of mechanical, electrical and controls/computer engineering for each subsystem or construction phase.

   b. Drawing submittal and approval.

   c. Long lead item order placement and expected delivery date.

   d. Beginning and ending of fabrication per subsystem or construction phase.

   e. On-dock plant to on-site transportation.

   f. Beginning and ending of work per each subsystem or construction phase.

   g. Beginning and ending of mechanical, electrical and controls/computer installation per subsystem or construction phase.

   h. Factory Acceptance Test dates

   i. Milestone dates for completion of pertinent facility interfaces (e.g., permanent system power).

   j. Date(s) L3 3DX 6600 device(s) installation to be completed by (installation by others)

   k. Owner/Engineer witnessed Factory Acceptance Testing (FAT) date(s)

   l. EDS/BHS integration test plan

   m. In-line EDS system SAT dates

   n. In-line EDS system IV&V dates

   o. Equipment item test.

   p. Training and test plan submittals.

   q. Submittal of operation and maintenance manuals.

   r. Operation and maintenance training periods.

   s. Submittal of manufacturer's recommended spare parts list.

   t. Commissioning by subsystem.

   u. System acceptance testing by subsystem.

   v. Operational dates by subsystem or construction phase.

   w. Punch list rectification.

   x. Final acceptance testing.

   y. Submittal of As-Built documentation.

2. The BHS Contractor shall maintain and update the Master Schedule weekly showing the actual progress made and any revisions in the schedules or at any time that changes in the design, construction, procurement and installation cause any major change in the overall schedule. Required reporting frequency intervals may be shorter during critical periods at the discretion of the Owner or his representative. Such additional reporting frequency shall not be grounds for additional cost claims.

3. If the BHS Contractor's weekly schedule update reflects, or the Owner or his representative determines, that the BHS Contractor is at least ten percent (10%) or fourteen (14) or more calendar days behind the original progress schedule (whichever is less) for the BHS project as a whole, a major Contract item, an item of BHS which is on the critical path, or an item of BHS not on the original critical path but that, because of the delay or anticipated delay, becomes a critical path item, then the BHS Contractor must submit its proposed recovery plan for bringing the BHS project back on schedule and for completing the BHS within the Date of Completion with the weekly schedule update.

4. The BHS Contractor shall allow for the co-ordination and interfacing of his work in line with the construction work of Portland International Jetport Terminal Expansion, and other such contractors. Such co-ordination and interfacing shall include for permitting the direct contractors to complete their work before proceeding to complete the balance of project under this BHS Contract. In the event of failure by the BHS Contractor to allow for such co-ordination and interfacing, no claim whatsoever shall be entertained by the Owner or his representative for any additions, amendment, re-medial or abortive works to be carried out by the BHS Contractor or the contractors to ensure satisfactory completion of the project. The BHS Contractor shall obtain the overall construction program and project schedule of Terminal Expansion and other such direct contractors and include them into his Master Schedule.

5. The BHS Contractor may also request revisions to the Project Schedule in the event the BHS Contractors planning for the work is revised. If the BHS Contractors desires to make changes in the Project Schedule to reflect revisions in the method of operating and scheduling of the work, the BHS Contractor shall notify the Owner or his representative in writing, stating the reason for the proposed revision.

6. The BHS Contractor shall ensure there are sufficient personnel available for the purpose of coordination to ensure timely completion of the BHS and to ensure that the BHS Contractor does not hinder the work of other trades. The BHS Contractor shall provide personnel with the required experience for coordination at meetings as required by the Owner or his representative so that decisions regarding coordination issues can be made during coordination meetings.

F. Construction (Phasing) Schedule

1. Construction phasing shall be in accordance with the General Construction Manager's schedule. The BHS Contractor shall coordinate with the General Construction Contractor, the Owner or his representative to develop a BHS installation phasing plan

2. Submit a detailed phasing plan for each subsystem designated for modification, installation, description of the work, staffing requirements and schedule per phase. The overall plan/schedule shall be broken down by subsystem of activity (as coordinated with the project team). The BHS contractor shall clearly identify any differences between the proposed schedule and the Part III BHS Construction Phasing Sequence.

G. Structural Attachment Details

1. Submit structural and seismic attachment detail drawings and the design computations of all structural supports for the BHS and associated platforms/walkways signed and sealed by a Professional Structural Engineer licensed in the State of Maine, the same jurisdiction where this project is located.

2. Submit for review the design and locations of all structural attachment points, wherever the equipment is to be supported by the building structure. Show, as a minimum, the type of anchor device to be used and the amount of load to be imposed.

3. Submit a complete vibration isolation-drawing package, showing isolation type, as well as method and location of installation.

4. Submit a list of successful projects, which used the type of BHS and vibration isolation package being proposed for this project.

5. The BHS Contractor shall coordinate with the Architect's structural engineer to ensure that all State and Local codes for any seismic requirements are met and abided by for this project.

H. Shop Drawings, Installation Drawings, and As-Built Documents

1. General

a. All drawings submitted shall become the property of the Owner.

b. All drawing submittals shall be to scale. The scale utilized shall be clearly defined in the title block.

c. The North arrow shall also be shown on all mechanical drawings.

d. Drawings shall include the following items unless otherwise specified.

1.) Document Title Blocks

a.) In addition to information normally presented in a drawing title block, each drawing title block shall provide the following specific information:

(1.) Three letter airline code for Portland International Jetport (PWM)

(2.) Name of the Baggage Handling System

(3.) Drawing scale

(4.) Drawing title

(5.) Drawing number/sheet number

(6.) Drawing date

(7.) Drawing revision date and revision number

(8.) NOTE: All drawing revisions shall be foot noted on the drawing face as well as in the appropriate revisions section of the title block.

e. Professional Engineer Approval Requirements

1.) The BHS Contractor shall engage Professional Engineer(s) licensed in the State of Maine in the relevant disciplines, at its own cost, to design, review, verify and certify the BHS structural systems including all necessary temporary works and supports.

2.) Minimum requirements for Professional Engineer signed and sealed drawings and calculations to be submitted are defined below. The BHS Contractor shall provide any additional signed and sealed drawings, calculations or submissions required by federal, state or local codes. As a minimum, the following drawings, calculations and submissions shall be signed and sealed:

a.) Mechanical/Structural

(1.) All structural and seismic attachment details and design computations for the BHS and associated platforms/walkways

(2.) All structural support details and design computations for the BHS and associated platforms/walkways

(3.) Drawings of all structural attachment points to the parent building including imposed load on the building

(4.) Drawings defining all structural supports and attachment types and locations. Generic details will not be acceptable for this purpose.

b.) Electrical

(1.) Power requirement and electrical load calculations

c.) All final “as-built” drawings as listed above in part a.) and b.)

2. Drawing Submittal Package Requirements

a. Submit to the Owner or his representative final installation drawings defining BHS erection procedures, mechanical and electrical component layouts and the relationship of the equipment components to each other and to the facility prior to the commencement of fabrication. Employ an approved independent agency for the required inspection of all BHS related support attachments to the building structure and the review and approval of the Contractor’s PE signed and sealed structural attachment documents and point loading diagrams as they relate to the actual installation; these special inspections of BHS related structural members shall be performed in compliance with the International Building Code (IBC) 2006, Chapter 17 – Structural Tests and Special Inspections.

b. Submit a motor schedule listing: motor horsepower, belt speed, VFD, dynamic brake, clutch brake, voltage, source of feed, circuit breaker size, disconnect size, conduit and wire size and overload heater size selected to be used, prior to the installation of overload heaters on the controllers.

c. Submit to the Owner or his representative for review the BHS equipment combined heat output figures with calculations for the following areas of the facility. The information typically includes friction losses from conveyor equipment and heat outputs from the drive motors, motor control panels and computer equipment:

1.) BHS Control room(s)

2.) BHS Motor Control Panel room(s)

3.) Conveyor equipment enclosures.

d. Submit As-Built drawings as per the specified submittal schedule (plans and associated sections/elevations) indicating the location of the BHS, including all mechanical components, maintenance platforms and electrical devices, operator's control panels, MCP, switches, and other control devices. All final “As-built” drawings shall be signed and sealed by a Professional Engineer licensed in the State of Maine, at no additional cost to the Owner.

e. Submit final assembly drawings, shop detail drawings and any other pertinent drawing files in AutoCAD.DXF format, version 2008 or higher, for all phases of the work, indicating BHS components, construction and assembly details of all components prior to releasing drawings for fabrication.

f. As-Built drawings shall be submitted on CD ROM in addition to other forms of media described herein.

3. BHS Mechanical Drawing Submittal Requirements

a. General

1.) If standard parts are purchased, reproduced details and identifying part numbers shall be provided.

2.) Each BHS device or conveyor that appears on plan, elevation and section drawings of the BHS shall be identified with the appropriate I.D., as established in this Specification.

3.) Properly number conveyor equipment and control devices starting at the beginning of each conveyor system or subsystem.

4.) All plan views of the BHS system shall be based on an overlay of the building structure as is appropriate.

5.) All plan; elevation and section drawings of the BHS shall also show the vertical and horizontal clearances between the related system equipment and the building structure with its related interferences.

b. Provide the following types of mechanical drawings:

1.) General arrangements with dimensions of all equipment (plan, elevation, details and sections, as appropriate) for all mechanical, maintenance platforms, crossovers, ladders (coordinate with the Architect and the Owner or his representative for the final number and location of all maintenance access equipment), impact protection, electrical motor control panels, electrical equipment support, electrical control workstation, BMAs, ATR scanner arrays, and encoding consoles.

2.) Drawings with appropriate level of detail, as noted above, shall be provided for any equipment designed and manufactured for this project.

3.) Detailed drawings are required for all BHS equipment framing, supports, hangers, and other required supports.

4.) Detailed drawing indicating locations and type of safety signage.

4. BHS Electrical Drawing Submittal Requirements

a. General

1.) Each BHS device or conveyor and related control and power devices that appear on any electrical drawings of the BHS shall be identified with the appropriate I.D., as established in this Specification.

b. Provide the following types of electrical drawings:

1.) Plan view of the BHS noting the identity and location of each control device, control station, motor, limit switches, safety disconnect switches, and the like as related to each BHS device of the system.

2.) Layout of MCP system touch screen display or any related control devices or indicating lamps.

3.) Submit all power requirements for the subsystems of this project as per the specified submittal schedule. System power requirements shall be calculated in accordance with the recommended practice and shall include connected and demand power.

4.) Detailed drawing indicating locations and type of safety signage.

5.) Programmable Logic Controller (PLC) computer control system in block diagram format to include the data communication system showing the connections among all PLC, sortation computers and remote I/O units if utilized.

6.) Motor Manifest indicating type, part number of driven equipment, power in horsepower, full load amperes and speed.

7.) MCP general layout showing enclosure size, type, power requirements, equipment location and enclosed component general arrangement. Include a separate I/O list for each PLC or remote I/O in the panel. Identify I/O assignments with Equipment Item Numbers.

8.) Detailed block diagram representing internal layout of components within each motor control panel, both internal as well as external layout of components related to workstations, external layout of ATR scanner array, BMA / ATR array, and the like.

c. Provide the following types of control system drawings:

1.) Plan view of the BHS noting the identity and location of each control device, control station, motor, limit switches, safety disconnect switches, and the like as related to each BHS device of the system.

2.) Plan view of the BHS noting the identity and location of each motor with power in horsepower. Identify all motors that will have a VFD, clutch/brake or brake. Annotate which motors are controlled by Variable Frequency Drives; indicate the location of the VFD (either at the motor or located in the relevant MCP).

3.) Plan view of the BHS noting the identity of each conveyor with expected speed in feet per minute.

4.) Plan view of the BHS noting the identity of every photocell location annotated whether a tracking or non tracking device

5.) Plan view of the BHS noting the identity of every tracking belt tachometer

6.) A set of drawings showing those conveyors that will stop by the activation of each specific Emergency Stop in the system as per the specified submittal schedule. The drawings should indicate (using different colors or hatches) the conveyors of the specific subsystem and any adjacent subsystems that will stop for each emergency stop or group of emergency stops as appropriate. The BHS Contractor should take into consideration the following when developing the e-stop zones:

a.) When splitting up e-stop zones, consideration must be given to the MCP breaks. If the down stream MCP is shut down, upstream bags that are left in the system should be able to divert prior to the equipment that is inoperable.

b.) 45-degree merge e-stops should be tied into the receiving or take-away conveyor.

d. The BHS Contractor shall also provide detailed shop drawings which include all interfaces between systems that are affected by the scope of work and shall include but is not limited to connection details (connector type, communication protocol) software protocol, transmission media, location of connections and any other required information.

e. Provide an approved 11" x 17" reduced copy of the schematic wiring diagram(s) of each MCP including outline and wiring diagram of all special devices which shall be placed in the door pocket of the MCP.

5. Control System Description Submittal

a. Submit Control System Description as specified in Part II of this specification.

6. BHS Control Room, Computer and Control System Descriptions

a. Submit the Computer/Control Room requirements containing all information pertaining to the requirements of the proposed Computer/Control hardware (refer to Part II of these contract documents for full details on the BHS control room requirements), including:

1.) A proposed room layout of the final layout drawings showing spatial requirements.

2.) Environmental requirements (temperature and humidity)

3.) Submit HVAC requirements

4.) Raised floor for cable access

5.) Fire protection

6.) Electrical and power requirements (e.g., the number and location of UPS electrical sources)

I. Catalog Cuts

1. Submit a catalog cuts manual for all manufactured and purchased items (mechanical, electrical and computer equipment) as per the specified submittal schedule.

2. The catalog cuts shall be contained in binders of the “presentation” type equipped with “D” rings. Additionally, the binders shall be equipped with a clear spine pocket to permit the insertion of the manual title. The catalog cut manual shall be contained within at least one volume of appropriate size and contain the following:

a. Record of Revisions: A "Record of Revisions" sheet shall be provided at the beginning of the catalog cut manual.

b. Table of Contents: A Table of Contents shall be provided at the beginning of the catalog cut manual.

c. Index Tabs: Each catalog cut shall be identified with an index tab with permanently printed information.

3. The catalog cuts must be completely legible and have the specific items used in the system highlighted with a shaded arrow. Where a variation occurs from the standard component or a special custom ordered part has been used as a replacement for the standard supply, additional details shall be submitted to clarify the identity of the component.

4. The catalog cuts shall include the following items (this list is not to be construed as being complete since it is provided only as a guide):

a. Speed reducers

b. Motors

c. Bearings

d. Pulleys and rollers

e. Motorized pulleys

f. Belting

g. Roller chain and sprockets

h. Belts and sheaves

i. Queue conveyors

j. 45 degree merge conveyors

k. Power turns

l. HSVPDs

m. Vertical sorter

n. Wiring devices

o. Control devices

p. Soft starts, electronic

q. Electric brakes

r. Electric clutches

s. VFDs

t. PLC and peripherals

u. Power regulators

v. Computer equipment

w. Video monitors

x. Flat Plate devices

y. Baggage Measuring Array (BMA) components

z. Directional Input Device (DID) components

aa. Automatic Tag Reader (ATR) components

bb. Manual encode consoles

cc. Hand held scan guns

dd. Laptop computers

J. Operation and Maintenance Manuals

1. Purpose

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

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

c. The manual is to be divided into two main sections:

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

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

2. Binder Type

a. Binders shall be of the "presentation" type equipped with "D" rings. Additionally, the binders shall be equipped with a clear spine pocket to permit the insertion of the manual title.

3. Format

a. The O & M Manual shall be contained within at least two (2) volumes of appropriate size. Note that additional volumes may be required to accommodate multiple operational or maintenance information chapters.

b. The title information shall be generally as follows:

1.) First line: Three letter code of the Jetport in which the system is located (e.g. PWM).

2.) Second line: "Operations Manual" or "Maintenance Manual"

3.) Third line: "For"

4.) Fourth line: Type of system: (such as: Portland International Jetport Terminal Expansion Baggage Baggage Handling System)

5.) Fifth line: Date of System, as based on actual beneficial use date

6.) Sixth line: Project Number (to be Coordinated with the Owner or his representative)

4. Contents of Manual

a. Record of Revisions: A "Record of Revisions" sheet shall be provided at the beginning of the O & M Manual.

b. Table of Contents: A Table of Contents shall be provided at the beginning of the O & M Manual.

c. Chapter Index Tabs: Each chapter shall be identified with an index tab with permanently printed information.

d. Chapter Index: Each chapter of the O & M Manual shall begin with an index for the related chapter.

5. Operational Information

a. Chapter 1 - Glossary of Operational Terms

1.) Chapter 1 shall include a glossary of operational related terms and equipment identification/designations.

b. Chapter 2 - System Overview

1.) Chapter 2 shall include, at a minimum, the following items:

a.) A basic overview of the system showing overall layout and arrangement.

b.) Identify locations, number of and types of inputs.

c.) Identify locations, number of and type of sort areas (as appropriate).

d.) Identify system and subsystem conveyor designations.

e.) Processing rate of each subsystem as well as the total system-processing rate.

c. Chapter 3 - Baggage Weight and Size Limitations

1.) Chapter 3 shall include, at a minimum, the following items:

a.) Normal Size Baggage

b.) Out of Gauge Bags

c.) Baggage that can be processed by system but requires special considerations/handling such as but not limited to skis, and golf bags.

d.) Fragile Baggage

e.) Oddsize Baggage

d. Chapter 4 - Detailed Description of System Operation

1.) Chapter 4 shall include, at a minimum, the following items written in a clear concise manner:

a.) The detailed operational description of system operation must be written to provide operational personnel a thorough understanding of how to operate the system. Operational personnel include:

(1.) Sky Caps

(2.) Passenger Service Ticket Agents

(3.) Service Baggage Handlers

(4.) TSA Agents

b.) The operational information shall cover system start-up and shut down operational requirements.

c.) The operational information shall also provide a thorough understanding of the system fault annunciation system so that faults can be recognized and appropriate action can be directed.

d.) The operational information shall provide an operator's troubleshooting guide for the safe and effective correction of operational problems.

e.) The BHS shall be equipped with sortation controllers, computers and workstations; Provide detailed information for the items noted below, affected by the specified requirements of this project (this list is not to be construed as being complete and is provided only as a guide):

(1.) All operator interface command entries

(2.) All operator initiated reports

(3.) All system automatically generated reports

(4.) All system fault alarm messages and reports

(5.) All graphic display information systems

(6.) Creation of Flight/Sort Assignment Tables: Specific sortation controller operation

(7.) Placing equipment "in" or "out" of service

(8.) ATRs

(9.) BMAs

(10.) Hand Held Bar Code Scanner Guns

(11.) Manual Encode Consoles

(12.) Baggage Loading Procedures relative to placement of Bar Coded Bag Tags

f.) The detailing of the above information shall include:

(1.) Thorough explanation and purpose of the command message or report.

(2.) Required keyboard or operator response.

(3.) Explanation of expected system response

g.) The operator’s information must also include procedures and recommendations for alternative modes of system operation as may be required due to various equipment or subsystem failures.

e. Chapter 5 - Operational Safety

1.) Chapter 5 must provide safety information related to the proper and safe operation of the specified system and its equipment from an operator's point of view and at a minimum must cover the following items (this list is not to be construed as being complete since it is provided only as a guide):

a.) Jam Detection, Jam Clearance and Restart Procedure

6. Maintenance Information

1.) Chapter 1 - Glossary of Terms and Identification

a.) Chapter 1 must include a glossary of all terms and equipment identification/designations associated with the specified system.

2.) Chapter 2 - Description of System Equipment

a.) Chapter 2 must include, at a minimum, the following items:

(1.) Detailed description of the mechanical conveyor equipment used in the system including widths of conveyors, general specifications and capabilities of the system.

(2.) Detailed description of the electrical equipment used in the system, including the location of motor control panels (MCP(s)), PLC(s), fire/security door(s), sortation controller(s), encoding console(s), workstation(s), ATR scanner arrays, and BMA arrays.

3.) Chapter 3 - Electrical Control Sequence of Operation

a.) Chapter 3 shall include a detailed description of the electrical control sequence of operation. The detailed description shall cover the following items (this list is not to be construed as being complete since it is provided only as a guide):

(1.) Location and operation of Control Stations

(2.) Location and operation of Photocells

(3.) Location and operation of Limit Switches

(4.) Operation of MCP(s)

(5.) Operation of PLC(s)

(6.) Operation of Fire/Security Door(s)

4.) Chapter 4 - Maintenance Safety Procedures

a.) Chapter 4 must provide safety information related to the proper and safe operation and maintenance of the specified system and its equipment from a maintenance point of view and at a minimum, the following items shall be covered (this list is not to be construed as being complete since it is provided only as a guide):

(1.) Pre-operating Procedure

(2.) Start-up and Shut-down Procedure

(3.) Emergency Stop and Restart

(4.) Jam Procedure

(5.) Equipment Lockout/Tag Out Procedure (the procedure must reflect/refer to the most current OHSA, ANSI, and local codes, policies and standards)

5.) Chapter 5 - Service, Inspection and Preventive Maintenance

a.) Chapter 5 must provide detailed information for the proper servicing of all of the system equipment and at a minimum must cover (this list is not to be construed as being complete since it is provided only as a guide):

(1.) A general explanation, regarding what the servicing requirements is for the related system equipment.

(2.) Detailed preventive maintenance program outlining required functions and frequencies for the proper preventive maintenance of the components that make up the system equipment items such as belt conveyors, power turns, flat plate devices, HSVPDs, security doors, motor control panels, ATR scanner arrays, and BMAs. At a minimum, the following items shall be covered however; this list is not to be construed as being complete since it is provided only as a guide. It shall be noted that the information shall be "brand specific" for the actual equipment provided for this system only. Information for equipment types and brands not provided in this system will not be acceptable.

(3.) Inspections for:

(a.) Straight Conveyors, Power Turns, Merge Conveyors, Diverters, Flat Pallet Devices, Vertical Sorter, ATR Scanner Arrays, and BMA Arrays.

(4.) Lubrication of:

(a.) Motor Bearings, Pulley Bearings (as required), Drive Chains, Speed Reducers, and Power Turn Perimeter Chains/Guides, and all other items requiring lubrication.

(5.) Cleaning of:

(a.) Motors, Drive Chains, Speed Reducers, Photocells (and related reflectors), Motor Control Panels, Workstations, and BMA & ATR Laser Scanner Equipment.

(6.) Adjustment of:

(a.) Straight Conveyor Belt Tracking, Straight Conveyor Belt Tensioning, Power Turn Conveyor Belt Tracking/Tensioning, Merge Conveyor Belt Tracking/Tensioning, Flat Plate Devices, Drive V-Belt and Sheave Alignment, Drive V-Belt Tensioning, Drive Chain and Sprocket Alignment, Drive Chain Tensioning, Photocell alignment and sensitivity, Drive Motor Clutches, Drive Motor Brakes, BMA & ATR Laser Scanner alignment and sensitivity, and Limit Switches.

6.) Chapter 6 - Warranty Information and Procedures

a.) Chapter 6 shall provide detailed information regarding the specific Warranty Conditions that prevail on the specified system.

b.) Additionally, the detailed information regarding the system warranty must include the following:

(1.) Date of Beginning and Expiration of Warranty Period.

(2.) Specific instructions regarding the procedures for the documentation and return of items under warranty.

(3.) Names and telephone numbers of the "point of contact" for warranty questions and discussions. Note that the "point of contact" information shall be provided for both "normal" 0700 to 1800 Monday through Friday hours as well as "after hours".

7.) Chapter 7 - Troubleshooting

a.) Chapter 7 shall provide detailed information for the proper troubleshooting of the system equipment.

b.) At a minimum, the following items must be included in a detailed "problem and correction" type of troubleshooting chart (this list is not to be construed as being complete since it is provided only as a guide):

(1.) All mechanical equipment

(2.) All electrical equipment

(3.) All control equipment

(4.) All computer equipment

(5.) BHS/EDS Interfaces

c.) The troubleshooting information provided in the chart is to cover an exhaustive list of possible causes of system failure or malfunction.

d.) The information is to be arranged in a three (3) - column format with respective headings of:

(1.) Trouble

(2.) Probable Cause

(3.) Corrective Action.

e.) Empirical Readings: This chapter shall include the Empirical Readings, as noted in “Testing and Acceptance” section of this Specification, that were recorded at the time of the Conditional Acceptance Testing and Inspection of the system. This information is to be provided as a maintenance reference.

8.) Chapter 8 - Removal and Installation Procedures

a.) Chapter 8 shall provide detailed information for the proper removal and installation of all of the system equipment components.

b.) It must be noted that the information shall be "brand specific" for the actual equipment/components provided for this system only. Information for equipment/components types and brands not provided in this system will not be acceptable.

c.) At a minimum, the following items shall be included in this chapter (this list is not to be construed as being complete since it is provided only as a guide):

(1.) Basic Considerations

(2.) Safety Precautions

(3.) Procedural Orientation

(4.) List of special tools, gauges and equipment required for the maintenance of the system, together with illustrations and instructions as to how they are to be used. Sources for procurement of these items shall also be provided.

(5.) Torque Values

(6.) V-Belt Tension Procedures and Values

(7.) Drive Chain Tension Procedures and Values

d.) Component List (this list is not to be construed as being complete since it is provided only as a guide):

(1.) All the components for straight conveyors.

(2.) All the components for power turn conveyors.

(3.) All the components for merge conveyors

(4.) All the components for queue conveyors

(5.) All the components for flat plate make up devices

(6.) All the components for vertical sorters

(7.) All the components for workstations

(8.) All the components for sortation controllers

(9.) All the components for HSVPDs

(10.) All the components for ATR scanner arrays.

(11.) All the components for BMA arrays

(12.) All the components for DIDs

(13.) All the components for MCPs

9.) Chapter 9 - Illustrated Parts Information

a.) Chapter 9 must contain detailed illustrated parts information. The illustrated parts information shall be provided in the following manner for all mechanical, electrical, workstation, computer, ATR array, and BMA array.

b.) Clear, concise exploded view isometric drawings showing the parts, the relationship of adjacent parts with one another within a given conveyor equipment assembly as well as the diagram number that shall reference the specific part on the adjacent parts information sheet.

c.) The parts information sheet shall be adjacent to the isometric drawing and shall contain:

(1.) Part reference number from isometric drawing

(2.) Part description

(3.) Part Number

(4.) Manufacturer of part

(5.) Number of parts found in the conveyor equipment isometric drawings

d.) Provide the above information in a manner so that the isometric drawing (up to 11" x 17" that can be folded up) shall be on the left hand side of the open manual with the associated parts information sheet as the right hand page of the open manual.

e.) Include model and serial numbers for all special equipment such as power turn conveyors, vertical sortation conveyors, vertical sortation devices, HSVPDs, and the like.

10.) Chapter 10 - Manufacturer's Literature

a.) Chapter 10 shall provide all of the manufacturer's literature for all of the conveyor equipment mechanical, electrical and electronic components.

b.) It shall be noted that the information shall be "brand specific" for the actual equipment/components provided for this system only. Information for equipment/components types and brands not provided in this system will not be acceptable.

c.) At a minimum, only a first copy of a manufacturer's original literature will be accepted if the actual original manufacturer's literature cannot be provided.

d.) All such copies shall be clear and legible.

e.) All manufacturers' literature shall be appropriately highlighted with a legible solid black arrow for identification of the specific model or type of device used in the specified system.

f.) All manufacturers' literature shall include information adequate for proper servicing of the item, proper operation of the item as well as all required information for the ordering of the item.

g.) Complete list of parts manufacturers including address, telephone number and point of contact.

11.) Chapter 11 - Mechanical Drawings

a.) Chapter 11 shall contain a complete, clear and legible 11" x 17" set of "As-Built" BHS mechanical drawings.

b.) The 11" x 17" drawings are to be folded so that they will fit within the O & M Manual.

12.) Chapter 12 - Electrical Drawings

a.) Chapter 12 shall contain:

(1.) A complete list and definition of the electrical symbols used in the electrical drawings.

(2.) A complete, clear and legible 11" x 17" set of "As-Built" BHS electrical drawings. The As-built drawings shall contain as a minimum the following:

(a.) Detailed wiring connection drawing noting each control device, control station, motor, and all other controls devices, in block form with a detail of the actual "field wiring" numbers and configuration.

(b.) Detailed conduit routing diagram indicating size of conduit, size and number of conductors, junction boxes, control devices, motors, safety disconnect switches, motor control panels, ATRs, BMAs, and workstations.

(c.) Detailed block diagram representing internal layout of components within each motor control panel, both internal as well as external layout of components related to workstations, external layout of scanner arrays (BMA, ATR).

(d.) Schematic Wiring Diagram of each MCP, including outline and wiring diagram of all special devices. An additional approved 11" x 17" reduced copy shall be placed in the door pocket of the MCP.

(3.) The 11" x 17" drawings are to be folded so that they will fit within the O & M Manual.

13.) Chapter 13 - PLC Listings

a.) Chapter 13 shall include a complete, clear and legible set of "As-Built" BHS PLC listings. The

listing shall include the following:

(1.) Complete set of PLC program ladder logic diagrams as well as PLC and Sortation controller listings for the related system.

(2.) A complete Sequence of Operation shall be included on the schematic diagrams or the PLC ladder logic diagrams.

(3.) PLC ladder logic diagrams shall have detailed "right hand" margin descriptors clearly identifying the function of each device and its associated contact rung locations.

(4.) Include a separate I/O list for each PLC or remote I/O in the panel. Identify I/O assignments with Equipment Item Numbers.

7. Draft O & M Manuals

   a. Submit two (2) sets of a draft Operations and Maintenance Manual for review and approval to the Owner or his representative prior to Start-up of the system(s).

8. Final O & M Manuals

   a. Three sets of the Final O & M Manuals shall be presented to the Owner in accordance with the submittal schedule. Timely submittal of a system's O & M Manual is absolutely essential to the proper operation and maintenance of the BHS.

   b. All three sets of the O & M Manuals must be updated by supplement to reflect any Field Changes, equipment changes due to warranty changes, and any other changes., that were made during the Warranty Period of the System, so that all sets of manuals shall reflect "As-Built" information.

   c. An electronic medium copy of the O & M Manuals shall also be required on CD-ROM at no additional cost to the Owner.

K. Periodic Maintenance Inspection and Lubrication Chart

1. Provide a master chart or series of charts involving periodic maintenance of all equipment items in the system and defining, under equipment item subdivisions, the points and frequency of recommended periodic maintenance functions, including inspection, lubrication and replacement.

2. This chart need not detail the procedures involved with such periodic maintenance functions since such procedures will be found in the maintenance manual; but reference shall be made to specific sections or pages therein.

L. Training Program

1. Provide an operational and maintenance training program as specified in Part III of these Specifications.

2. The training program shall be submitted to the Owner or his representative for review and approval prior to the start of System Testing and in accordance with the schedule of submissions.

M. Environmental Requirements

1. Submit any special environmental requirements above and beyond what is shown in these specifications that may be essential for correct equipment operation (e.g., computer hardware, scanner arrays and any other items with special requirements).

N. List of Lubricants

1. Submit a complete list of lubricants to be used on the equipment components. This list shall be standardized on one supplier in order to minimize the number of different lubricants used.

O. Inspection, Functional Specification and Testing Program

1. Submit an Inspection, Functional Specification and Testing Program for the BHS to demonstrate compliance with all specified requirements. Prepare the inspection and test plans based on the information provided in this specification. Assume the responsibility to meet with the Owner, the TSA and their representatives, at the Jetport or other location as requested by the Owner, to review the SSTP and obtain a copy, to ensure the completed CBIS meets all the protocols and requirements contained within, prior to the Pre-IV&V/TRR with the Owner, the

formal TRR with the TSA's representative and IV&V with TSA representative. The CBIS Contractor's test plan submittal shall include the tests that are associated with the SSTP for the TSA's CBIS Performance and Commissioning Requirements, which will include, as a minimum, the tests that are outlined in Part 3 of this specification. This program shall comply with the guidelines presented in the Acceptance and Testing section of Part 4 of these Specifications (34 77 16) and include the required support and participation by the BHS Contractor for the TSA's SAT testing of the EDS machines, separate Pre-IV&V/TRR, formal TRR and IV&V, all consistent with the Site Specific Test Plans (SSTP) for the Checked Baggage Inspection Systems Performance & Commissioning Requirements as well as the requirements of the TSA's PGDS. This program shall comply with the guidelines presented in the Acceptance and Testing section of this Specification.

2. The Functional Specification and Test Program shall identify and demonstrate all System Control Functions. The Functional Specification/Test Plan is to list each Control Station, and Control Device, and its related Control Function that is to be demonstrated/tested. Refer to the Acceptance and Testing Section of this specification for detail test plan content requirements.

3. The testing plan shall include testing of all systems integrated with the BHS e.g. fire system, EDS devices and other interfaced devices.

4. The Inspection, Functional Specification and Testing Program shall be submitted for the Owner or his representative's review and approval prior to the start of System Testing in accordance with Schedule of Submissions.

P. Test Reports

1. Submit a report after completion of the internal testing, debugging and system tests performed prior to Acceptance Testing summarizing the detailed results of the tests, to the Owner or his representative prior to requesting final acceptance testing by the Owner or his representative.

2. In addition, the BHS Contractor shall carry out a "dry test run" of Acceptance Tests prior to conducting such tests with the Owner or his representative to ensure that tests conducted with the Owner or his representative are successful.

3. Provide the Owner or his representative, upon request; the results of all in-plant tests, conducted on assemblies or sub-assemblies of equipment or equipment of like that are to be installed.

Q. Bag Tag Verification

1. The BHS Contractor shall collect from all the terminal user airlines samples of the originating tags and pier tags they are utilizing. The BHS Contractor shall then perform a factory scan test of these bag tags for readability by both the ATRs and hand held scanners. The BHS Contractor shall submit a report detailing the readability of all terminal user airlines bag tags to the Engineer and the Owner for review as part of the shop drawing submittal review process.

2. If a bag tag fails the readability test, there will be sufficient time to allow the Owner or the user airline(s) to either change the format of the bag tag, use a local pier tag or if provided by the Owner a local DCS will be utilized to print tags for these airlines prior to the completion of the BHS sortation system.

R. Certification of Installation Compliance

1. Submit certificates issued by Regulating Authorities (in compliance with work permits (electrical, mechanical, welding, Fire Marshall and other Authorities)), that the equipment has been properly installed, meets all safety standards and is operating within the required accuracy.

S. Certification of Test Compliance

1. Submit BHS Equipment Supplier's Certification that the system has been tested in compliance with the supplier's requirements for testing and has met all testing requirements.

T. Final Parts List

1. Provide a detailed listing and description of all individual system (subsystem) components with reference to layout and assembly drawings.

2. The listing of system parts shall include the following information:

a. Name of part

b. Complete description of part

c. Each specific location that the listed part is used in the system(s).

d. Total number of parts in system(s)

e. Manufacturer of part

f. Manufacturer's part number

g. Source of supply

h. Recommended quantity of spares per each item

i. Price per unit

j. Lead time or availability of part

k. Complete list of manufacturers, with addresses, telephone numbers and point of contact.

l. Manufacturer's catalog literature and specifications for all purchased parts.

U. System Power Requirements and MCP Sizes

1. Submit all the motor control panel (MCP) sizes and related power requirements for the all subsystems of this project. The power requirements shall indicate conveyor segment horsepower, and the total connected load of the subsystems (horsepower and full load amps).

V. Estimated Spare Parts List

1. Submit a list of estimated spare parts required for the first year of operation for the Owner or his representative's review and consideration for a budgetary allowance - include unit price per unit for the estimated spare parts list based on reasonable airline market rates. Spare parts may/shall be purchased for each phase prior to the commissioning of that phase. Include recommended inventory and replacement levels for each phase prior to commissioning as well as part description and identification quantities in system, delivery times, manufacturers and suppliers (their part or ordering numbers).

2. Include any special test instruments required for maintenance beyond the normal inventory of a conveyor maintenance shop. Include a device for measuring conveyor speed and shaft rotational speed, a VOM and a clamp-on hand-held Ammeter.

3. Submit a spare parts list in accordance with Schedule of Submissions.

W. System Reliability Calculations

1. Submit system reliability calculations demonstrating compliance with the "System Reliability" requirements specified herein.

X. Weekly Status Reports

1. The BHS Contractors Project Manager shall submit a Weekly Status Report to the Owner or his representative, which shall include schedule updates in accordance with the provisions of the contract terms. The Owner or his representative shall have the right to change the time of submitting and the details of the report. The weekly status reports shall cover, including but not limited to, the following information:

a. Percentage of mechanical, electrical and controls/computer engineering completion, per subsystem.

b. Percentage of fabrication completed

c. Equipment delivery schedule (month look ahead)

d. Percentage of equipment installed complete:

1.) Mechanical

2.) Electrical

3.) Controls

4.) Computer

e. Updated detailed Project Schedule.

f. Task activities planned for the next week

g. BHS Engineering Issues.

h. Interface Issues including but not limited to the following:

1.) Fire and Security Systems

2.) EDS devices

3.) The Owner's (and/or Airlines') Reservation System(s)

i. Right of Way Issues.

j. Brief description with status of accepted and proposed change orders with associated cost.

k. Status of payments

l. Manning by trade.

m. Percentage of testing completed.

n. Any other issues.

Y. Submittal Log

1. Provide a log to the Owner or his representative listing all required project submittals to include, at a minimum, the following information:

a. Type of submittal.

b. Submittal revision number. (The submittal revision number shall also be clearly identified within the submitted document as well.)

c. The date in which the submittal is sent out for review.

d. Company or individual the submittal is sent to.

e. Date in which the submittal was returned after review has been completed.

f. Review status.

Z. Computer/Software/Hardware Inventory

1. Provide to the Owner or his representative a detailed listing for each computer/PC to be submitted upon Conditional Acceptance.

2. It shall be the responsibility of the BHS Contractor to submit the listing (by computer) along with all program disks, manuals, manufacturers information, and the like information in an organized format (i.e.: binder with dividers or an acceptable format to the Owner) upon Conditional Acceptance.

3. It is to include in addition to the above, at a minimum, provide the following:

a. Complete software inventory by computer.

b. Complete hardware inventory by computer.

c. Registration numbers, serial numbers.

d. Computer emergency boot disks.

AA. Computer Log

1. Upon conditional acceptance it shall be the responsibility of the BHS Contractor to keep a computer log. The purpose of the log is to keep track of any system computer problems/issues, which occur during the conditional acceptance period for trouble shooting/tracking purposes during its operational life.

2. The log shall be compiled in an electronic format acceptable to the Owner or his representative and shall include, at a minimum, the following information:

a. Date/Time of Occurrence

b. Type of Issue(s) (i.e. Manual encode console issue, graphic monitoring system issue, sortation computer issue, scanner array issue, or the like issue)

c. Description of the issue.

d. Name/shift of individual that discovered the problem.

e. Resolution to the problem on site.

f. Affect on the system.

g. BHS Contractor Individual Contacted for support and troubleshooting.

h. Programs, files affected by the resolution to the issue.

3. As a minimum, the computer log should be issued to the Owner or his representative on a weekly basis, or as requested by the Owner or his representative.

1.06 QUALITY ASSURANCE GENERAL REQUIREMENTS

A. Laws, Codes, Rules and Regulations

1. Comply with applicable Local, State and Federal laws, rules and regulations pertaining to the following:

a. Installations and demolition, including but not limited to the Federal Occupational Safety and Health Act and the Construction Safety Act.

b. Protection of the public during installations and demolition, including but not limited to, requirements for safety of operations, noise control, removal and disposal of waste materials, control of dust, dirt, pollutants, flammable materials, explosive materials, corrosive substances, and protection against fire.

B. BHS Contractor Qualifications

1. Authenticate a minimum of five years of demonstrable experience as a turnkey BHS Contractor for high speed automated baggage sortation systems with the completion of a minimum project value of $5,000,000 (per project) that utilized laser bar code scanning and bag dimensioning for the automatic processing of baggage, direct interfacing with the airline industry reservation systems for IATA License Plate bag tag information processing, high speed baggage diverters capable of operating at a minimum throughput rate of 45 bags per minute, integration with EDS devices, computerized sortation control systems controlling PLC systems, baggage tracking and computerized report generation for operational as well as maintenance status and graphic fault annunciation for the automated baggage system.

C. Non-Standard Equipment

1. Any proposed equipment which is appreciably different from items previously fabricated or which has not displayed satisfactory performance in a similar environment for at least one year (for a minimum of 18 hours per day, 7 days per week), shall be so noted in the proposal.

2. Prior to the start of fabrication, a prototype of the new item shall be built and test data shall be presented showing that the item has successfully performed the equivalent of one full year of operation. The Owner or his representative shall be invited to witness the test and review the test data at no additional cost to the Owner.

3. The testing requirements and demonstration will identify such requirements as follows:

a. Number of hours of run time

b. Number of test cycles

c. Processing rates

d. Mean time between failures

e. Repair time, serviceability

4. The Owner or his representative must approve the design before the final design and fabrication, provided that the BHS is produced by a firm with at least 3 years of experience in manufacturing and installing such systems

comparable to that required under this contract. The Owner or his representative must approve the use of firms with less than 3 years experience.

5. In lieu of developing a prototype, arrangements may be made for the Owner or his representative to inspect an existing component in operation at a Jetport at no additional cost to the Owner.

D. Factory Acceptance Testing (FAT)

1. The BHS Contractor shall invite the Owner or his representative to their facility for a demonstration and review of the BHS Contractors developed controls systems software, sortation and maintenance diagnostics computer software/hardware interfaces with other airport systems and devices and operator interfaces.

2. The BHS Contractor shall demonstrate through simulation/analysis at the Factory Acceptance Testing that the system as designed by the BHS Contractor shall meet the minimum design/performance criteria as specified in this specification (i.e. L3 3DX 6600 throughput rates (individual device and matrix), OSR decision time from each EDS device, sortation subsystem(s) throughput, interfaces with airport).

3. The BHS Contractor shall submit to the Owner or his representative a Factory Acceptance Testing agenda, based on the previously submitted Functional Specification and System Acceptance Test Plan, for review and approval. The Factory Acceptance Testing shall take place prior to the on-site installation of the computer software and associated hardware.

4. Items identified during the Factory Acceptance Test, as being deficient, shall be rectified prior to installation on-site. The BHS Contractor is solely responsible for any additional monies incurred regarding completion of this task and will not be granted any schedule variances.

5. If the BHS Contractor was not able to demonstrate all facets of the Factory Acceptance Testing, or provided documents stating that they had performed the tests internally prior to the Owner's or his representative arrival, the Owner reserves the right to back charge the BHS Contractor for the time and expenses of all who attended on the Owner's behalf.

1.07 PROJECT CONDITIONS

A. General

1. The Owner or his representative does not guarantee the accuracy or the completeness of the information relating to the utility services, facilities, or structures that may be shown on the drawings or encountered in the work. Any inaccuracy or omission in such information shall not relieve the responsibility to protect such existing features from damage or unscheduled interruption of operations and services.

2. Prior to commencing the work in the general vicinity, utility service or facility, notify the Owner or his representative 72 hours in advance and obtain approval before proceeding with the work.

3. Failure to give the 72-hour notice shall be cause for the Owner or his representative to suspend the BHS Contractor's operations in the general vicinity of the System, utility service or facility.

4. Should damage to or unscheduled interruption of airline operations, utility service or airline facility occur by accident or otherwise, the BHS Contractor shall notify the Owner or his representative and take all reasonable measures to prevent further damage or interruption of service. In such events, cooperate with the utility service, Jetport Authority until such damage has been repaired and service restored to the complete satisfaction of the utility service or the Jetport Authority.

5. Coordinate all building modifications performed by any trade to accommodate the installation of the BHS.

B. Installation Conditions

1. Portions of this BHS is to be installed within an existing Jetport at both a new (Terminal Expansion) and expanded/renovated facility (Existing Terminal), working simultaneously with other trades.

2. The BHS Contractor shall visit the site to familiarize himself with the site conditions and to understand local conditions that may affect the project before submitting his bid proposal. Where possible the BHS Contractor shall familiarize himself on the availability of temporary access, temporary lighting and power, telephone services, storage facilities, water supply, waste disposal facilities, labor supply, weather conditions, parking of vehicles, loading and unloading of materials, and equipment. In particular, he shall take into account in his bid proposal any effect that any adjacent construction, operations and maintenance works may have on the BHS

installation. The BHS Contractor shall ascertain for himself and allow in his bid proposal for all necessary precaution and for any difficulties that may arise in the execution of the BHS Contract. No claims whatsoever arising out of the site constraints, difficulties of access, temporary services and facilities, labor, and any other charges will be entertained by the Owner.

C. Phasing Sequence

1. Comply with the phasing sequence specified herein, in compliance with the overall project phasing requirements.

D. Ramp Area Proximity

1. The portions of the construction/installation associated with this project shall take place immediately adjacent to an active aircraft ramp area and airline operations area.

E. Lay-down Area Restrictions

1. Lay-down and shake out areas may be limited to the confines of the immediate building. All Lay-Down areas shall be designated and approved by the Owner or his representative.

2. The BHS Contractor shall coordinate usage of lay-down areas with the General Contractor.

F. Restoration of Service Costs

1. Incur all restoration of service costs due to the negligent or accidental damage of any airport utility service or facility. The Owner reserves the right to deduct such costs from any monies due, or which may become due, from the BHS Contractor, or its surety.

G. Right-of-Ways

1. It is acknowledged by all parties that the BHS Contractor has first priorities to the right-of-ways available and/as provided by others. Cooperate with other contractors for coordination of all building right-of-ways performed by other trades to accommodate the installation of the BHS.

2. In addition, the BHS Contractor shall preserve all right-of-ways for deferred equipment depicted on the Contract Drawings.

1.08 PROTECTION OF THE WORK

A. General

1. Make such explorations and probes as are necessary to ascertain any required protective measures before proceeding with installation, demolition and removal. Give particular attention to equipment supports and bracing requirements so as to prevent any damage to BHS equipment.

2. Provide, erect and maintain catch platforms, dust partitions, lights, barriers, warning signs and other items as required for proper protection of operating personnel, the public, occupants of building, workmen engaged in installation, removal and demolition operations, and adjacent construction. Comply with the requirements and restrictions of the Contract Drawings.

3. Do not store or place materials in passageways, stairs or other means of egress. Do not close or obstruct walkways, passageways, stairways, streets, walks, terminals, runways, rights-of-way, or other occupied or used facilities without written permission from the Owner or his representative. Conduct operations with minimum traffic interference.

4. Provide and maintain temporary protection of the existing BHS designated to remain where demolition, removal and new work is being done, connections made, materials handled or equipment moved.

5. Utilize suitable coverings to protect existing work. Be responsible for any damage to the facilities or other contents by reason of the insufficiency of protection provided. Promptly repair damage caused to adjacent facilities and restore as new.

6. Repair any damage to work in place. This includes repair of both new and existing fireproofing materials removed to allow the installation of BHS structural attachment supports, header steel, and any other BHS equipment.

1.09 SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

A. General

1. All equipment shall be in strict accordance with the specifications described herein. It should be noted and stressed that the system shall be engineered, fabricated and installed with the objective of being of rugged, heavy duty, impact resistant equipment capable of withstanding the abuse and exposure to damage experienced in an air transportation baggage handling facility. Other key factors to be considered in the development of the system and its elements shall be simplicity, reliability, maintainability, and safety.

2. The BHS Contractor is deemed to have studied the system design and requirements presented in the drawings and specification respectively and accepted the design and requirements as suitable and appropriate to safely accomplish the functions and processes described herein. The BHS Contractor shall identify in the bid submission any design aspect or specification requirement that is believed to be inappropriate or inadequate and shall propose alternate solutions to alleviate the perceived problem but shall, in all cases, include in the bid submittal pricing for the base system presented in the drawings. Any alternate designs, developed by the BHS Contractor must meet or exceed the design criteria as listed in the specifications.

3. Careful consideration shall be given to the design, fabrication and installation of all projections, welds, and transfer points between conveyor segments and conveyor items to eliminate damage to the various types of baggage processed.

4. The system and subsystem layout configuration and item/component functional requirements are specifically described on the contract drawings. However, alternate solutions, may be proposed on an optional bid cost basis for consideration by the Owner. Any alternate designs, developed by the BHS Contractor shall meet or exceed the design criteria as listed in the specifications.

B. Material and Equipment Approvals

1. Where manufacturer's name, brand or trademark is specified, it has been selected to establish a standard of quality for the materials, components or equipment required. Materials, components or equipment of different manufacture considered to be equal to the materials, components or equipment specified will receive full consideration and shall be subject to approval by the Owner or his representative before being incorporated into the work. The contract price shall in all instances be based only upon materials, components or equipment specified. A list of material, component or equipment suppliers shall be submitted to the Owner or his representative for approval. Provide a listing of sources where any material, component or equipment, for which a substitution approval is being requested, can be obtained.

2. Furnish all engineering data, engineering/shop drawings, literature, test results, calculations, and any other requested information, for review of substituted material, components or equipment. The BHS Contractor shall pay for any redesign necessary to accommodate an “approved equal”.

C. Request for Deviations from Drawings or Specifications

1. Requests for deviations from drawing or specification requirements may be approved at the discretion of the Owner or his representative to permit use of standards inherent in the equipment when it has been determined by the Owner or his representative that such deviations will in no way be detrimental to the conveyor equipment, the safety, operation and maintenance of the specified system, system design, system reliability and its associated inventory of spare parts.

2. Any materials, components or equipment submitted for substitution for this BHS shall be previously proven under the loads as specified in Part I of this Specification in an operational or test equivalent environment for a minimum of 1 year, 18 hours per day, 7 days per week.

D. Baggage Conveyors

1. Conveyor Loads

a. Design the conveyors and their supports using the following loading criteria:

1.) The live and dead static load imposed on the building (composed of the conveyor components, supports and baggage) used for designing structural elements, rollers and pulleys shall be 100 pounds per linear foot except for merges and conveyors designated as oddsized, in which case it shall be 150 pounds per linear foot.

2.) All conveyor equipment shall be capable of supporting a single concentrated static load of 250 pounds.

3.) The live dynamic load to be utilized for sizing drives, belts, bearings, and other components, shall be 60 pounds per linear foot for load, unload and accumulating conveyors operating up to a speed of 120 feet per minute. For all other conveyors (e.g. transport, or sortation) it shall be 40 pounds per linear foot operating at a conveyor speed of 90 feet per minute and a throughput of 25 bags per minute adjusted proportional to speed and throughput. As an example, a sort line traveling at 360 feet per minute and rated at 60 bags per minute would have to be rated at 24 pounds per linear foot for load testing. The following formula shall be utilized to determine the test ballast for the purpose of load testing and preparation of related test plans during the BHS acceptance period:

4.) Formula: 40 lbs per Linear Foot x (90 FPM / actual conveyor speed) x (throughput rate / 25 bags/min) = xx lbs per linear feet

2. Conveyor Dimensions

a. All equipment shall be of U.S dimensions.

b. Unless otherwise specified on drawings, construct conveyors to the following dimensions:

Conveyor Type	Overall Width	Between Guide Width	Belt Width
Oddsize Conveyor and Power Turns	60"	57"	54"
Standard Conveyor and Power Turns	42"	39"	36"

Note: 1. Standard Power Turn Inside Radius shall be 4' 0".

Note: 2. Oddsize Power Turn Inside Radius shall be 5' 0"

3. Conveyor Side Guard Heights

a. Refer to Part II of this specification for side guard heights.

4. Conveyor Speeds

a. Unless otherwise specified, conveyors speeds shall be selected by the following criteria:

Type/Location	Speed (Feet/Min)
Public Area Load Conveyors	90
Transport to Sortation Conveyors	120 to 350*
Flat Plate Pallet Make Up Devices	90
Sortation	240*
Non-Public Load / Unload Conveyors	120
ETD Area Load / Unload Conveyors	90
Transport to EDS	90 **
Transport from EDS to Level 2 Decision Point	Variable Speed Drive (30 – 240 FPM Range) ***

* As required to achieve specified throughput rate

** As required by the applicable EDS device manufacturer. Refer to Part II of the project specification for details.

*** As required to achieve a minimum of 45 seconds of OSR time

b. Speed Changes

1.) Make speed changes between adjacent conveyors to increase or decrease a maximum speed (nominally 30 feet per minute) so as not to adversely affect baggage spacing or tracking. Conveyor speed changes between adjacent conveyor segments shall be set that the specified positive bag tracking requirements are not compromised.

2.) Feed conveyor speed onto the related make-up device will not be greater than 120 feet per minute,

unless otherwise specified.

E. System Processing Rates

1. Unless otherwise specified, System Processing Rate shall be:

Conveyor Type	Minimum Processing Rate
Ticket Counter Lines (Each Subsystem)	20 bags per minute
Reinput Subsystem	20 bags per minute
Outbound Transport Conveyors	40 bags per minute
Sortation Mainline (Each Subsystem)	40 bags per minute
Manual Encoding	15 bags per minute
Transport to EDS	As required by EDS device manufacturer in order to satisfy TSA processing requirements.

2. The design of the system shall ensure the following:

a. An EDS Level-2 operator decision time of 45 seconds minimum of OSR time.

b. EDS machine throughput shall be measured at the point or points where bags are returned from the TSA screening system to the BHS outbound system (i.e at the exit conveyor handover to the BHS).

c. All “Non-Clear” bags shall arrive at the CBRA, including EDS Out of Gauge bags, purge bags, and that the Error Rate shall be less than 1%.

1.) Error Rate = ((Total Bags at Reconciliation) – (Valid EDS Out of Gauge) – (“Non-Clear Bags” with valid tracking IDs)) / (Total Bags Inducted).

d. 1% or less of total bags may jam in the Checked Baggage Inspections System as measured in a 24 hour period. No more than three (3) bags may be involved in any given bag jam event.

e. Fail-Safe features activate on all mis-diverted bags but activation rate is less than 0.5% of total bags.

f. Note: Throughput rates shall not be less than the above referenced amounts unless pre-approved by the Owner, the TSA or their representatives.

g. Note: EDS conveyor subsystem Error Rates shall be calculated using all EDS conveyor lines simultaneously and shall occur over a flow of bags of at least 100 bags per EDS.

F. Baggage Characteristics

a. Design the BHS to convey standard airline baggage tubs and to process baggage having the following characteristics:

b. Size of Single Piece

Conveyor Type	Length	Width	Height
Standard Conveyor Maximum	54"	33"	34"
Standard Conveyor Minimum	12"	12"	3"
Oddsize Maximum	13'	50"	34"
Oddsize Minimum	12"	12"	4"
L3 3DX 6600	54”	31.5”	24”

(1.) Note 1: Average bag length for the purpose of rate testing shall be 33". The system shall be capable of accommodating 42" bag lengths without compromising the baggage-processing rate. The standard outbound conveyors shall also be capable of accommodating 54" bag lengths at lower processing rates. The specified dimensions for the standard baggage sizes are intended to provide the maximum individual dimension for each of the three magnitudes indicated, and not to exceed the maximum baggage weight. For any given length or width

dimension, the baggage conveying surface area must not exceed 12 ft².

(2.) The specified dimensions for oddsize baggage sizes are intended to provide the maximum individual dimension for each of the three magnitudes indicated and not to exceed the maximum baggage weight. For example, given a 10' length dimension, the width must not exceed 18"

Note 3: The L3 Communications eXaminer 3DX 6000 has a tiered restrictor plate at the face of the entrance tunnel that limits the size and shape of acceptable baggage. The BHS Contractor is responsible for the complete understanding of baggage positioning issues related to conveying baggage into the eXaminer 3DX 6000 and providing equipment and controls to center the bag and measure overheight and overlength prior to the machine.

c. Weight of Single Piece

Conveyor Type	**Weight**
Oddsize Conveyor Maximum	150 lbs.
Oddsize Conveyor Minimum	1 lb.
Standard Conveyor Maximum	120 lbs.
Standard Conveyor Minimum	1 lb.

d. Shape

1.) At least one flat conveyable surface. Baggage meeting the above size limitation but lacking a flat conveyable surface (such as baby carriages, round duffle bags, and the like) shall be processed in standard airline tubs.

2.) Design system to accommodate 90% of the baggage normally encountered with or without the use of standard airline tubs, including but not limited to, golf bags.

e. Surface Material

1.) Complete spectrum of checked luggage materials found in air transport baggage, including paper, cardboard, cloth/canvas, plastic, leather, wood, and metals in the following conditions:

a.) Dry to Wet

b.) With/Without:

(1.) Paper/cloth/plastic tape/wrapping

(2.) Plastic/steel bands

(3.) Fiber cord

(4.) Twine

(5.) Wheels

(6.) Straps

G. Physical Constraints

1. Design the BHS to accommodate the following physical constraints imposed on the System by either operational or facility considerations:

a. All conveyors, supports and related components (unless shown as floor supported, within the confines of protective guard rails, or within a confined and protected space) shall have a minimum underside clearance of 8'-0" from the bottom of the support structure to the floor, unless otherwise specifically noted on the Contract Drawings.

b. Minimum clearance on all conveyors from the top of the conveyor belt to the underside of any obstruction

shall be 36 inches, unless otherwise specifically noted on the Contract Drawings.

c. All inclined and declined conveyors shall have the following:

1.) Nominal 15° and a maximum slope of 18° for non-tracking conveyors

2.) Nominal 12° for tracking conveyors (15° maximum) unless otherwise indicated on contract drawings.

3.) In all cases, where space permits a shallower angle, the Contractor shall minimize the slope utilizing the least possible incline/decline angle to achieve the proper elevation change.

d. All inclined or declined spiral power turns shall have a maximum elevation change of 1 foot in rise or fall per 45° of turn for non-tracked conveyor.

e. All inclined or declined spiral power turns shall have a maximum elevation change of 1 foot in rise or fall per 90° of turn for tracked conveyor

f. If any of these design criteria cannot be maintained, notify the Owner or his representative in writing for resolution.

H. Vibration

1. Provide shaft mounted components (pulleys, sprockets, and other shaft mounted components) and other components subjected to vibration with some means of preventing loosening of the component such as snap rings, cotter pins, or other methods approved by the Owner or his representative.

2. Mount all conveyors on vibration isolation pads or hangars except those components supported from a ground floor slab or other structural floor whose characteristics prevent vibration from the conveyors from being transmitted to adjacent structure(s) or perceived surrounding area.

3. Vibration isolation devices shall be determined based on individual support loads, vibration frequency and vibration amplitude so that appropriate vibration isolation is proved.

4. Provide vibration isolation devices that prevent perceivable vibration from being transmitted to the surrounding building structure.

5. The BHS Contractor shall ensure that all National, State, and Local codes for seismic requirements are met for the project.

I. Balancing

1. Dynamically balance all rollers and pulleys.

J. Service Conditions

1. Design each element to operate satisfactorily in its respective environment as follows:

a. Mechanical - Indoor (Bagroom Environment)

1.) Temperature: 32° to 120° F (0° to 48°C)

2.) Relative Humidity: 5% to 99% Non-condensing

3.) Protected from direct exposure to weather

b. Electrical/Electronic Equipment Inside Control Panels

1.) Temperature: 32° to 140° F (0° to 60°C)

2.) Relative Humidity: 5% to 99% Non-condensing

c. Electrical/Electronic Equipment - Indoor (Bagroom Environment)

1.) Temperature: 32° to 120° F (0° to 48°C)

2.) Relative Humidity: 5% to 99% Non-condensing

3.) Protected from direct exposure to weather

d. Mechanical - Outdoor or in Unheated Enclosures

1.) Temperature: -20° to 120° F (-30° to 48° C)

2.) Relative Humidity: 5% to 100% condensing

3.) Covered but not protected from driving rain.

e. Electrical/Electronic Equipment - Outdoor or in Unheated Enclosures

1.) Temperature: -20° to 120° F (-30° to 48°C)

2.) Relative Humidity: 5% to 100% condensing

3.) Covered but not protected from driving rain.

f. Electrical Equipment Inside Computer/Control Room

1.) Temperature: 50° to 80° Fahrenheit

2.) Relative Humidity: 5% to 60% Non-condensing

g. EDS Room

1.) Temperature: 41° to 90° Fahrenheit (5° to 32° Celsius)

2.) Relative Humidity: 5% to 85% Non-condensing

2. During construction if sealed office area is not available for the BHS related computer equipment, a filtered air environment area should be provided (by building contractor).

3. Provide and clearly identify any special environmental requirements more stringent than what is shown in these specifications that may be essential for correct equipment operation (e.g., computer hardware, scanner arrays, and any other components with special environmental requirements).

4. The above listed requirements do not take into consideration separate requirements that may be required for any related non-BHS equipment that may be provided and installed by others (such as but not limited to EDS devices and EDS workstations) or personnel that may drive environmental requirements in various areas where BHS equipment also exists.

K. System Safety

1. The BHS Contractor shall be responsible to design, manufacture, supply, install and construct the BHS in accordance with all of the requirements in the Contract Documents, and shall meet or exceed all applicable laws rules, orders, regulations and codes. In this regard, the BHS Contractor shall be responsible throughout this Contract to bring to the attention of the Owner or his representative in writing any changes in such laws, rules, orders, regulations and codes and any condition(s), whether caused by its design or any BHS Contract requirements, which the BHS Contractor believes may result in or has resulted in an unsafe condition(s). The BHS Contractor shall be responsible to rectify at his own cost any such condition(s) resulting from its design and not directly as a result of any Contract requirement(s). Where the Owner and the BHS Contractor mutually determine that such condition(s) is directly a result of any Contract requirement(s) or any changes in laws, rules, orders, regulations and codes, then the Owner and the BHS Contractor shall seek a mutual resolution of the condition(s) to be effected by a Change to the Contract.

2. Utilize control methods and techniques, circuitry, mechanical and electrical equipment and operating/maintenance procedures to provide maximum safety for operation and maintenance personnel and to minimize potential damage to the equipment and to the baggage being processed. Incorporate fail-safe techniques to prevent the occurrence of unsafe conditions, which could result from an equipment failure or improper implementation of the operating procedures.

3. As employed herein, the failsafe principle shall be interpreted as follows: In the event an equipment failure or external influence such as improper operation, high temperature, power failure, or other adverse condition affects the proper function of a system or element involved with the safety of life or health, said system or element shall revert to a state known to be safe to all personnel interfacing with the equipment.

L. Personnel Safety

1. The operation of the system shall be convenient and safe to use, and control functions to be performed shall be simple to minimize possible errors. The BHS Contractor shall provide convenient means for emergency system

shutdown.

2. Provide adequate means for ensuring the safety of all personnel who have access to the system in the system design.
3. The BHS Contractor shall provide sufficient safety signage throughout the system.
4. Provide lockable devices such as disconnect switches and lockouts to prevent the accidental activation of those portions of the system shut down for maintenance. These devices shall be located in all areas.
5. Provide equipment and component guards on all drives for conveyors and sortation devices. House all moving parts in personnel areas with guards (such as bearings, return rollers, and return conveyor belts).
6. Provide sufficient work space in all limited access areas
7. Provide audible and visual warning signals along all areas of the system to make apparent any potential hazards to the public, operating and maintenance personnel resulting from moving or about-to-start equipment.
8. Provide protection from falling objects in work areas or aisles located beneath overhead portions of the system with gap pans, netting etc.
9. Locate conduits and all other electrical components where they shall not be subject to damage by maintenance or operational personnel.

M. Noise Levels

1. Design, fabricate and install the BHS to limit combined equipment and controlled ambient noise levels to the following allowable maximum requirements. However, the BHS equipment shall not increase the ambient noise level by more than 15 dB (A). In any case, ambient noise levels for the BHS equipment shall not exceed OSHA standards.
2. Design, fabricate and install the BHS to limit combined equipment and controlled ambient noise levels to the following allowable maximums

Noise Level	Ambient
45 dB (A)	In adjacent or nearby office areas (measured at the center of room at a height of 5’-0” above the floor).
65 dB (A)	In public areas or ceiling above public areas and offices and CBRA (measured at a number of positions normally occupied by passengers, public and staff).
75 dB (A)	In bagroom and all other associated non-public areas or unoccupied areas.

3. Unless otherwise specified the measurements shall be taken at a maximum distance of 5 feet vertically and 5 feet horizontally from noise producing components.
4. The noise level measurement shall be accomplished utilizing an integrating sound level meter supplied by the BHS Contractor. A qualified person employed by the BHS Contractor shall accomplish measurements and evaluation. The BHS Contractor shall provide a certificate of calibration to the Owner or his representative.
5. The noise level shall be the Equivalent Continuous Sound Pressure Level measured over a period of one minute or more at each location. In addition, to the overall A-weighted noise level, the Equivalent Continuous Sound Pressure Level shall be measured for each octave frequency band from 125 Hz to 4000 Hz.
6. Conveyor noise shall not be unduly impulsive. Observing the difference, between the measured Equivalent Continuous Sound Pressure Level and the instantaneous sound pressure level, shall test the impulsiveness of the noise. A component shall be considered unduly impulsive if the differences exceed 3 dB (A).
7. Conveyor noise shall not be unduly tonal. Tonality shall be determined by observing the difference in level between any A-weighted octave band and each of its adjacent A-weighted octave bands. The sum of the differences shall not exceed 6 dB (A). All octave bands from 125 Hz to 4000 Hz shall comply with this requirement.
8. Every conveyor component shall be tested. The components shall be tested at full design speed under load conditions.

9. Where conveyors are located in the ceiling spaces of non-bagroom areas, the noise measurements shall be taken after the architectural ceilings are in place.

10. Noise level measurements shall be taken during non-operational hours to ensure passenger conversations; movements, etc. do not unduly increase the ambient noise levels in public areas.

11. Measurements shall be taken during a time when the ambient noise levels are at least 6 dB (A) below the conveyor noise level. The ambient noise level shall be determined both before and after the measurement of the components. The ambient noise level shall be determined as follows:

    a. The BHS equipment shall be turned off.

    b. All other equipment (i.e., air-conditioning and heating equipment) shall be on and outside noise sources (from aircraft and mobile ground equipment) shall be as normal.

    c. Noise level readings shall be taken throughout a zone 5 ft vertically and 5 ft horizontally from the BHS equipment using an integrated sound level meter set to the A-weighted network.

    d. After the ambient noise level has been determined, the BHS equipment shall be turned on and the total noise level shall be measured at the same points throughout the zone that the ambient levels were measured.

12. The BHS Contractor shall provide a written report to the Owner or his representative detailing the results of the noise level measurements.

N. Radio Frequency Interference/ Electro Magnetic Interference (RFI/EMI)

1. Ensure by proper design and shielding that system equipment shall not create electromagnetic emissions, which can, in any way, cause interference with communications within the airport or between the airport and aircraft or ground support vehicles.

2. Choose all electrical and electronic equipment (including computer and related equipment) to operate without malfunction in the presence of normal electromagnetic emissions generated by other equipment normally installed or used at the airport including but not limited to the aircraft communications bands, high-power radar systems, various electrical motors and controls, power tools, welding equipment, automotive vehicles, ground power units and air handling units. Provide isolation transformers and line suppression units, if required.

3. Radio frequencies, if used for communications or information transmission within the systems, shall be applied for to the relevant Jetport and Government Authorities for their designation and assignment.

O. Maintainability, Life & Reliability

1. The requirements set forth in this section are minimum requirements and do not relieve the obligation to provide a system in which all required maintenance tasks can be readily performed.

2. Design all components so they can be easily disconnected and removed from the equipment without the necessity for extensive disassembly. Design the components for removal and replacement by two (2) staff in a period not to exceed two (2) hours. List in the maintenance manual all component removal/replacement or other maintenance tasks, which require more than four (4) staff-hours to accomplish. Be prepared to demonstrate that any maintenance task, not so listed, can be accomplished as described above. Correct any installation, without charge, as required to accomplish this demonstration.

3. Design the system so that equipment components requiring inspection and servicing are readily accessible. Provide suitable doors for this purpose. Where necessary, provide access holes in frames or guards but keep them to a minimum number and size, and ensure that they do not create protrusions or discontinuities detrimental to the baggage being conveyed.

4. Design equipment to facilitate maintenance functions in preference to ease of fabrication.

5. Design equipment such that, whenever possible, assemblies shall not require dismantling in order to troubleshoot, repair or replace assemblies or components of assemblies involved in such servicing procedures.

6. Affix cover plate attachment hardware to, or hold captive in, the cover plate assemblies.

7. Provide all electric assemblies, panels, or boxes with the appropriate schematic, enclosed in a clear-faced envelope affixed in a location visible to personnel while servicing such items.

8. Provide one set of special test instruments and tools for each group of equipment items requiring such special test

instruments and tools. These shall be provided in a metal toolbox with identification of the equipment for which the tools shall be used.

9. Provide a device for measuring conveyor speed and shaft/pulley rotational speed prior to commencement of Acceptance Testing for use by the Owner or his representative, during the Acceptance Testing period.

10. Provide fixed or mobile ladders, service platforms, lifting lugs or other applicable provisions to ensure easy access to components requiring servicing, either as shown on the specification drawings or as required to assure a safe and efficient system for all personnel who operate, maintain or have access to it.

P. Standard/Interchangeable Components

1. Minimize the number of different types and makes of components used in the BHS to simplify spare part inventory. Such standardization of spare parts is of significant value in order to reduce operating expenses.

2. Design all equipment and components to definite standard dimensions, tolerances, and clearances to provide maximum inter-changeability.

3. Provide like types of equipment from the same manufacturer wherever practicable.

Q. Lifespan

1. Provide equipment components and items for a system equipment life of a minimum of 15 years and an operating duty cycle of 18 hours a day, 365 days per year. This provision is a design objective, not a warranty.

2. It is understood that PC based computer equipment may not have the identical hardware available for the full 15 year period (PLC equipment does not fall under this category), as such the BHS Contractor shall submit a list of the estimated spare parts required to maintain the PC based computer hardware for the 15 years of operation for the Owner or his representative review and consideration for a budgetary allowance - include unit price per unit for the estimated spare parts list based on reasonable airline market rates.

R. System Reliability

1. Reliability requirements of the total BHS shall be measured in terms of "System Availability" (A_s).

2. Failure

a. A failure is defined as any malfunction of a System component, assembly, or subassembly which stops normal operations. A failure shall be charged against only the one subsystem, which causes that failure. The following shall not be classified as failures:

1.) Malfunctions caused by a failure on the Owner’s part (after system acceptance) to properly maintain and operate the System in accordance with recommended procedures.

2.) Malfunctions due to causes outside the System such as sabotage, general power outage, etc.

3.) Malfunctions due to baggage jams not caused by failure of a system component, assembly or subassembly unless it is a defective part, a poor installation, or a failure of a component or subassembly to perform its intended function.

4.) Incipient failures, which are detected and repaired without affecting normal operation of the System.

5.) Malfunction of one of a redundant Computer/PLC pair where the repair time does not affect normal operation of the system. However, reliability of redundant computer pairs is defined elsewhere in this specification.

3. Sub-System Availability (As)

a. Sub-System Availability (As) shall be defined by the following equation:

$$As = \frac{(ST - RT)}{ST}$$

ST = Scheduled Operating Time: The scheduled time that the BHS is available for baggage processing (normally 18 hours per day).

RT = Repair Time: The interval of time between initiation of repairs due to a failure and return of the BHS to operation.

b. Each subsystem of the BHS shall have an availability of not less than 0.995 (99.5%) to be calculated on a monthly basis. However, the maximum allowable downtime in a single operating day shall be no more than 15 minutes on one subsystem; additionally the accumulative downtime for all subsystems shall not exceed 20 minutes.

c. No more than one failure per month of one of the computers, PLCs, workstations and any other control equipment within of any slave/master pair shall be acceptable.

d. All computer and control systems (including BHS host computers, Sortation computers, workstations, etc.,) shall have an availability of not less than 0.999 (99.9%) to be calculated on a monthly basis. However, the maximum allowable downtime in a single operating day shall be no more than 2 minutes for a single event. The maximum downtime where both slave/master pair within computers, PLCs, workstations etc. fail simultaneously shall be 10 minutes in a year.

4. Tracking Accuracy

a. Tracking accuracy shall be defined as the percentage of successfully tracked bags from an encoding position (EDS device, ATR, BMA array, decision point, manual encoding, etc.) to the final output device. Tracking accuracy shall be a minimum of 99.5% calculated on a daily basis, for the total number of bags input into the baggage system. Tracking accuracy is a measure of the system's ability to identify and control the location of the baggage from the point of encoding to the correct output. The intent of this requirement is to ensure system transit times are met and the baggage is sorted in a timely fashion with a minimum of manual encoding intervention. The tracking accuracy shall be based on missing/lost bag counts as reported by operations/ramp personnel.

b. All bags, which are read by the scanners or manual encoding hand scanner guns, or assigned an ID by an EDS device shall be verified for proper destination.

c. If a bag that has been successfully read by the scanner array (or assigned an ID from an EDS device) gets out of its respective "tracking window", that bag shall be tracked as a "missing"' or "lost bag". It is not acceptable for any bag to be mis-sorted because of a failed tracking process. The BHS Contractor shall route "missing" or "lost bags" as follows:

1.) All "missing" or "lost bags" within the BHS sortation system shall be sent to manual encoding for subsequent re-identification.

2.) All "missing" or "lost bags" within the EDS matrix shall be routed as detailed in Part III (3.08 - BHS Detailed Control Descriptions/Requirements – EDS Security Screening Subsystem) of this specification.

3.) The BHS Computer System shall generate appropriate fault messages indicating the "missing bag".

d. The BHS Contractor should note that bags that are proven (as reported by maintenance/operations/ramp or TSA personnel) to have lost tracking due to being incorrectly introduced into the system (i.e. bags on wheels) are moved out a tracking window as a result of the clearance of a bag jam shall not be counted against the tracking accuracy.

e. The BHS Contractor should also note that bags that are assigned an "Unknown Status" from an EDS device are not to be treated/reported as mis-tracked bags, these bags are to be tracked, routed and reported as detailed in Part III (3.08 - BHS Detailed Control Descriptions/Requirements – EDS Security Screening Subsystem) of this specification.

f. If a bag has been successfully read by the scanner array (or otherwise tracked by the BHS from an origination point such as BMA or EDS Device) but fails to appear at any tracking photocell, that bag shall be identified as a "missing bag" by the tracking control system. Three missing bags in succession at the same tracking photocell shall cause the tracking control system to automatically stop the associated conveyors and declare a "missing bag jam". Note that all missing bag occurrences shall be reported regardless if they are singular or multiple occurrences.

g. The BHS Contractor shall provide as part of the MIS day end report, tracking accuracy as a percentage of bags inducted per line versus number of bags that lost tracking on the respective line. The BHS Contractor shall also detail in the MIS reports a listing of all bags that lost tracking with associated BSM details, time and location tracking was lost.

5. Sortation Accuracy: Sortation accuracy shall be defined as encoded baggage that is sorted correctly to the assigned make-up device. Baggage that is sorted to an incorrect make-up is classified as a mis-sort. Sortation accuracy from an encoded position (ATR or manual encoding) of 99.9998% shall be achieved for the total number of bags input into the BHS i.e. mis-sorts are unacceptable. Sortation accuracy shall be demonstrated during system acceptance testing and must be proven (through operational reports) that it is maintained during the three month operational period prior to system final acceptance.

6. ATR Read Rates: The minimum monthly successful ATR scanner array read rate maintained for originating baggage, shall be 95% successful reads of all IATA 10 digit license plate tags, IATA 10 digit fallback tags, and 4 digit city code tags that are in good condition. This figure does not apply to hand written tags or non-compliant tags, which negatively impact actual, read rates. The intent is to reduce the volume of baggage processed through manual encoding, thus reducing transit times. Each ATR scanner array shall achieve a minimum read rate of 99% during testing and 95% for originating bags during actual operations on which machine-readable tags, in good condition, are affixed.

7. Baggage Dimensioning Sizing Rates: The Baggage Dimensioning Device (BMA) shall accurately size 99% of all items that pass through the array. Any item that is detected by the bag present photocell but not sized by the BMA shall be treated and acted upon as an out of gauge item by the BHS.

S. Parts Availability

1. Maintain, for immediate delivery, an adequate inventory of spare parts (especially long lead time items) required for routine maintenance of the system. Ensure that critical spare and replacement parts required by the system are made available for a minimum of a fifteen (15) year operational period through the availability of shop and as-built drawings and through the availability of the actual parts. Additionally, ensure the availability of custom or "special" components.

2. If the BHS Contractor fails to make such parts available during the fifteen (15) year operation period or should pricing become unreasonably high on a competitive basis, the Owner has the right to permit the use of the project drawings, at their discretion, for fabricating such parts, or having such parts fabricated so as to maintain the specified system.

1.10 STANDARDS AND CONSTRUCTION CODES

A. General

1. The design and subsequent installation shall provide adequate safety factors and shall conform to all current standards and codes of the USA, State of Maine, the City of Portland, and Portland International Jetport Authority, whichever is more stringent.

B. Construction Codes

1. In the event no specific local codes or standards can be identified, the Contractor shall comply with the most recent version, applicable provisions and recommendations of the following:

a. American Welding Society (AWS)

1.)	D-1.1	Welder Qualifications
2.)	AWS-C1.1	Recommended Practice for Resistance Welding in Building Construction
3.)	AWS-A2.0	Standard Welding Symbols
4.)	D-1-0	Standard welding practice in building construction

b. American Gear Manufacturers Association Standards (AGMA)

1.)	6009-A00	Practice for Gear Motors
2.)	6035-A02	Practice for Worm Gear Motors

c. American National Standards Institute (ANSI)

1.)	A-1264.1	Safety Code for Floor and Wall Openings, Railing, and Toe Boards
2.)	B-20.1	Safety Code for Conveyors, Cableways, and Related Equipment

3.) B-29.10M Transmission Roller Chains and Sprocket Teeth

4.) C-33.1 Safety Standard for Flexible Cord and Fixture Wire

5.) Z535 Safety Color Code

d. National Bureau of Standards (NBS)

1.) Handbook H28 Screw-Thread Standards

e. National Fire Protection Association (NFPA)

1.) NFPA No. 70 National Electrical Code Volume 2, National Fire Code

2.) NFPA No. 79 Electrical Standards for Industrial Machinery

3.) NFPA No. 80 Standard for Fire Doors and Fire Windows

f. NEC National Electrical Code (most current version)

g. Underwriters Laboratories (UL) Standards (Components must be labeled appropriately)

1.) UL 508 Industrial Controls Equipment

2.) UL 508A Industrial Control Panels

3.) UL 508C Power Conversion Equipment

4.) UL 1998 Software in Programming Components

5.) IEC 61508 Functional Safety Standard for Electrical/Electronic/Programmable Electronic (E/E/PES) Safety Related Systems

h. National Electrical Manufacturers Association Standards (NEMA)

1.) ICS Industrial Controls and Systems

2.) MG1 Motors and Gear Motors

i. American Society for Testing Materials (ASTM)

1.) A-36 Structural Steel

2.) A-794 Sheets cold rolled

3.) A-659 Sheets & Strip - hot rolled

4.) A-307 Fasteners (Bolts)

5.) A-563 Fasteners (Nuts)

6.) F-844 Fasteners (Washers)

j. American Wood Preservers Association (AWPA)

1.) C-27 Fire Retardant Wood

2. 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 revision of the following in effect as of the Contract date:

a. Williams-Steiger Occupational Safety and Health Act (OSHA), of 1970, Public Law 91.596, most current version.

b. Occupational Safety and Health Administration (OSHA)

1.) 29 CFR Part 1910 Subpart D (Walking-Working Surfaces)

2.) 29 CFR Part 1910 -211 (Definitions)

3.) 29 CFR Part 1910 – 212 (General Industry Standards and Requirements) for machines

4.) 29 CFR Part 1917.48 (Conveyors)

5.) 29 CFR Part 1926.555 (Conveyors, Construction Industry Standards)

6.) 29 CFR Part 1926.1053 (Ladders)

c. Office of State Health Planning and Development (OSHPD)

d. American Society of Mechanical Engineers (ASME)

1.)	ASME B20.1 – 2006	Safety Standards for Conveyors and Related Equipment, and all Addenda up to and including ASME B20.1-2006

e. Conveyor Equipment Manufacturers Association (CEMA)

1.)	ANSI/CEMA 402-2003	Belt Conveyors
2.)	ANSI/CEMA B105.1-2003	Specifications for Welded Steel Conveyor Pulleys with Compression-type Hubs

1.11 WARRANTIES

A. General Warranty

1. Warrant any new BHS equipment for one (1) year against defective parts and labor beginning on the Final Acceptance Date as related to this Project.

2. Warrant all new BHS equipment for three (3) years against design defects beginning on the Final Acceptance Date as related to this Project.

3. Warrant all new BHS software, high level and low level controls for three (3) years against design defects beginning on the Final Acceptance Date as related to this Project.

4. Assign the Owner all warranties for all materials and equipment received from Subcontractors and Suppliers.

5. Considering the construction program for this project is specified to be performed under a Sequenced Implementation Process, where existing subsystems and related conveyor equipment will either be removed from service or that will be installed and turned over for operational use on an Activity-By-Activity basis, the warranty for the BHS shall begin as follows:

a. Upon the Substantial Completion Date of a given Sequence for all BHS related field components, such as motors, gearboxes, bearings, belting, field control components and MCP control components. Submit a certified warranty statement summarizing the type of warranty coverage with the warranty commencement date for that given Sequence and outlining the BHS equipment that has been substantially completed and turned over for operational use.

b. Upon the Final Acceptance Date as related to this project for all related BHS Computer Systems and PLC system hardware and software provisions. Submit a certified warranty statement summarizing the type of warranty coverage with the warranty commencement date and an outline of the BHS equipment that will be covered under the warranty.

B. Warranty Exclusion

1. This warranty shall not apply to any defects or inconsistencies, which are attributable to repair, alteration, misuse or abuses by any person other than authorized personnel or Subcontractors. Liability shall be limited to repairing or replacing defective or non-performing part(s) at no cost to the Owner.

C. Warranty Limitation

1. Liability shall be determined in the Contract Agreement and shall also include repairing or replacing defective or non-performing part or parts at no cost to the Owner.

D. Technical Support

1. Provide off-site on call technical support for two (2) years beginning at Final Acceptance. This support shall be by personnel qualified to advise the Owner on training, provisioning, start-up and maintenance of the equipment and shall specialize in PLC and the high level and low level controls for Portland International Jetport. It shall be someone that is familiar with the PWM system.

2. The technical representative(s) for warranty support and additional technical support shall be within six (6) hours travel distance of Portland International Jetport, in the City of Portland, State of Maine, where the equipment is to be located, as required by the Owner.

3. Provide technical support pricing as a separate line item as a selectable option as:

   a. 8 a.m. to 5p.m. weekdays

   b. 8 a.m. to 5p.m. 7 days a week

   c. 24 hour

E. Royalties and License Fees

1. Pay all royalties and license fees and defend all suits or claims for infringements of any prior or patent rights and save the Owner harmless from liability, expense of loss on account thereof, with respect to any processes, devices, methods, articles, inventions, things or procedures used in the project.

F. Labor Warranty

1. Warranty support shall be provided as follows:

   a. Provide labor to accomplish any warranty repair work. In the event such labor is not provided in a timely fashion, pay the Owner to accomplish warranty labor repair with its maintenance staff.

   b. The BHS Contractor shall provide labor for work related to design deficiencies.

G. Parts Warranty

1. Terms

   a. Provide a parts warranty which states material and equipment furnished and installed shall be new and free from faults and defects in material, workmanship, detail or incorrect component selection; shall conform to the functional and technical requirements of this Section and Contract Drawings contained herein; shall comply with all laws, statutes, ordinances and codes applicable at the installation site; and shall be suitable for the intended purposes. Excessive wear shall be considered a defect within the provisions hereof.

   b. Parts shall be shipped freight pre-paid to the location specified by the Owner. Failed/malfunctioned parts shall be returned to the BHS Contractor, FOB, within ten (10) days of notification of detection of such failed/malfunctioned parts.

2. Spare Parts

   a. Contractor shall provide at time of Bid a list of recommended spare parts for the first two (2) years warranty period and first five (5) years after warranty period. Such spare parts shall be made available for purchase prior to commissioning of the system.

   b. Spare parts for each phase, shall be made available for purchase by the Owner prior to the commissioning of the subsystem. The Owner may, taking the recommendations of the BHS Contractor, purchase such spare parts as it deems necessary, and said parts, shall be stocked on the Jetport property. Stock control shall be by the Owner who shall grant reasonable access to the BHS Contractor's warranty service agency during the warranty period. All items withdrawn from stock shall be replaced pursuant to warranty services, within two weeks of such withdrawal.

   c. Ending of the warranty period shall be contingent on the replacement by the BHS contractor of all stock withdrawn pursuant to warranty services whether the warranty service agency or the Owner accomplished such services. Where the BHS Contractor has cause to believe that an item or items may require stocking pursuant to the terms and conditions of warranty provisions, which item or items the Owner declines to stock, the BHS Contractor shall stock such items separately at no cost to the Owner. In no case shall the absence of appropriate spare parts in the Owner’s spare parts stock be construed in any way to abridge or interfere with the responsibilities of the warranty services as defined herein.

H. Design Warranty

1. Terms

   a. Provide a Design Warranty which states that the system, materials, equipment, software and high level and

low level controls furnished and installed shall be free from faults and defects in design; shall conform to the functional and technical requirements of this Section and Contract Drawings contained herein; shall comply with all laws, statutes, ordinances and codes applicable at the installation site; and shall be suitable for the intended purposes. Excessive wear shall be considered a defect within the provisions hereof.

2. Design Failure

   a. In the event a design failure occurs during the warranty period, replace all such components, assemblies or devices utilizing the design in a similar application in which the failure occurs by components, assemblies or devices redesigned to prevent such occurrences at no cost to the Owner. Submit proposed redesign drawings and re-selected component designations to the Owner for their approval. Issue a new warranty period upon the replacement of such redesigned items.

   b. Components, assemblies or devices shall be considered as design failures if any of the following occurs during the warranty period:

      1.) A leakage loss of over 10% of an operating fluid in any hydraulic assembly.

      2.) A demand for frequent, unscheduled adjustment or other maintenance action in similar devices.

      3.) Failure of a component to perform its specified function or a failure of a component to operate at its specified rate.

      4.) Frequent activation of overload protection elements in similar devices.

      5.) Loosening of anchoring or attachment provisions on similar devices.

      6.) An increasing level of noise being generated by similar devices.

      7.) A structural failure due to BHS supports, hangers, headers etc.

      8.) Inappropriate action of control or sensor elements during operational conditions.

      9.) Occurrence of an accident or an imminent safety hazard revealed during operational conditions.

      10.) Uncovering of a condition of specification non-compliance or degradation of specified functional requirements during the warranty period.

      11.) More than 2 failures on one or more components or assemblies of components of similar construction or design, used in similar devices.

      12.) More than 2 unscheduled replacements of an expendable component in similar devices.

   c. The Owner shall act to resolve any disputes regarding the definition of a design failure in a fair and equitable manner.

3. Period and Responsibility

   a. If, within three (3) years from the date of Final Acceptance of the work, the work or the system, or any equipment, material or software is found, in any respect, not to conform to the Warranty set forth herein, within forty-eight (48) hours of notification by the Owner, initiate the following series of steps in order to correct the deficiency:

      1.) Determine the cause of failure.

      2.) Prepare drawings showing recommended design changes and submit to the Owner or his representative.

      3.) The Owner or his representative shall comment with a change request or approval.

      4.) Make design changes if requested.

      5.) After the Owner or his representative has approved the design, all components of the system incorporating the same design deficiency shall be modified as agreed upon by the Owner or his representative.

      6.) The Parts Warranty period and the Design Warranty period shall start again for the changed item/system on the date that the design change has been incorporated if the make, manufacture or

model is replaced.

- END OF PART I -

PART II - PRODUCT SPECIFICATIONS

2.01 ACCEPTABLE MANUFACTURERS

A. BHS Contractors

1. Subject to compliance with requirements, the following firms are qualified to perform as BHS Contractors for this Project:

a. G & T Conveyor Company, Inc., Tavares, FL

b. Glidepath LLC, Grand Prairie, TX

c. Jervis B. Webb, Inc., Farmington Hills, MI

d. Logan Teleflex

e. Pteris Global Limited, Singapore (formerly Inter-roller)

f. Siemens Airport Logistics, DFW Airport, TX

g. Vanderlande Industries, Inc., Marietta, GA

B. BHS Equipment Subcontractors

1. Subject to compliance with requirements, the following firms are qualified to perform as component subcontractors for this project:

a. Equipment Erectors, Inc., Somerset, NJ

b. G & T Conveyor Company, Inc., Tavares, FL

c. Glidepath LLC, Grand Prairie, TX

d. Jervis B. Webb, Inc., Farmington Hills, MI

e. Logan Teleflex

f. Pteris Global Limited, Singapore (formerly Inter-roller)

g. Siemens Airport Logistics, DFW Airport, TX

h. Vanderlande Industries, Inc., Marietta, GA

C. BHS Controls Subcontractors

1. Subject to compliance with requirements, the following firms are able to perform as BHS controls subcontractors for this project:

a. Alliant Technologies, Louisville, KY

b. Brock Solutions, Kitchener, ON

c. G & T Conveyor Company, Inc., Tavares, FL

d. Jervis B. Webb, Inc., Farmington Hills, MI

e. MCS Automation, Farmingdale, NJ

f. Siemens Airport Logistics, DFW Airport, TX

g. Vanderlande Industries, Inc., Marietta, GA

D. BHS Equipment

1. In order to establish a minimum standard of quality and reliability, the following manufacturers have been listed for various components of the BHS.

2. This list has been presented to establish this standard and the manufactures on this list shall not be

perceived or construed as favored or preferred. This list shall, in no way, preclude other manufacturers, provided that their equipment and components have been reviewed by the Owner or his representative and determined to be of equivalent or similar quality, functionality, and reliability. The Owner or his representative's decision in this regard shall be final.

a. For Belting:
   1.) Ammeraal Beltech
   2.) B.F. Goodrich
   3.) Fenner/Dunlop
   4.) Goodyear Tire and Rubber Co
   5.) Habasit Belting, LLC
   6.) Midwest Conveyor Company, Inc. (Ashland Conveyor Products)
   7.) Morrison Company, Inc.
   8.) Siegling America, Inc.
   9.) Sparks Belting Company

b. For Belt Lacing:
   1.) Clipper Belt Lacer Company (Flexco)

c. For Bearings:
   1.) Browning (Emerson Power Technologies)
   2.) Dodge (Baldor Electric Company)
   3.) Fafnir/The Timken Company
   4.) Sealmaster/Morse Industrial Corp. (SF, SFT, ST, SKF or STH Goldline Series)
   5.) SKF Bearing Services Company

d. For Clutches:
   1.) Dodge (Baldor Electric Company)
   2.) Reliance Electric (Baldor Electric Company)
   3.) Stearns Electric (Rexnord Industries)
   4.) Warner Electric

e. For Brakes:
   1.) Dodge ("D" Type) (Baldor Electric Company)
   2.) Stearns Electric (Rexnord Industries)
   3.) Warner Electric (Failsafe)

f. For Motorized Pulleys:
   1.) Precismeca (Formerly Joki, Distributed by Interroll)
   2.) Van der Graaf (model UMV)

g. For Power and Spiral Turns:
   1.) Portec, Flo-Master Division
   2.) Transnorm (Series TS1500)

h. For Flat Plate Make-Up devices:
   1.) FKI Logistex Integration, Inc
   2.) G & T Conveyor Company, Inc.
   3.) Jervis B. Webb, Inc.
   4.) Pteris Global Limited
   5.) Siemens Airport Logistics
   6.) Vanderlande Industries, Inc.

i. For Pushers:
   1.) The use of pushers will not be accepted

j. For High Speed Vertical Paddle Diverters:
   1.) Siemens Airport Logistics
   2.) Pteris Global Limited

k. For 45 Degree Merges:
   1.) G&T Conveyor Company.
   2.) Jervis B. Webb, Inc.
   3.) Pteris Global Limited
   4.) Siemens Airport Logistics
   5.) Transnorm Systems

l. For Vertical Sorter:
   1.) Jervis B. Webb, Inc.
   2.) Logan Teleflex
   3.) Pteris Global Limited
   4.) Siemens Airport Logistics
   5.) Vanderlande Industries, Inc.

m. For Control/Communication Products:
   1.) Motor Starters:
      a.) Allen-Bradley
      b.) Cutler Hammer
      c.) Square D (Type S)
      d.) Telemecanique (TeSYS U-Line Series)
   2.) Programmable Logic Controllers (PLCs):
      a.) Allen-Bradley
      b.) Siemens
      c.) Telemecanique-Modicon and Quantum series
   3.) Photoelectric Controls:
      a.) Allen Bradley

b.) Banner Engineering Corp

c.) Cutler Hammer

4.) Manual Encode Consoles:

a.) Accu-Sort Systems, Inc.

b.) Allen Bradley – Touch Screen

5.) Variable Frequency Drives (VFD):

a.) Allen Bradley/Rockwell Automation

b.) SEW Eurodrive

c.) Telemecanique (Altivar Series)

n. For Motor Control Panels (MCP Cabinets):

1.) Control Engineering Company

2.) EMF Company, Inc

3.) Hoffman Engineering Co.

o. For Motors:

1.) Baldor

2.) LeRoy Somers (Part of Emerson Motor Technologies)

3.) Reliance Electric (Part of Baldor Electric Company)

4.) SEW Eurodrive

5.) U.S. Motors (Part of Emerson Motor Technologies)

p. For Reducers (shaft mounted):

1.) Browning (Part of Emerson Power Transmission)

2.) Dodge ("TXT" ABHS Series) (Part of Baldor Electric Company)

3.) Link Belt, Inc.

4.) SEW Eurodrive

5.) Sumitomo

q. For Reducers (foot-mounted or base-plate mounted):

1.) Link Belt, Inc

2.) Dodge (Quantis Series)

3.) SEW Eurodrive

4.) Sumitomo

5.) US Gear Motors (Browning) (Part of Emerson Power Transmission).

r. For Roller Chains:

1.) Acme

2.) Diamond Chain Company

3.) Dodge

4.) Morse Industrial (part of Bearing Distributors, Inc)

s. For Rollers and Pulleys:
   1.) Precision, Inc
   2.) The Chantland Company
t. For Scanner Arrays:
   1.) Accu-Sort Systems, Inc.
   2.) Datalogic
   3.) SICK Auto Ident, Inc.
u. For Hand Held Bar Code Scan Guns:
   1.) PSC, Inc. (part of Datalogic)
   2.) Symbol Technologies, Inc. (Part of Motorola)
v. For Baggage Dimensioning Scanners:
   1.) Accu-Sort Systems, Inc.
   2.) Mettler Toledo
   3.) SICK Auto Ident, Inc.
w. For Signaling Devices (audible alarms):
   1.) Allen Bradley
   2.) Edwards Co. Signaling Products Div.
   3.) Federal Signal Corporation
   4.) Mallory Company
x. For Signaling Devices (visual alarms):
   1.) Allen Bradley
   2.) Cooper Crouse-Hinds
   3.) Federal Signal Corporation
y. For Uninterrupted Power Supply (UPS):
   1.) APC
   2.) Eaton Powerware
   3.) Leibert (Part of Emerson Network Power)
z. For Grounding Connectors:
   1.) Burndy Electrical
aa. For Draft Curtains:
   1.) TRAX Industrial Products
bb. For Powered Fire/Security Doors:
   1.) Raynor
   2.) The Cookson Company
   3.) Vigneaux Corporation
cc. For Soft Start Devices:

1.) Allen-Bradley

2.) Nordic (P/N 2535-I00)

3.) Reuland Electric (Type "TC" Soft Start Controller)

dd. For Hour Meters:

1.) ENM Company

2.) Hobbs Corporation

ee. For Power Regulators:

1.) Sola/Hevi-Duty Electric

2.02 MATERIALS

A. General

1. All welding and qualification of welders shall comply with AWS D1.1.
2. All fasteners shall be zinc-plated, cadmium plated or stainless steel. All fasteners shall be locked with lock nuts or lock washers.
3. Use of alternate materials
   a. Whenever an article or any class of articles, devices or material are specified by the trade name or by the name of any particular patentee, manufacturer, or dealer, or by reference to the catalog of any such patentee, manufacturer or dealer, it shall be taken to mean and specify the articles, devices or materials specified and none other.
   b. If the BHS Contractor desires to use any articles or materials which he believes are equal in quality, finish and durability, and equally as suitable for the purpose for which intended as the particular articles, devices or materials specified, he shall indicate his desire to the Owner or his representative in writing.
   c. The articles, devices and materials specified shall not be changed except with the written consent of the Owner or his representative, and the BHS Contractor shall not contract, purchase or cause to be delivered any substitute articles, devices or materials prior to obtaining such consent.

B. Material

1. Structural Steel: ASTM A-36
2. Stainless Steel (Trim): AISC Type 304 with #4 Brush Finish
3. Plywood (FR-S Rated Fire retardant): Interior Type A requirements in AWPA Standard C-27.
4. Lumber (FR-S Rated Fire retardant): Interior Type A requirements in AWPA Standard C-20
5. Rubber/Neoprene: ASTM D-2000

2.03 FABRICATION

A. General

1. Fabricate equipment-using steel clean and free from rust, rust pits, kinks and sharp bends. Use forming methods that will not fracture or otherwise damage the metal. Remove burrs, sharp edges, and sharp corners. Smooth all joints and round all corners. Align joints in components to ensure smooth conveyance of baggage.
2. Holes in metal side guards for photocell beams are to be "punched", not burned, and tapered from the inside (wide) to the outside (narrow).
3. When two sections of conveyor bed meet, these joints shall be chamfered to ensure that there is no step-

up condition between bed sections.

2.04 BELT CONVEYORS

A. Belting

1. General

a. All conveyor belting shall be flame retardant according to ISO 340, DIN 22103, ASTM D-378 and NFT-47108 or equal.

b. Belt widths shall be 3" less than the between frame (guard) dimension unless otherwise specified. Belt edges must be sealed after being cut to width.

c. Ensure that no belt slippage occurs in order to meet all tracking performance requirements specified herein.

d. The actual length of belting installed on each unit shall be included on the system's drawings and in the spare parts list.

e. All belting shall have a minimum acceptable working tension of 100 pounds per inch of belt.

f. The BHS Contractor shall ensure all ratings for proposed belting designated for exterior use exceed the local environmental weather conditions.

g. The BHS Contractor shall submit cut sheets for all types of belting being proposed for this project for review and approval by the Owner or his representative.

2. Conveyors

a. For level, general purpose baggage handling applications such as load, unload transport and inclines/declines of 7° or less use two ply urethane impregnate, solid woven fabric polyester or bare by bare (if not exposed to the public), top face of 0.02" PVC, smooth (public areas), maximum coefficient of friction of 0.3 with elongation of 1% maximum rated tension. For load conveyors provide belting that is flat laying, roll resistant and cut/wear resistant.

b. For incline and decline conveyors of greater than 7° use 0.08" PVC two ply urethane impregnate, solid woven fabric polyester or bare by bare, rough top, maximum coefficient of friction of 0.25 with elongation of 1% maximum rated tension.

c. For incline and decline conveyors or other locations where bag slippage may occur, the use of longitudinal rough top belt may be used. Habasit Trackmate, model 135 LR (or approved equivalent), shall be used.

3. Power Turns: Furnish belts for power turns suitable for the application, as provided by the power turn manufacturer.

4. Spiral Turns: Furnish belts for spiral turns suitable for the application, as provided by the spiral turn manufacturer.

5. 45° Merges: Furnish belts for merges suitable for the application as provided by the merge manufacturer.

6. Vertical Sorter: Furnish belts for merges suitable for the application as provided by the vertical sorter/merge manufacturer.

7. HSVPDs: Furnish belts for HSVPDs suitable for the application as provided by the HSVPD manufacturer.

B. Belt Splicing

1. Lacing

a. All belt lacing (except for power turns) shall be of the Clipper “Unibar” type with a minimum #2 hook-type of the proper size recommended by the belt manufacturer for the belt being used. When cutting belts for proper length, sufficient material shall be allowed for take-up pulleys to be at a maximum of one-half the

take-up distance with the belt running.

b. Belt lacing for power turns shall be of the Clipper type with either #1 or #1A hook-type of the proper size recommended by the belt manufacturer for the belt being used or as recommended by the power turn manufacturer. When sizing belts for proper length, sufficient material shall be allowed for take-up pulleys to be at a maximum of one-half the take-up distance with the belt running.

c. Belting and related hardware must be trimmed in a 1" "V" notch fashion, lacing connecting pin must be either enlarged by heating lacing connecting pin nylon jacket or bent 90° to prevent lateral movement of the pin.

d. Belt lacing for applications in 45° merge conveyors shall be of the Clipper brand type of fastener.

e. Belt lacing connecting pins for the Clipper type-lacing materials shall be of the nylon covered steel cable type of appropriate diameter for the lacing hooks being used.

f. Belt edge shall be squared and cut according to manufacturer's specifications.

g. All rough top belting to be skived per manufacturer's specification.

2. Vulcanization

a. The option to vulcanize all belting material instead of utilizing belt lacing must be approved by the Owner or his representative.

b. All belts shall be supplied as endless, hot-overlap finger splice joints, as per the manufacturer's requirements. Provisions shall be made within the conveyor frame and side guard's to allow for future repair due to belt failure. For this purpose, removable side guards shall be provided at an appropriate location to allow for on-site positioning of a hot splice machine.

c. For power turns, new belting will be spliced prior to installation and installed as per manufacture's recommendations.

d. Provisions must be made to ensure future accessibility of the appropriate power requirements unique to the vulcanizer.

e. If the Owner approves the use of vulcanization, the BHS Contractor shall be responsible to supply a hot splice machine for the Owner's Maintenance personnel's use at substantial completion of the project.

C. Pulleys

1. General

a. All shafts shall be designed to CEMA standard No. 402-1992 and all subsequent revisions. Shafts are to be AISI 1018 steel, polished and ground and within tolerances for the associated bearings.

b. All pulleys are to be dynamically balanced. Rollers of eccentric material, such as standard pipe, are to be dynamically balanced.

c. Run-out:

1.) 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 related shaft furthermost from the conveyor, shall not exceed .0075" per inch.

2.) The maximum run-out of any pulley shell shall not exceed .060".

d. Machining:

1.) Swaged:

a.) Pulleys shall be 10-gauge (minimum) thickness with 3/8" (minimum) thick end plates.

b.) End pulleys are to be swaged between centers to create a trapezoidal face with a taper from the pulley end to a minimum 25% of the pulley length thereby having 50% of the pulley flat in the center.

2.) Machined:

a.) If end pulleys are machined (not swaged) using Schedule 40 pipe, center plates must be made from 1/2" thick steel plate and shall have bored centers to facilitate a slip fit on the shaft.

b.) Pulleys are to be turned between centers to create the crown or trapezoidal. Pulleys shall be crowned from each outer end to within 1/2" of the centerline leaving 1" straight but turned true to standard thickness required for each pulley application. When welding is involved, turn the assembly after welding to true the weldment and create the crown/trapezoidal.

c.) The recommended minimum wall thickness after crowning or trapezoidal shall be as follows:

Pulley Diameter	Minimum Wall Thickness
8-5/8"	5/32"
12-3/4"	7/32"
16"	11/32"
18"	11/32"

e. Hub plates shall be made from 3/8" (minimum) thick steel plate turned and bored to fit on the shaft or have a taper locking hub arrangement welded in the end plate.

f. All pulleys shall be manufactured for high-speed application.

g. All bearings shall be supplied pre-lubricated and sealed for life with plugs inserted into the grease fitting bore. Bearings are to be secured to their respective shafts with an approved form (as specified in the submittal procedure) of eccentric or squeeze locking type collar arrangement.

2. Powered Pulleys

a. Drive pulleys

1.) All drive pulleys for intermediate-type drives shall be lagged with vulcanized lagging of 50 - 60 Durometer rating with a minimum thickness of 3/8". Lagging material on individual pulleys shall be compatible with the type of belting used on the associated conveyor. Examples of lagging material are as follows:

a.) 85 durometer neoprene with a minimum of 70% neoprene content

b.) Minimum 70 durometer carboxiled nitrile

c.) Minimum 70 durometer thermo-set urethane

2.) Powered pulleys shall be steel, crown faced, flat faced, or trapezoidal (per the belting manufacturer's recommendation), shall be equipped with taper-lock type hubs with 1-7/16" minimum diameter shafts mounted in eccentric locking-type or squeeze locking type precision and ground flange-type ball-bearing units.

3.) The minimum acceptable belt wrap on drive pulleys shall be 210°.

4.) Drive pulleys for end-type drives must be lagged with a minimum 3/8" thick vulcanized lagging of 50 - 60 durometer, again using lagging material compatible with the type of belting used on the associated conveyor. In addition, powered pulleys shall be 6" with taper lock hubs with 1-7/16" minimum diameter C.R.S. shafts mounted in eccentric locking type precision and ground flange ball bearing units.

5.) Drive pulley and shaft sizes shall be determined by maximum belt pull. The following are provided as examples:

a.) Light-Duty: 250 lb. maximum belt pull. Consists of a 6-3/4" minimum diameter drive pulley with a 1-7/16" minimum diameter shaft. Bearings mounted with two bolts can be used with light duty applications.

b.) Normal-Duty: 500 lb. maximum belt pull. Consists of an 8-3/4" minimum diameter drive pulley

with a 1-11/16" minimum diameter shaft. Roller chain, if used, shall not be less than RC - 60. Bearings mounted with two bolts can be used with normal duty applications.

c.) Intermediate-Duty: 1000 lb. maximum belt pull. Consists of a 10-3/4" minimum diameter drive pulley with a 1-15/16" minimum diameter shaft. Roller chain, if used, shall not be less than RC - 60. Bearings mounted with four bolts are to be used with intermediate duty applications.

d.) Heavy-duty: 1,500 lb. maximum belt pull. Consists of a 12-3/4" minimum diameter drive pulley with a 2-7/16" minimum diameter shaft. Roller chain, if used, shall not be less than RC - 80. Bearings mounted with four bolts are to be used with heavy-duty applications.

b. Motorized Pulleys

1.) The reduction gears and motors associated with power driven pulleys shall be mounted in an oil bath for lubrication and heat dissipation. The design of the pulley shall permit the lubrication oil level to be checked without dismounting or removing the drum motor from the conveyor frame. The lubricant shall be rated for 10,000 hours of life. Gears shall be hardened and ground steel alloy.

2.) In addition, drums shall be machine crowned and lagged to facilitate belt tracking. Lagging material on individual motorized pulleys shall be compatible with the type of belting used on the associated conveyor.

3.) Power: The power supply shall be connected directly to the starter without the use of slip rings and brushes. The terminal board housing (if used) must be capable of being rotated 180° to facilitate the direction of cable inlet.

3. Non-Powered Pulleys

a. Snub Pulleys

1.) Snub pulleys are to be installed on all conveyors at all points where the slack portion (non-load carrying portion) of the conveyor belt makes a change in vertical or horizontal direction. At a minimum, such points of vertical or horizontal change shall include:

a.) Points immediately adjacent to head, tail, take up and drive pulleys.

b.) Points on the underside of any conveyor where the belt bends vertically or horizontally (nose-over sections).

2.) All snub rolls shall be a minimum of 4" in diameter and equipped with fixed (welded) 1-7/16" minimum diameter shafts mounted in eccentric locking-type or squeeze lock type precision and ground flange-type ball-bearing units.

3.) Bearings are to be secured to their respective shafts with an approved form (as specified in the submittal procedure) of eccentric or squeeze locking type collar arrangement.

4.) All snub rollers used for belt tracking shall be equipped with jacking bolts to facilitate adjustment. Jacking bolts must be equipped with jam nuts to prevent the jacking bolts from loosening.

b. Take-Up Pulleys

1.) All take-up pulleys shall be steel, crown faced, flat faced, or trapezoidal (per the belting manufacturer's recommendation), and at a minimum 4" in diameter. Take-up pulleys are to be equipped with taper-lock type hubs or squeeze lock type and 1-7/16" minimum diameter shafts mounted in eccentric locking-type precision and ground flange-type ball-bearing units. Pulleys must be mounted on threaded take-up devices with steel guides and have a minimum allowable adjustment of 10" (6" on conveyors less that 12' in length).

2.) All conveyors shall be provided with take-ups for field adjustment of 2% of the conveyor bed length. Take-ups shall be an integral part of the drive frames on all intermediate-drive conveyors.

3.) Automatic take-up devices shall be installed:

a.) On all conveyor sections in excess of 60' in length

b.) On conveyors which operate outside the building or are subject to extreme temperature and humidity changes.

c.) In areas where belts are subject to stretch/shrinkage that will cause weekly adjustment.

4.) Spring take-ups are not acceptable. Design of the pulleys shall be subject to by the Owner or his representative's approval.

5.) Take-ups used in heavy-duty or high-speed applications shall be a minimum of 6" in diameter with a minimum 1-7/16" diameter shaft and shall otherwise comply with the above specifications.

6.) Bearings are to be secured to their respective shafts with an approved form (as specified in the submittal procedure) of eccentric or squeeze locking type collar arrangement.

7.) All take-up pulley bearing adjustors are to be chain coupled so that both bearings are tightened and slacked in equal increments. All belt lengths shall be adjusted so that the respective take-up pulley adjustments shall permit a further adjustment of 85% before the belt length needs to be shortened. The 15% maximum adjustment of the take-up pulley adjusters shall have been accomplished prior to Acceptance Inspection and Testing.

c. Head and Tail Pulleys

1.) All non-powered head and tail pulleys shall be steel, crown-faced or trapezoidal and equipped with taper-lock type hubs. Pulleys shall be equipped with shafts having a minimum diameter of 1-7/16" mounted with eccentric locking-type precision and ground flange type ball bearing units. All head and tail pulleys shall be a minimum of 6" in diameter x #10 gauge wall. In addition, all head and tail pulleys shall be of a single-piece construction having steel end discs attached to the rim by continuous welding.

2.) Slider beds shall be arranged to minimize the gap between the end section and the end pulley such that the gap does not exceed 1" with a 1/2" design objective.

3.) All head and tail pulleys used for belt tracking shall be equipped with jacking bolts to facilitate adjustment. Jacking bolts are to be equipped with jam nuts to prevent the jacking bolts from loosening.

4.) Bearings are to be secured to their respective shafts with an approved form (as specified in the submittal procedure) of eccentric or squeeze locking type collar arrangement.

5.) Finger Safety Guards:

a.) All end pulley rollers in staffed areas (manual encoding, load conveyors (public and non public areas), etc.) shall be narrower than the belt width by a distance not less than two times the difference between the belt width and the between-guides width of the conveyor (usually 6 inches).

b.) A securely fastened steel finger guard matching the radius of the end roller shall take up the remaining width on each side of the roller. The BHS Contractor shall ensure that the outer surface of the finger guards are smooth and that the junctions between the finger guards and the slider bed and that between the finger guards and the pulley do not subject the belting to any undue damage or wear. Attachment of the finger guards shall be such that the guards will move with the pulley when it is adjusted, therefore ensuring proper alignment.

c.) At the tail end of load belts, pulleys shall also be covered with a removable metal shroud located just above, but not in contact with, the conveyor-belting surface. Where exposed to public view, these pulley shrouds shall be constructed of stainless steel matching that used on their respective conveyors (type 304 stainless steel with #4 brushed satin finish, unless otherwise specified).

d.) The BHS Contractor shall submit to the Owner or his representative the proposed finger safety guard design for review and approval.

4. Return Rollers/Idlers

a. Return rollers shall be constructed from 12-gauge steel and must be full-faced with a minimum 2-1/2" diameter equipped with an 11/16" hex axle for belt speeds up to 150 fpm and a minimum of 3-1/2" in

diameter with a 11/16" hex axle for belt speeds above 150 fpm.

b. All hex shaft return idler rollers shall be equipped with sealed, permanently lubricated, caged, semi-precision type ball-bearings. Return idlers shall be located on centers not exceeding 10', with spacing being reduced in areas where belting may drag against the floor or conveyor structure. The shafts shall be mounted to the conveyor bed with adjustable retainers for proper belt tracking.

c. Provide two return rollers spaced on 5'-0" centers in each 10'-0" intermediate section from which lateral diversion of baggage takes place. Center the return rollers on the associated diverter.

d. Return rollers must not be used at snub points.

e. Provide a minimum of one return roller per 10'-0" section. The position of the return rollers shall assure that the return belt is routed and supported so that it does not contact any stiffening members. Mounting for the end of each return roller shall be adjustable for belt tracking.

f. For application where conveyors are exposed to inclement weather, provide a minimum of one return roller every 5'-0" on center on load belts to help the conveyors start when wet or frozen to the bed. The position of the return rollers shall ensure that the return belt is routed and supported so that it does not contact any stiffening members. Mounting for the end of each return roller shall be adjustable for belt tracking.

g. Provide return roller finger guards at all possible return roller mounting positions where accessible by personnel.

D. Drive Assemblies

1. The BHS Contractor shall submit to the Owner or his representative for approval a schedule of all drive assemblies showing configuration of motor and reducer assembly. The selection of the drive assembly shall be based on efficiency, low noise, sized for the application, achieves long service life and has low maintenance.

2. End-type drive units may be used for conveyors 25' or less in length, with intermediate drives used for conveyors over 25' long.

3. For non-reversing conveyors, the drive assembly shall be located towards the head end of the conveyor.

4. For reversing conveyors, the drive assembly shall be located as close to the midpoint of the conveyor as possible.

5. Motors:

a. The conveyors shall be driven by AC induction motors (except where motorized pulleys are used). The motors shall conform to AIEE, NEC and NEMA standards. These motors shall be equipped with two-groove minimum, taper-lock type hubs, and “A” or 3VX -belt sheaves.

b. Motors shall be sized for maximum load and belt speed requirements under continuous operation (minimum of 1HP unless approved by the Owner or his representative) and, where applicable, shall be capable of withstanding shock caused by frequent starting and stopping under full load conditions. Motor FLA will be measured with full load during load tests and any motor that draws more than the name plate FLA (after start up in rush current has flattened) must be replaced with a motor of appropriate size that will result in no more than the max name plate FLA during load test.

c. Motors shall also be of the constant speed (nominally 1800 RPM), continuous service, and ball-bearing type with a minimum of class "F" insulation. For 2hp motors and smaller class “B” insulation shall apply.

d. If overrun is critical to system control operation (i.e., wherever baggage tracking is required), motors shall be equipped with automatically applied brakes to prevent overrun after the motors are de-energized.

e. With the exception of “High-Slip” design motors, for applications that require dual drives, and motors that are controlled by “VFDs”, all of the BHS motors shall be copper-wound NEMA Design "B" open drip proof or TEFC with Class F insulation, utilize a "T-frame" base, and shall be provided with overload protection in the motor control panel. These motors shall have a minimum of 1.15-service factor. High-Slip Motors are required by specification where the use of dual drives is used. These motors shall be copper-wound NEMA

Design "D", Class "H" Insulation at 1.0 Service Factor with Class "F" temperature limits. Inverter (Vector) Duty Motors shall be used at "VFD" controlled applications. These motors shall be copper-wound NEMA MG1 Rated Design "B", Class "H" Insulation at 1.0 Standard Service Factor with Class "F" temperature limits. All motors shall be of the "high efficiency - low energy" type.

f. All motors shall meet the following criteria:

1.) Low noise

2.) Removable conveyors (e.g. EDS device in feed and exit conveyors) shall be equipped with heavy-duty quick couplings for electrical connections

3.) Fitted with low noise fan reduction guard or equivalent.

g. Motor size selection shall be based on the design load and friction coefficient requirements as described in these specifications. Motor size shall not exceed 7-1/2 HP, unless otherwise approved by the Owner or his representative. Use minimum 1horsepower motors (unless other specified or approved by the Owner or his representative). All drive motors shall be furnished in 1, 1½, 2, 3 or 5 horsepower. Size conveyor equipment drive motors to permit start-up under full load conditions at the specified frequency of start-up cycles per minute without exceeding a temperature rise of 68°C based on an ambient temperature of 40°C. Provide motors designed for 480 VAC, three phase, 60-Hertz operation.

h. C-faced motors (with VFD control) can be utilized. Such usage shall be coordinated with the Owner or his representative.

i. Motor mounts shall be equivalent in function to Dodge Type "A" slide motor bases with boltholes drilled and tapped, or tack-welded nuts under the holes in the top portion of the mounting plate. Use of loose nuts to hold the motor mount is unacceptable. Provide jacking bolts to resist effect of belt or chain pull on foot mounted motors.

j. On all belts with frequent start/stop operations, such as indexing belts, all motors shall be continuous-running NEMA-B design, coupled with VFD control.

k. In the case where the conveyor line configuration, related controls and baggage input/processing are directly associated with the EDS or is in a tracking zone, the conveyor shall be equipped with a VFD with appropriate sized dynamic brake resistors and shall be capable of operating at two speeds.

6. Reducers

a. Shaft-mounted reducers shall be attached with tapered type bushings or full length bore with keyway.

b. Reducers shall be sized for a Class II application (minimum). Based on actual motor horsepower, the service factor required to obtain an L10 life of 70,000 hours shall be as follows:

1.) For reducers utilizing ball bearings the service factor used shall be 2.4

2.) For reducers utilizing roller bearings the service factor used shall be 2.2.

c. Reducers shall have adequate provisions for drain, fill, inspection ports and sight gauge. The manufacturer's recommended lubrication shall be attached to the reducer by means of a riveted, or bolted stamped metal tag. All units shall be installed with proper lubrication and vent plugs intact upon start-up of conveyor.

d. Reducers used on inclines where roll-back would be critical shall be equipped with “backstop" devices or brake motors.

e. All bearings within the reducer shall have a minimum L-10 life of 70,000 hours based on service factor and loading of conveyors, and on the manufacturer's published data showing load rating of each bearing used.

7. General Drive Requirements

a. Where applicable, all gear reducer-mounting frames shall be fabricated from 1/4" thick steel "C" channels. The mounting frame shall be so designed to allow bolting to both the bottom and sides of the conveyor bed. The mounting frame shall be a totally separate weldment that can be unbolted to allow for installation as either a right or left hand drive. The mounting frame shall span the full width of the conveyor bed and attach to both sides of the bed frame.

b. Electro-mechanical brakes, if required, shall be internally mounted. The stopping torque shall be at least equal to the starting torque of the motor.

c. The drive unit shall be provided with a factory warranty for 2 years or 15,000 operating hours, whichever is longer.

8. Mounting

a. C-Faced

1.) In-line foot mounted reducer is an acceptable mounting method.

2.) The C-faced configuration with VFD control used on conveyors capable of continuous stop/start operation (i.e. queues, indexing conveyors etc.) shall be capable of a minimum of 60 continuous start/stop operations per minute in an unloaded condition.

b. Foot Mounted or Base-Plate Reducer and Motor Mount

1.) The gear reducer shall be mounted on a fully adjustable mount. To allow for fast, easy motor and gear reducer replacement and adjustment, the mount shall be designed as follows:

a.) The mount shall be a two-piece assembly:

(1.) The bottom portion can be bolted or welded to the mounting frame (as specified above).

(2.) The top portion shall be designed to slide over the bottom portion and be adjustable via a single bolt adjustment. The top of the motor mount shall have boltholes drilled and tapped to accept the layout pattern as the gear reducer mounting feet or the multi-mount feet.

b.) Use of tack-welded nuts under the holes in the top portion of the mounting plate shall be acceptable in lieu of tapped holes; however, the use of nuts to hold the motor in place shall not be acceptable.

c.) The purpose of this design is to allow replacing the motor by using an extension and properly sized socket from above without having to hold locking nuts.

d.) Use of Dodge Type “A” Slide Motor Bases is recommended, or an approved equal, for this application.

9. All drive units shall be equipped with a suitable guard of "clamshell" design with quick-release fasteners, and fabricated from a minimum of 16-gauge steel. All guards shall comply with applicable OSHA standards and have an expanded metal-screened window to allow belt inspection without removal of the guard.

10. All drive motors and reducers shall be equipped with drip pans. The drip pan shall be constructed out of minimum 14-gauge steel. The drip pan shall be appropriately mounted such that the pan must be secured in the horizontal attitude and shall not impact maintenance access.

11. Whenever possible, all drive sprockets and V-belt sheaves shall have a taper-lock type of hub construction, with keyways. When keyways are used, they shall be secured by two sets of screws, one on top of the other to ensure positive locking of keyway. Sprockets shall be steel with a minimum of thirteen Type B form teeth.

12. Driving and driven sheaves shall be (minimum) two-groove "A" or 3VX section sheaves with taper-lock type hubs.

13. Roller chain shall be compatible with the torque and horsepower requirements of the application and shall be RC-60 minimum size. The roller chain ends shall be connected with a removable connecting link.

14. All pulley and sprocket adjustments provided for the purpose of adjusting belt tension, belt tracking, drive chain tension, and drive chain alignment shall incorporate a positive means of adjustment and restraint (i.e., tensioning screws and locking nuts). Slotted holes for mounting bolts shall not in

themselves be considered satisfactory.

15. Chain drive sprockets shall be designed for a sprocket ratio between the driven and drive sprockets as close as possible to 2:1, but not less than 1.5:1 or greater than 2.25:1. The maximum size for driven and drive sprockets shall be 35 and 18 tooth respectively. Wherever possible within the standard range of stock Taper lock-type sprockets, hardened tooth sprockets shall be furnished.

E. Flexible Couplings

1. Mount coupling hubs to their respective shafts with keys and two setscrews, one of which shall be over the key and the other 90° from the key. When keyways are used, they shall be secured by two sets of screws, one on top of the other to ensure positive locking of keyway. The use of a screw-locking compound in lieu of two – (2) setscrews is acceptable.

2. Select the coupling so as to permit the replacement of internal parts without removal of the motor or reducer.

F. Intermediate Sections

1. Provide conveyor frames capable of supporting a uniform load as specified with supports at a maximum center distance of 10'-0".

2. Construct the slider bed shell of 12-gauge minimum hot rolled steel and designed to present a smooth surface to the belt. The slider bed shall be well braced for rigid construction with the side frames a minimum of 6" x 1-1/2" channel or equivalent. A minimum of 1 1/4" x 1-1/4" x 3/16" angle stiffeners shall be welded to the underside of the slider bed at a maximum center distance of 3'-4" on transport conveyors and 2'-6" centers on load conveyors. Butt-coupled joints shall be provided.

3. When two – (2) sections of slider bed meet, both sections shall have chamfered slider bed lips to ensure that there are no step-up conditions between slider beds.

G. Floor Supports

1. Provide floor supports for conveyors located within 7'-6" of the floor or any mezzanine that is shown on Contract Drawings. Locate floor supports at intermediate section splices or within 1'-0" of intermediate section splices at 10'-0" maximum spacing.

2. Supports shall be on 5'-0" centers on loading/unloading conveyors and on 10'-0" maximum centers elsewhere. In all cases, each bed joint shall be supported.

3. All floor supports shall be of an “H” type design (i.e. two legs with a horizontal brace member) with vertical field adjustability of +/- 3". Floor support vertical members shall be constructed of 10 gauge, hot rolled formed steel channel with 10 gauge, hot rolled steel universal foot and head plates.

4. All conveyor floor supports shall be secured to the floor with a minimum of two (2) anchoring devices per leg (e.g., stud expansion anchor bolts).

5. All conveyors shall be adequately sway braced in order to ensure that there is no lateral or longitudinal displacement.

6. All support structure must be designed and installed so that maintenance access to the conveyor components and access to walkway(s), work areas and drive aisles are not blocked.

7. The location of the floor support shall not impede the installation/removal of the conveyor gap pan.

H. Overhead Supports

1. The BHS Contractor is responsible for the design and structural integrity of all bolts, hangers, support structures etc, and is to provide all necessary materials required for installation.

2. Provide overhead supports for conveyors located 7'-6" or more above the floor or any mezzanine that is

shown on the Contract Drawings. Locate overhead supports at intermediate section splices or within 1'-0" of intermediate section splices at 10'-0" maximum spacing.

3. All supports shall not exceed a 10'-0" maximum on-center spacing. In all cases, each bed joint shall be supported.
4. Ceiling hangers of threaded rod shall have a minimum diameter of 3/4" with structural angle, channel, unistrut or pipe sills. The hangers shall have provisions for anchoring to the building structure and header steel. A Structural Engineer must approve all hanger supports.
5. Threaded rods shall have a lock washer, a single flat washer, and a single nut above and below any header steel channel assembly. A 4" x 4" x ¼" minimum steel support plate shall be used on the load bearing side of the header between the channels and flat washer.
6. All conveyors shall be adequately sway braced in order to ensure that there is no lateral or longitudinal displacement, providing a rigid and rugged installation. Spacing must not exceed 20'-0".
7. Installation and layout of header steel and all support structure shall not pose interference to maintenance and operation access.
8. The BHS Contractor shall repair/replace both new and existing fireproofing materials removed to allow the installation of BHS equipment header steel, supports structures etc.
9. Equip all hangers with vibration isolators to ensure that there is no noticeable vibration transmitted to the building. The BHS Contractor shall submit the proposed type of vibration isolator for review and approval by the Owner or his representative.
10. Where catwalks are specified, the conveyor and adjacent catwalks shall be supported by a double sill configuration wherever possible without inhibiting maintenance and operational access. A single sill application is permissible at specific locations as approved by the Owner or his representative.
11. To achieve maximum drive aisle clearance under the conveyor the BHS Contractor is permitted to utilize a side clip attachment configuration for the conveyor hanger to support the bed section instead of a sill type application. The BHS Contractor shall submit drawings showing those areas where a side clip attachment configuration is to be utilized to the Owner or his representative for approval.

I. Safety Guards

1. Provide and install conveyor underpans on conveyors with clear heights between 18" and 7'-6" above the floor or within an envelope around a catwalk, walkway, or platform defined as 7'-6" high and 4' wide on either side of such catwalk, walkway, or platform. Fabricate underpans of either solid sheet metal or expanded metal at least 14 gauge thick and fasten to the conveyor intermediate section. The underpans, regardless of type shall be hinged and pinned for easy maintenance access; the pin shall have a lanyard attached to reduce potential of losing the pin. Sheet metal screws will not be accepted. The underpan design shall be such that the opening size prohibits inadvertent physical contact (e.g. Fingers, etc can not protrude through openings). All mesh under guarding shall be framed and dressed to avoid sharp edges and undressed edges shall be considered unacceptable.
2. Protect all exposed moving parts of conveyors, such as, but not limited to, pulleys, rollers, lower or return belts, shafts and couplings less than 7'-6" above the floor or within an envelope around a catwalk, walkway, or platform defined as 7'-6" high and 4' wide on either side of such catwalk, walkway, or platform. The guards shall be made of sheet metal not less than 14 gauge thick, and hinged and pinned for easy maintenance access.
3. Enclose all drive chains and belts using sheet metal protection covers at least 16 gauge thick. Hinge the covers at one end for ease of maintenance and size the covers with sufficient clearance to prevent contact with the normal excursion of chains and belts. Fasten with hex head bolts with captured nuts or similar means of avoiding losing parts.

4. Eliminate or round unguarded exposed sharp corners and edges of items such as, but not limited to, support legs, braces and trim, to prevent injury to personnel or damage to their clothing. Locate no overhead steel framework, conveyor part, or support structure less than 8' above any platform, walkway, catwalk, ramp or stair tread nose. If due to building constraints, support structure is less than 8', the structure, framework, support etc., shall be encased in padding, identified with safety marking (yellow/black stripped tape) and a prominently positioned low overhead warning sign.
5. Install bearing covers on all exposed rotating shafts in workstation areas and in all maintenance areas with platforms. Workstation areas shall, at a minimum, include manual encode stations, sort devices/conveyors, load conveyors, ETD work areas and EDS work areas. Install appropriate safety guarding on all exposed parts associated with the conveyor drive's rotating shaft and direct drive gearbox, in compliance with OSHA Standards 1910.219. Ensure that the proposed safety guarding does not restrict maintenance access and it is easily removable, as the location requires, for maintenance access
6. Install finger guards on all Return/Idler Rollers on conveyors not equipped with underpans.
7. Gap pans must be provided and installed on all conveyor-to-conveyor junction points or transfer locations, where there is any likelihood of small objects falling to the floor, mezzanine or catwalk. Gap pans must be solid sheet metal not less than 12 gauge, unless otherwise approved by the Owner or his representative, with minimum 2-inch high sides on the edges. The gap pan must be no wider than the conveyor width and a minimum of 18"inches long. Mounting must be such as to permit easy lowering and removal for cleaning.
8. Drive pans shall be provided and installed on all conveyor drive sections. Drive pans must be solid sheet metal. They shall be no wider than the conveyor and associated platform width, and no longer than the drive section.
9. All gearbox assemblies shall be equipped with drip pans, fitted with drain plugs to assist with clean up. Drip pans shall be solid sheet metal, not less than 12 gauge, unless otherwise approved by the Owner or his representative, with minimum ¾" high sides on all four edges. The drip pan shall be a bolt-mounted unit of the gearbox assembly.
10. Refer to "Head and Tail Pulleys" section of this specification for details on end pulley finger safety guards.

J. Side Guards

1. Provide side guards the full length of both sides of all conveyors except at points that baggage is loaded or removed.
2. Provide hinged or removable sections only where overhead clearance restricts access for clearing jams. Design hinged or removable side guards to permit rapid removal (removable without tools). The design must preserve rigidity and alignment equivalent to fixed side guards. The Owner or his representative must approve all locations where hinged or removable sections are to be used.
3. Side guards shall be minimum 12-gauge hot rolled steel, integral to the slider bed. Side guards shall incorporate a formed 90° edge turned away from the conveyor and a formed 90° edge turned down to eliminate sharp edges. There shall be no gap between the side guard and bed section that can cause jams or baggage tags to be snagged/ripped off.
4. Use type 304 stainless steel with #4 brushed satin finish uniform throughout (if not otherwise specified by the Owner or Architect) passenger areas (claims, check-in, etc.) and through penetrations into non-public areas.
5. Use cold rolled or hot rolled low carbon steel galvanized or hot dip, primed and painted on both surfaces in areas exposed to the weather.

6. Use cold rolled or hot rolled low carbon steel primed and painted on both surfaces in all interior areas.
7. Provide side guards with vertical stiffeners a maximum of 40" on center for transport conveyors and 30" on center for load conveyors. Make the stiffeners from steel angle at least 1-1/4" by 1-1/4" by 3/16".
8. Provide 30° transition panels between side and back guards of different heights.
9. Conveyor Side Guard Heights:
    a. Unless otherwise specified on drawings, construct conveyor side guards for this project to the following heights:

Conveyor Type	Side Guard Height
Check-in Take-away Back Guards	21"
Transport Conveyors	12"
Incline/Decline conveyor Side Guards	12"
Decline-fed Power Turns (flat or spiral)	21"
Power Turns (flat)	12"
Power Turns (spiral)	12"
Take Away Conveyor Side Guard directly opposite a high speed vertical paddle diverter or 45 degree merge	21"
45 Degree Merge Side Guards	12"
Manual Encoding Station Queue Conveyor (operator side)	6"
Manual Encoding Station Queue Conveyor (back guard)	12”
EDS Device In-Feed and Exit Conveyor (operator side)	4"

10. Provide holes 1.5" in diameter 2.5" from the top of the belt to the center of the hole through side guides for photocell beams as required. Punch the holes with a dimple away from baggage flow to minimize the possibility of snagging a bag and causing a jam. Deburr all photocell holes so that they are free of sharp edges and burrs.
11. Provide removable side guards at locations where diverters or 45° merges shall be installed at a later date.
12. Mounting of any mechanical or electrical equipment on the outside radius side guard of power turns is not acceptable since it restricts maintenance access to the outer perimeter chain or guide bearings of the turn belt.

K. Break-Overs

1. Provide break-overs wherever conveyors follow a convex curve.
2. Vertical or horizontal to vertical bends shall be constructed in the same manner as slider bed conveyor sections. The bed shall have a 10'-0" radius break-over slider bed to effect a smooth change in belt direction.
3. For return belt idling, vertical horizontal to vertical bends shall be equipped with a snubber pulley to ensure that the return belt does not extend below the conveyor frame.

L. Bearings

1. All bearings shall be pre-lubricated, self-aligning, anti-friction and sealed for the specified life of the bearing. Lubrication fittings shall be removed (removal to be approved by the Owner or his representative) at the time of installation or at the factory and replaced with appropriate plugs.
2. All bearings shall have a minimum L-10 life of 70,000 hours based on service factor and loading of

conveyors, and on the manufacturer's published data showing load rating of each bearing used.

3. All bearings shall be surface-mounted flange bearings attached to the outside of the conveyor bed.
4. Bearings are to be equipped with an eccentric or squeeze locking type collar arrangement to secure the bearing to the related shaft.
5. All bearings and exposed shaft ends at load conveyors, unload conveyors, manual encode workstations, ETD work areas and EDS work areas shall be covered with bearing covers.

M. Hardware

1. Provide zinc plated or otherwise treated fasteners. Use washers, lock washers and nuts.
2. All fasteners in public areas are to be made of stainless steel and are described elsewhere in these specifications.

N. Straight Belt Conveyor

1. Construct transport, queue, load, unload, incline and decline conveyors of components as specified previously.
2. Design each baggage handling belt conveyor with a length to width ratio less than 2.5 with special tracking provisions to ensure positive belt tracking.
3. The maximum length of a straight belt conveyor shall be 60' unless otherwise shown in the contract drawings.
4. In the case where the conveyor line configuration, related controls and baggage input/processing are directly associated with the EDS or is in a tracking zone, the conveyor shall be equipped with a VFD.

O. Ticket Counter Take-Away Conveyors

1. The end pulleys of the ticket counter take-away conveyors shall be such that there are no exposed gaps between the pulley and slider bed, nor shall it constrict the continuous gap between the belt edge and the guard (refer to “Head and Tail Pulleys” section of this specification for details on end pulley finger safety guards).
2. Bearings shall be installed on adjustable brackets.
3. Take-up and snub rollers shall be easily accessible and adjustable for belt tracking.
4. Bearings shall be pre-lubricated (grease-packed) and sealed for life.
5. The drive unit shall be of the center drive type.
6. All equipment with exposed surfaces visible to the public shall be covered with type 304 stainless steel with a #4 brushed satin finish uniform throughout, unless otherwise specified by the Architect or the Owner.

P. Power Turns

1. All power turns shall be provided with a four (4) foot inside radius for standard conveyors, unless noted on the contract drawings. All power turn support structures are to be of metal construction. Power turn shafts shall be 1-7/16" diameter C.R.S.
2. The conveyor system layout shall be designed to permit maximum radius power turns of 180° for flat power turns.
3. Ensure that the outside circumference side guard shall remain readily removable for maintenance. Ensure that no conduit is fastened to it.
4. To minimize the gap between a power turn and straight conveyor, ensure the end rollers (both power

turn and straight conveyor) are extended to gain a maximum gap of 1" between the faces of the belts.

5. Design the power turn conveyor so that trained maintenance personnel can easily replace belts.
6. Belt speed shall be measured on belt centerline.
7. Drive assemblies, bearings, pulleys etc., shall be designed as per straight conveyors detailed within this section of the specification.
8. If a power turn is installed prior to a 45-degree merge conveyor, the turn shall be equipped with a VFD so that baggage queuing can be achieved on the turn.
9. In the case where the conveyor line configuration, related controls and baggage input/processing are directly associated with the EDS or is in a tracking zone, the turn shall be equipped with a VFD.

Q. Spiral Turns

1. All spiral turns shall be provided with a four (4) foot inside radius for standard, unless noted on the contract drawings. All spiral turn support structures are to be of metal construction. Spiral turn shafts shall be 1-7/16" diameter C.R.S.
2. The conveyor system layout shall be designed to permit maximum radius spiral turns of 225° where the rate of incline or decline is less than or equal to 24" in 90°.
3. Match side guard height with adjacent conveyors where rate of rise or fall is less than 12" per 90°. Provide 21" high side guards for other spiral turns with a greater degree of rise or fall.
4. Ensure that the outside circumference side guard shall remain readily removable for maintenance. Ensure that no conduit is fastened to it.
5. To minimize the gap between the spiral power turn and an adjoining straight conveyor, ensure the end rollers (both spiral power turn and straight conveyor) are extended to gain a maximum gap of 1" between the faces of the belts.
6. Limit rise or fall to a maximum rate of 24" in 90°.
7. Belt speed shall be measured on belt centerline.
8. If an “S” spiral power turn configuration is incorporated in the project design, provide a “gap brush” between the power turns to fill the gap.
9. Design the spiral power turn conveyor so that trained maintenance personnel can easily replace belts.
10. Drive assemblies, bearings, pulleys etc., shall be designed as per straight conveyors detailed within this section of the specification.
11. In the case where the conveyor line configuration, related controls and baggage input/processing are directly associated with the EDS or is in a tracking zone, the turn shall be equipped with a VFD.

R. Queue Conveyors

1. Supply queue conveyors of the manufacturers approved design capable of sustaining continuous stop/start operation at thirty – (30) cycles per minute under loaded conditions.
2. Design the queue conveyors so that trained maintenance personnel can easily accomplish belt tracking.
3. Design of the queue conveyor shall be so that adjustments to belt tracking should only be required at a maximum of once every thirty- (30) days.
4. Design, manufacture and installation of queue conveyors shall be in accordance with the design specifications of transport conveyors.
5. In the case where the conveyor line configuration, related controls and baggage input/processing are

directly associated with the EDS or is in a tracking zone, the conveyor shall be equipped with a VFD.

S. 45° Merge Conveyors

1. Design and construct merge conveyors with typical slider bed construction. Set drive/take-up unit at 90° to the flow of baggage. Run the belting over fixed 3-1/2" minimum diameter Schedule 40 pipe (or manufacturer's equivalent) and set at 45° to the conveyor centerline.
2. The drive motor is equipped with a VFD unit and it shall be capable of a continuous operating capacity of 30 cycles per minute.
3. All merges in tracking zones shall be equipped with VFD and dynamic braking.
4. Design the merge conveyors so that trained maintenance personnel can easily accomplish belt tracking.
5. Design the merge conveyors so that trained maintenance personnel can easily replace belts.
6. Install merge conveyors with top of belt (TOB) 2" higher than that of the receiving conveyor to ensure smooth baggage transfer.
7. Merge shall be equipped with spring loaded, self-adjusting tensioners to prevent slippage and excessive noise.
8. Merge to downstream or "take-away" conveyor speed relationship must ensure that merged items are not skewed on the take-away conveyor.
9. Merge equipment design and speed must ensure the successful transfer of airline garment bag boxes or items of similar size onto the downstream or "take-away" conveyor so that there are no jam problems associated with the garment bag boxes at either that conveyor or any conveyors downstream of the merge. Install a minimum ½" wide brush (with holder arrangement) inserted between the merge and the take-away conveyor biased towards the downstream corner of the merge to eliminate potential snag points.
10. Merge conveyors, shall be fabricated by a qualified manufacturer, with previous installations in BHS applications. Final approval of the qualified manufacturer shall be at the discretion of the Owner or his representative.

T. Vertical Sorter Conveyors

1. The purpose of the vertical sorter conveyors is to provide vertical sortation of baggage from one transport conveyor line to two transport conveyor lines situated in a vertical attitude. The baggage may be transferred either in the upward or downward direction.
2. Vertical sorter conveyors are to be constructed with the following capabilities:
   a. Load capacity
      1.) Static: 450 lb
      2.) Dynamic: 120 lb
   b. Speed
      1.) As required for specified processing rates
3. Guarding shall be provided to ensure adequate personnel safety. Guards shall be interlocked so as to disable the vertical sorter conveyor function when the guards are open/removed. Provide a maintenance bypass switch, which has the capability to bypass the interlock. Provide drawings of the proposed guarding to the Owner or his representative for approval.
4. Each vertical sorter conveyor shall be capable of sorting at a minimum sustained rate of 35 bags per minute when cycling between vertical positions for every bag. This rate shall increase to a minimum of

40 bags per minute when the device is not cycling between vertical levels.

5. The use of 1 horsepower motors is permitted for each of the vertical sorter belt conveyors. Minimum 2 horsepower shall be utilized for the crank mechanism.
6. The design, manufacture, and installation of the vertical sorter conveyor must conform to all sections of this specification as is appropriate. Note that the design, manufacture and installation of the vertical sorter conveyor must be such to ensure that the device is heavy-duty and shall withstand the abusive environment of a high volume baggage operation.
7. In the event of a vertical sorter conveyor position switching device breakdown, it shall be possible to manually position the device into one configuration. Provide outputs from a manual/auto switch to the BHS PLC for use when the vertical sorter is to be positioned manually.
8. Each of the conveyors comprising the vertical sorter conveyor shall be independently powered.
9. It shall be acceptable to use motorized pulleys in this application, provided such design complies with the specifications identified elsewhere in this document.
10. Final approval of the qualified vertical sorter manufacturer shall be at the discretion of the Owner or his representative.

2.05 FLAT PLATE SORTATION DEVICES

A. General

1. Flat plate devices shall be constructed of articulating, heavy duty, metal crescent-shaped pallets forming a continuous rotating flat surface.

B. Dimensions

1. The usable pallet width for flat plate devices shall be between 32" and 35" (pallet width will be dependent on the flat plate manufacture selected).
    a. The height of flat plate devices shall be as follows unless otherwise specified or shown on the Contract Drawings:
        1.) Make-up devices: 29 to 33"

C. Load Rating

1. All flat plate devices shall be capable of supporting a minimum dynamic load of 85 lb. per linear foot and a single concentrated static load of 200 pounds.

D. Operating Speeds

1. Device operating speeds for flat plate devices shall be 90 fpm.
2. Flat plate devices shall be capable of accepting a baggage input of thirty – (30) bags per minute.

E. Drives

1. The drive shall consist of a heavy-duty roller chain driven by a motor through a gear reducer. The motors and speed reducer assembly shall be connected using double grooved sheaves and matched V-belts. Drives shall be designed such that the speed reducer drives an endless chain equipped with a minimum of twelve heat treated dogs which shall engage drive pins in the main chain. The chain must engage at least two carrier assemblies at all times. The drive chain must be self-aligning and supported throughout its length.
2. Drives shall be provided with an appropriately sized soft-start controller.
3. The design of the drive circuitry shall be such that the drive motor safety disconnect switch will also

open the control circuitry of the device whenever the disconnect switch is turned off. Whenever the disconnect switch is turned back on, it shall be required to reactivate the appropriate device start controls, thus allowing the drive motor start-up to be controlled by the soft start controller.

4. A minimum of two drive units are required for all baggage claim/make up applications due to redundancy requirements. The device shall be designed and configured such that if one of the drive units should fail, the device shall continue to operate at 100% capacity including the ability to start-up under full load conditions with the remaining drive unit. Easy access and means for disconnecting failed drive unit shall be provided to allow for system maintenance with a minimum of time and effort. Drive design and motor applications must provide for the potential of variations in “actual” motor speeds so that the drive motors are equally loaded. The motor used in the dual drive units is to be of the “high slip” design type.
5. High-Slip Motors are required by specification where the use of dual drive units is used. These motors shall be copper-wound NEMA Design "D", Class "H" Insulation at 1.0 Service Factor with Class "F" temperature limits. Inverter (Vector) Duty Motors shall be used at "VFD" controlled applications. These motors shall be copper-wound NEMA Design "B", Class "H" Insulation at 1.0 Standard Service Factor with Class "F" temperature limits. All motors shall be of the "high efficiency - low energy" type.
6. For ease of drive synchronization, variable frequency controllers are acceptable.
7. The device drive and idler shaft sprockets must be restrained through the use of double setscrews to prevent any lateral movement of the sprockets on the respective shafts. Setscrews alone are not sufficient.
8. Drives shall be designed for operation from a 480 VAC, 3-phase, 60 Hz power source. The drive shall be sized to permit start-up under full load conditions.
9. One 120 VAC, single-phase, 60 Hz duplex outlet shall be provided as a maintenance outlet in the general vicinity of each drive assembly.
10. The BHS control circuitry must be designed to ensure that the flat plate device is running at full speed prior to the start-up of any feed conveyors.
11. Install in close proximity to one of the drive units a control station with a Maint/Auto switch and a jog pushbutton for use by maintenance personnel only. When the switch is in the maintenance position, the device can move (jog) in the forward direction only when the jog pushbutton is held in.

F. Pallet/Flight Assemblies

1. All pallets consisting of 5/16" thick steel plates shall be provided. These steel plates must have a black urethane coating.
2. Gaps between adjacent pallets of the device shall not exceed 1/8".
3. Elevation differences between adjacent pallets shall not exceed 1/16".
4. All exposed mounting screws shall be counter sunk.

G. Frame and Pallet Support System

1. A support system and guide for the chain and pallets constructed of standard modular assemblies bolted together shall be provided. The track space must be fabricated from rolled or formed structural steel and shall form an integral part of the support structure. The structural supports for the tracks shall be spaced at a maximum of 5' on center. Pallets must be supported by a minimum of two rows of polyurethane tired ball bearing wheels. Leveling screws located at the base of each frame module shall allow for easy adjustment of the assembly. Leveling screws should provide a minimum elevation adjustment of 1".
2. Once the structure of the device has been installed and properly aligned, all track joints and cam

follower guide rail joints shall be welded and ground smooth to assure that the related track and guide surfaces are smooth and without vertical and horizontal differences.

3. The design of the sort/claim flat plate device shall incorporate a means of expansion of the device to offset any wear in the main link bushings/connecting link pins, etc. At a minimum, this shall include the following provisions:

   a. Overlapping design of the cam follower guide track so that the cam follower surface is always in contact with some portion of the guide track at the expansion joint.

   b. Heavy duty jacking bolt arrangement to assist in expanding the device when needed.

H. Finish and Trim

1. Baggage Make-Up Applications

   a. All steel trim elements of flat pallet devices that are located in the make-up area shall be painted. As an alternative, a powder coat finish may be applied electrostatically to said surfaces. All painted steel trim elements must be properly aligned both vertically and horizontally. Butt joints of adjacent painted steel trim elements must provide a smooth surface. Sharp edges on any of the painted steel trim elements as well as voids between adjacent element joints are not acceptable. In addition, all radii of trim elements must match.

   b. Finger Guards

      1.) A finger guard consisting of 6 inch, minimum 12-gauge formed channel or angle side rails shall be installed. The gap between the pallets and the finger guard shall not exceed 3/32". The vertical and horizontal alignment of the adjacent butt joints of the finger guards must not be misaligned nor is there to be any gap between the adjacent guards.

      2.) Special attention is to be given to the design, manufacture and installation of the inner and outer perimeter finger guards as well as the vertical front face skirting at the expansion point of the flat pallet device.

      3.) The design, manufacture and installation of the perimeter finger guards at the device expansion points must assure that they do not create a snag point. To further reduce the potential of snagging baggage at these expansion joint locations, the finger guards are to be designed and installed in an overlapping manner. The overlapping finger guards are to be welded and ground smooth on the upstream end of each expansion joint location.

   c. Side Guards

      1.) Inner perimeter side guards shall be provided for the entire inner perimeter of flat pallet devices used for baggage make-up applications to prevent baggage from falling into the center of the device.

      2.) Vertical side guards used as inner perimeter side guards shall be constructed of minimum 12-gauge steel. The inner perimeter side guards are to be 21" high with vertical stiffening bracing constructed of a minimum angle size of 1-1/4" x 1-1/4" x 3/16". The vertical stiffening bracing is to be located on a maximum center spacing of 2' - 6".

      3.) Design and installation of the inner perimeter side guards must not restrict maintenance access to the flat pallet device or any other conveyor equipment.

      4.) Any openings that are required in the inner perimeter side guards for photocells or their related reflectors are to be a maximum diameter of 1-1/2". These openings are to be punched with a dimple away from the flow of baggage to minimize the possibility of snags.

      5.) Where the tip chute feeds onto the flat plate device, provide sufficient outer perimeter side guarding (nominally 6" high by 4' long, flared at the charge end (to prevent bag jams)) so that baggage does not fall off the device when they exit the discharge end of the tip chute.

      6.) Provide guarding around the makeup radius downstream of the tip chute to ensure that bags do not fall off at the radius after tipping onto the carousel.

2.06 EXPLOSIVE DETECTION SYSTEM - L3 Communications eXaminer 3DX 6600

A. TSA Equipment Responsibility

1. The EDS equipment will be supplied and installed by the TSA.

B. BHS Contractor Responsibility

1. Coordinate with the EDS device provider for all the required interface details between the 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/conduits between the BHS and EDS systems that are required for these interfaces (hard-wired I/O, data interface cabling).
2. Coordinate the placement of the EDS equipment, in its final location, with the EDS supplier and ensure proper alignment/positioning with the respective conveyor line.
3. Assume responsibility for the EDS integration with the BHS.
4. Assume responsibility for the site acceptance testing of the integrated system, which shall be performed between the TSA's EDS provider and the BHS Contractor.

C. General

1. The following information is for reference only. Contact the EDS device provider to request the necessary documents that would be required for coordination, interface, and installation purposes; documents such as but not limited to: Technical Specifications, Installation Guidelines/Manual, BHS Integration Guide, BHS Interface Manual, and EDS testing guidelines).
2. Input/Output Conveyor Speed
   a. The L3 examiner is capable of achieving maximum throughput when the input speed is 30 fpm.
   b. The exit speed of bags from the L3 examiner should be set at 30fpm until a decision point if applicable to the design.
3. Minimum Bag Spacing
   a. A minimum bag spacing of 8 inches is required but EDS shall have a nominal spacing of 12"/
4. Out of Gauge Bags
   a. Requirements below are in addition to the BMA and are located prior to each machine.
   b. The L3 examiner can accept bags up to 54 inches in length in standard pipelined mode. The BHS contractor should provide suitable upstream sensing and removal of over-length bags exceeding these dimensions.
   c. The L3 examiner can accept bags up to 21 inches in height in standard pipelined mode. The BHS contractor should provide suitable upstream sensing and removal of over-height bags exceeding these dimensions.
   d. The L3 examiner can accept bags up to 29 inches in width in standard pipelined mode. The BHS contractor should provide suitable upstream sensing and removal of over-width bags exceeding these dimensions.
5. Bag Presentation
   a. Bag presentation immediately upstream of the L3 eXaminer is critical to successful bag scanning. Therefore the BHS contractor shall be required to provide a means of centering/positioning bags prior to entrance into the EDS device.
   b. The use of the D.I.D. is allowable or the BHS contractor may propose an alternative method of achieving required bag positioning. The method by which the positioning of the bag will be accomplished will be clearly illustrated/identified in the design. The BHS contractor will be required to submit for review any "non standard" equipment designs as outlined in Part I of this project specification.
6. The EDS equipment shall be supplied by the TSA. EDS internal system wiring, networking and

controls shall be provided by the TSA's Contractor. Coordinate with the EDS device provider, as required, for all the required interface details between the BHS and EDS in order to successfully accomplish the intended operation described herein. In all cases, provide any wiring/conduits between the BHS and EDS systems that are required for these interfaces (hard-wired I/O, data interface cabling and software driven).

7. The units shall be located in an In-Line configuration with the BHS conveyor equipment. Ensure proper alignment/positioning of the EDS machines with the respective conveyor line. The transportation of the EDS units (i.e., L-3 Communications 3DX 6600) between the truck dock and their final location within the Terminal Expansion shall be coordinated with the Owner and the TSA and is not the scope of the BHS Contractor. This scope shall be performed under close coordination with the supplier's (i.e., L-3 Communications) recommendations and assistance in all aspects of this work, including rigging and calibration. The location of these units shall be in compliance with all applicable regulations/requirements of the TSA and the respective supplier (i.e., L-3 Communications).

8. The conveyor segments, their associated components and related support system upstream as well as downstream of the EDS machines shall be designed and installed so as to allow the easy removal of the conveyor segments, to gain access to their respective subsystem EDS machine for the removal of the unit/sections and related egress paths, for major repairs and replacements. Provide quick disconnect fittings for these conveyor segments and their associated components, along with lockable caster wheels and pins on the respective conveyor's floor support legs, to assist in the removal/maneuvering of the BHS components/segments.

9. Coordinate the conveyor sideguard design for the segments upstream and downstream of the EDS machines with the EDS supplier to determine the proper alignment and whether or not they need to be flared to accommodate the entrance and exit tunnels of the respective EDS machine. Additionally, these sideguards shall be removable to allow for maintenance access and removal of the EDS unit in-feed, transit and exit conveyor sections.

10. Assume responsibility for the EDS integration with the BHS. Reference the EDS related documents that are outlined in Baggage Handling Specification Section 34 77 16-1.1.D and coordinate with the EDS supplier as required, to provide a fully integrated system between the BHS and EDS equipment.

11. Photocell signal and photocell location: The photocell signals from the end of the external in-feed conveyor and the end of the external exit conveyor shall be wired directly to the L3 EDS PLC. The location of the photocell at the end of these belts is critical. Provide an adjustment capability to vary the position of these photocells in order to optimize the system commissioning. A position of 20" from the end of each belt is a good starting point, but this shall very according to acceleration and deceleration parameters and response times. Photocells directly adjacent to the entrance and exit tunnel of the EDS machines shall be approximately 6" away from the EDS, to prevent the lead curtains at the exit and entrance of the EDS from interfering with the photocell operation.

12. Assume responsibility for the site acceptance testing of the integrated system, which shall be performed between the TSA's EDS provider, the TSA's designated tester and the BHS Contractor.

D. Cabling

1. Remote Workstation Connection

a. The L3 communications eXaminer is coupled to a remote eXaminer 3DX 6600 BVS workstation.

E. Related Documents

1. Siemens CP 341 Point to Point Communications Installation and Parameter Assignment Manual - Edition 03.

2.07 MISCELLANEOUS MECHANICAL EQUIPMENT

A. Platforms and Walkways

1. Provide as a minimum, the maintenance platforms as located on the Contract Drawings or as required to ensure safe access for all personnel who operate, maintain or have access to the BHS. The BHS Contractor shall be responsible to coordinate with the Architect, the Owner or his representative to confirm the final number and locations for all maintenance platforms, crossovers and walkways.
2. Include personnel protection at all platforms and walkways to ensure that any potential injury is minimized. This includes swing gates or off-sets at access locations per OSHA standards 1910.23, padding, rounded corners, smooth welds, deburred surfaces and any other measures as may be necessary.
3. Attach all platforms and walkways to the support structure, whether using decking of either sheet steel using stitch welds every 24" or use open steel grating (Ry-Weld 19W4 or approved equal), or as dictated by OSHA standards. The BHS Contractor shall coordinate the type of platform deck (solid or open grate) with the Owner or his representative and the Project Architect to ensure fire code/protection measures and lighting considerations are complied with.
4. Design platforms and walkways to provide adequate space for operating and maintenance personnel.
5. Design structure to limit the deflection to 1/360 of the unsupported span length, under a concentrated 250-pound load.
6. Design all platforms and walkways capable of supporting a dynamic load of 40 pounds per square foot. The use of pan type walkways and platforms constructed of #12 gauge hot rolled steel is acceptable.
7. Notch the decking where needed to clear obstructions. Add angle clips as required to maintain adequate support of notched structure.
8. Where lengths of decking are butted end to end, ensure that the joint falls on a structural cross member.
9. Securely weld all pieces of decking to the platform frame and all structural cross members.
10. Any walkways with inclines of up to 8° will be equipped with an anti-skid walking surface. Walkways with inclines of more than 8° will be equipped with steps as well as the anti-skid material.
11. Provide steps at all locations where there is an elevation change in excess of 8". Paint the step “yellow”.
12. Minimum catwalk width shall be nominally 36" with a 3" gap between the conveyor and the catwalk.
13. Unless otherwise noted on the drawings, the top of platform shall be installed 8” below the top of belt at the intermediate section of the conveyor (between drive sections) and 15” below the top of belt at the drive sections.
14. Design and installation of access into the conveyor platform areas shall not be less than a 36” wide by 44”high, clear access envelope, to allow fire fighters with breathing apparatus enough room to climb up to and access the platform area.

B. Toeboards

1. Provide toeboards on both sides of all platforms, walkways and ramps 24" or more above the finished floor except where adjacent equipment or building structure provides the required function. Construct toeboards of 1/4" x 4" minimum steel flat stock and install so as to leave no gap between the access way walking surface and the lower edge of the toeboard. It is acceptable to use # 12 gauge rolled steel 4” high toeboard. Securely weld toeboards to vertical handrail posts and to the access way support structure.
2. Design toeboards in accordance with OSHA standards.

C. Stairs

1. Provide as a minimum the stairs as located on the Contract Drawings or as required to ensure safe access for all personnel who operate, maintain or have access to the BHS. The BHS Contractor shall coordinate with the Architect, the Owner or his representative to confirm the final number and locations for all stairs/ladders.
2. Design stairs to the following specifications or per local code if more stringent:
    a. Treads:
        1.) Minimum of 10" deep
        2.) Non-skid upper surface
        3.) Extend front edge of tread over rear edge of lower tread a maximum of 1-1/4".
    b. Risers:
        1.) 8" (maximum)
        2.) Equal in height in any one flight within 1/8"
    c. Angle between stringer and horizontal - 38° (maximum)
    d. Provide platforms as required so that intermediate flights do not exceed 15 steps.
    e. Provide protective measures (i.e. swing gate or offset) at the top of stairs.
3. Design stairs in accordance with OSHA standards, section 1910.24 and 1910.23.
4. Provide stairs with handrails from top to bottom in accordance with OSHA sections 1926.500 and 1926.501.
5. Handrails shall be painted “yellow”.

D. Handrails

1. Provide handrails around all platforms more than 24" above the adjacent floor and on all stairways. Design handrails to withstand a minimum load of 200 lbs. applied in any direction at any point on the top rail. Vertical support posts shall be spaced not more than 8' on centers. Make handrails continuous.
2. Design all handrails to consist of a top rail with one intermediate rail positioned halfway between the top of the walking surface and the top of the top rail as per OSHA code of Federal Regulation Part 1926.500
3. In areas of restricted clearance (vertically or horizontally), make intermediate rails spanning across conveyor drive locations removable for drive maintenance access.
4. Close all open handrail ends, vertical or horizontal, by welding a metal cap.
5. Grind smooth all handrail welds.
6. Handrails shall be painted “yellow”.

E. Maintenance Ladder

1. Vertical Fixed Maintenance Ladders
    a. The use of vertical fixed maintenance ladders shall only be in applications where a stair or a ship’s ladder is not able to be installed due to space constraint. (i.e. Stairs and then Ships Ladder shall take precident over the use of fixed ladders)
    b. Provide fixed, 90-degree ladders to reach platforms and catwalks as shown on the Contract Drawings. Assume full responsibility for providing additional maintenance ladders as required to ensure safe access for all personnel who operate, maintain or have access to the BHS. The BHS Contractor shall coordinate with the Architect, the Owner or his representative to confirm the final number and locations for all maintenance

access ladders.

c. Design ladders to meet or exceed OSHA standards, section 1910.27 and 1910.23.

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

e. The distance between rungs shall be no more than 12 in. and shall be uniform throughout the height of the ladder. All rungs shall have a minimum diameter of 3/4 in. and shall withstand a 400-pound load when in use. All rungs shall be a minimum of 16 in. wide. The live loads imposed by personnel occupying the ladder shall be considered to be concentrated at such points as shall cause the maximum stress in the structural member being considered.

f. Grind smooth all rough surfaces and edges.

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

h. Allow a minimum of 4 in. between the back of the ladder and the nearest permanent object. Allow a minimum of 30 in. between the front of the ladder and the nearest permanent object. Allow 16 in. from the center of the ladder to the nearest object on each side. The step-across distance from the nearest ladder edge to the nearest equipment or structure edge shall be a minimum of 2-1/2 in. and shall not exceed 12 in.

i. Provide both a safety cage and safety chain at the top of all ladders.

j. Provide fixed vertical ladders with handrails from top to bottom in accordance with OSHA section 1926.500 and 1926.501.

k. Paint all fixed vertical ladders in “yellow”.

2. Ship’s Ladders

a. Provide fixed maintenance ship’s ladders to access platforms and walkways as shown on the Contract Drawings. Assume full responsibility for providing additional maintenance ladders as required to ensure safe access for all personnel who operate, maintain or have access to the BHS. The BHS Contractor shall coordinate with the Architect, the Owner or his representative to confirm the final number and locations for all ladders.

b. Design ladders to meet or exceed OSHA standards, section 1910.27 and 1910.23.

c. Provide serrated modified steel treads a minimum of 6 in. by 3.0 pounds per linear foot channel 16 in. long (unless noted otherwise in the Typical Details for Platform Access and Ladder Details in the Contract Drawings) covered with non-skid safety tread finish. The live loads imposed by personnel occupying the ladder shall be considered to be concentrated at such points as shall cause the maximum stress in the structural member being considered.

d. Provide steel stringers using minimum 7 in. by 4.72 pounds per foot channel.

e. Design ladder so that the angle between the stringer and the floor is not less than 60 degrees and not more than 65 degrees.

f. Make the distance between treads a maximum of 12 in. The distance between treads shall be uniform throughout the height of the ladder.

g. Provide handrails on both sides using 1-1/4 in. by 1-1/4 in. by 1/8 in. aluminum tubing.

h. Provide protective measures (i.e. swing gate or off-set) at the top of stairs.

i. Grind smooth all rough surfaces and edges.

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

k. Provide ship’s ladders with handrails from top to bottom in accordance with OSHA section 1926.500 and 1926.501.

l. Paint all ship’s ladders in “yellow”.

3. Swing Down Aluminum Ladders

a. The use of swing down ladders is not expected for this project. If a swing down ladder is required, each location and application must be submitted for review and approval prior to design or installation.

b. Provide Swing Down Aluminum Ladders to access platforms and walkways as shown on the Contract Drawings. The landing or top of the ladder should be adjacent to the associated platform or walkway not a part of it. Assume full responsibility for providing additional maintenance ladders as required to ensure safe access for all personnel who operate, maintain or have access to the BHS. The BHS Contractor shall coordinate with the Architect, the Owner or his representative to confirm the final number and locations for all ladders.

c. Swing down ladders are to be of Type 1A, 300 pound capacity extra heavy-duty aluminum construction.

d. Provide 1-5/8 in. serrated aluminum "D" rungs hydraulically double crimped in place. The live loads imposed by personnel occupying the ladder shall be considered to be concentrated at such points as will cause the maximum stress in the structural member being considered.

e. Provide 3-inch wide I-beam side rails.

f. Design ladder so that the angle between the side rails and the floor is not less than 60° and not more than 65°.

g. Make the distance between treads a maximum of 12 in. on center. The distance between treads shall be uniform throughout the height of the ladder.

h. Provide lifting mechanism, counter balance, pulleys, etc. to hold ladder in the up position when not in use. The ladder should be stable either in the up or down position due to the counter weight without requiring any tie off or similar.

i. Provide protective measures (i.e. swing gate or off-set) at the top of the ladder.

j. Design ladders to meet or exceed OSHA standards, section 1910.26 and 1910.23.

k. Grind smooth all rough surfaces and edges.

l. Provide swing down aluminum ladders with handrails from top to bottom in accordance with OSHA section 1926.500 and 1926.501.

m. Provide swing down aluminum ladders with a small pull cord and counterbalance that is set up so that at no time is a force more than 2- lbs required to either lift up, pull down or stop the ladder in mid motion. If such balance can't be achieved, gas springs can be used as "assist" mechanisms to achieve the maximum required force requirement, but counterbalance will still be required.

n. Swing Down Ladder Advisory/Warning Beacon

1.) Furnish a failsafe interlock with associated swing down ladder. Provide the following equipment/controls:

a.) An Amber rotating beacon as a swing down ladder warning in the vicinity of each swing down ladder that will be visible to tug and cart drivers entering the immediate area of the respective ladder.

b.) Activation of the beacon shall occur as the swing down ladder is traveling from the full up position to the full down position and be maintained while in the down position.

c.) Deactivation of the beacon will occur when the swing down ladder is in the full up position.

F. Fire Door (Powered)

1. Assume the responsibility for the procurement, power and control design, mechanical and electrical installation of rolling shutter, slat-type, between-jamb-mounted and interior-face-mounted fire doors, including, as a minimum, the following features:

a. U.L. labeled hour rating to match fire partition walls where door is installed. For example, at 2-hour rated walls provide minimum UL labeled 2 hour rated doors. Obtain the proper fire rating from the Owner or Architect for all fire doors within the scope of the BHS Contract.

b. Electric Operator with 480 VAC, 3 phase, 60-hertz motor provided by the door manufacturer.

c. Up and Down limit or proximity switches connected to PLC input.

d. Electrical or pneumatic bottom edge strip for automatic return to open position upon contact. A photocell or proximity switch shall be used in conjunction with the bottom edge strip for detecting a bag under the door.

e. Fire/heat/smoke detectors located to sense approaching fire, heat or smoke source on the conveyor shall be provided by others as per the specified requirements of their Fire Alarm System Specification.

f. One set of normally open dry contacts for each fire door shall be provided, mounted and wired, inside the MCP controlling the conveyor line that the fire door(s) is mounted on. Coordinate the spatial and access requirements within the MCP for these contacts with the Fire Alarm System Contractor. Connect each normally open dry contact to the appropriate PLC I/O module. The contact shall close upon detection of a fire, heat or smoke condition requiring the closure of the fire door. Upon receipt of a fire alarm signal the fire door will close after following shutting procedures (ref Part 3).

g. A 160°F fusible link which, when broken, will cause the door to close automatically and report to the central facility security/fire system the status of the door (e.g., open or closed). All wiring between the BHS MCP and the facility central security/fire alarm system for this reporting function shall be provided by others as per the specified requirements of their Fire Alarm System Specification. Provide the appropriate interface within the MCP/PLC to accommodate this reporting controls function and coordinate the interface requirements with the Fire Alarm System and Security System Contractors.

h. A means for manual operation. If operation is accessible from one side only, select the side offering the most danger should the door close and block a potential exit and select the side that is not available to the public.

i. The door is to be equipped with an externally mounted limit or proximity switch. The limit or proximity switch shall be mounted in such a manner so that the "fully open" position of the door is sensed. If the door is sensed by the limit or proximity switch not be in the fully open position, the associated conveyor shall be stopped if running or shall not be permitted to start if the conveyor was not already running. Note that this limit or proximity switch is in addition to those limit switches provided with the door operator if the door is powered.

j. Provide all steel trim elements around door opening. Coordinate the trim requirements with the Owner and Architect.

k. Coordinate installation and framing of the fire door(s) with the Owner, Architect and other contracts.

l. Clearly define by way of detail plans and elevations (on the submitted mechanical drawings) all of the required operational and maintenance clear zone requirements in order to avoid any obstructions with other trades involved in building construction.

m. Coordinate the testing of fire doors the Owner or his representative, the fire system installation contractor and the appropriate authorities.

n. All fire doors that are directly associated with BHS shall be installed perpendicular to the conveyor centerline. Coordinate installation and framing of the fire door(s) with other contracts.

o. The design of the fire door control system is described in the BHS “Special Control Requirements” section of this specification (Part 3)

G. Security Door (Powered)

1. The mechanical and electrical installation, power and control of rolling shutter, slat-type, between-jamb-mounted and interior-face-mounted security doors, shall include as a minimum, the following features:

a. Electric Operator with 480 VAC, 3 phase, 60-hertz motor provided by the door manufacturer.

b. Electrical or pneumatic bottom edge strip for automatic return to open position upon contact. A photocell or proximity switch shall be used in conjunction with the bottom edge strip for detecting a bag under the door.

c. The door is to be equipped with an externally mounted limit switch, photocell or proximity switch to sense

door position connected to PLC input. The limit, photocell or proximity switch must be mounted in such a manner so that the "fully open" position of the door is sensed. If the door is sensed, by the limit switch, photocell or proximity switch not be in the fully open position, the associated conveyor shall be stopped if running or shall not be permitted to start if the conveyor was not already running. Note that this limit switch, photocell or proximity switch is in addition to those limit switches provided with the door operator if the door is powered.

d. The BHS Contractor shall provide all stainless steel trim elements (around door opening etc.) for those security doors located in public view. The BHS Contractor shall coordinate the trim element requirements with the Architect, the Owner or his representative.

e. All security doors that are directly associated with the BHS shall be installed perpendicular to the conveyor centerline. The BHS Contractor shall coordinate installation of the security door(s) with other contracts.

f. The design of the security door control system is described in the BHS “System Control Requirements” section of this specification (Part 3) and shall contain a card swipe interface

g. All baggage handling system doors providing a security and shall contain a card swipe interface.

h. During initial configuration the door shall only be opened via the card swipe interface. When a bag arrives at the CBRA security doors it will wait outside of the room until the security door is opened. An alarm will be indicated on the MDS and a horn and light inside of the CBRA will indicate a bag waiting (provided by BHS Contractor). It shall be configurable to automatically open the CBRA security doors when a bag arrives to rout the bag to the appropriate ETD station thereby not requiring security card activation.

H. Directional Input Device (DID)

1. Bag presentation immediately upstream of the EDS device is critical to both successful bag scanning and in the reduction of jams at the EDS device entrance conveyor, to achieve this the BHS Contractor shall provide Directional Input Devices (DIDs). The DID shall position baggage such that there is less than 0.1% bag jams at the EDS device(s) entrance conveyor verses the number of total originating bags inducted into the system (e.g. total of number of jams shall not exceed 20 (combined for all EDS devices installed) per 20,000 originating bags).

2. The function of the DID is to position or rotate baggage (to present the bag in the correct orientation) into the center of the conveyor prior to the entrance of the EDS device. The typical location of the DID is illustrated in the Contract Drawings.

3. If the DID is installed within a section of conveyors where bag tracking is a critical operation, the DID shall be designed and constructed in such a manner so as to not cause tracked baggage to move out the tracking window during the centering operation.

4. Each DID shall be capable of processing baggage at a sustained rate of 10 bags (min) per minute with no malfunction (e.g., jams).

5. Design the DID such that there is a self clearing gap between the belt and the bottom of the DID blade.

6. Special care must be taken in the DID design and installation to ensure baggage on the device shall not be damaged or snagged. Note that the design, manufacture and installation of the DID must be such to ensure that the device is heavy-duty and shall withstand the abusive environment of a high volume baggage operation.

7. The BHS Contractor shall submit the method by which the centering of the bag will be accomplished to the Owner or his representative for review and approval prior to fabrication.

8. The BHS contractor will be required to submit for review any “non standard” equipment designs as outlined in Part I of this project specification.

I. Conveyor Transition (Transfer) Plates

1. The gap between the two sections of conveyors at HSVPDs shall be closed with a transfer plate.

2. The transfer plate shall be mounted parallel to the baggage flow.
3. The transfer plate between conveyors shall direct the baggage flow so as to not be impeded by the nearside edge of the receiving belt.
4. Conveyor-to-conveyor steel transfer plates may be welded to adjacent conveyor structure, if necessary, provided that all welds are ground smooth and finished.
5. All transfer plates shall be formed of galvanized steel or approved equal.
6. The parallel conveyor transition plate design and fabrication shall ensure that there is a vertical element between the two side guards at both ends of the transfer plate. This will ensure that there is no gap in which to snag bags.

J. Chutes and Slides

1. Construct chutes and slides of minimum 10 gauge electro-galvanized or stainless steel with welded joints, formed and reinforced as required to resist deforming from the effects of high speed vertical paddle diverters or manual loading. Remove rough spots and scale by grinding or filing to prevent snagging of baggage or tags.
2. In the event that joints must occur in the slide surface the upper sheet shall be lapped over the lower sheet (in the direction of baggage movement).
3. Design to allow a dynamic load of 50 pounds per square foot over the entire slide surface. No local deformation shall occur with a concentrated load of 150 pounds per square inch at any point on the slide.
4. Provide and install full-length side guards on both sides of all slides. Such guards shall be a minimum of 12" high above the slide surface with a rolled or formed top edge, a minimum of 3/4" thick, to afford stiffness to the guard panel.
5. Fasten side guard to the slide with bolts or by welding. Protrusions will not be permitted on the inside surface of the guard. Employ vertical stiffening support brackets a maximum of 2' on center on the outside of the side guards.
6. The charge end of the chute or slide shall be mounted so that is 1" below the adjacent belt height of the associated mainline conveyor.
7. Chute side guards or slide surfaces shall not deform or unduly deflect as a result of baggage impact caused by high-speed diversion.

K. Counterweight Slide (Tip Chute)

1. Construct the slide to swing up when contacted by a bag being conveyed on the lower conveyor.
2. Provide an adjustable down stop so that the slide can be set to stop at a maximum of 1"above the conveyor belt or a flat plate tread.
3. Construct the slide of a sheet metal surface attached to a frame to provide a rigid, lightweight assembly.
4. Mount a pivot shaft in self-aligning bearings grease packed for life with spring loaded contact seals.
5. Curve the slide so that the bottom of the slide is parallel to the conveyor belt or flat plate tread preventing exiting bags from digging into the belt or tread.
6. Provide the counterweight with a screw adjustment in order to ensure satisfactory operation. The slide shall be counter-weighted to the down position.
7. Provide a minimum 2" drop between the tail pulley of the feed conveyor and the slide. Ensure baggage does not jam or snag at the transition.

8. Slide angle shall not exceed 30º.
9. Prior to start of final design of the counterweight slide, build a prototype of the proposed design and demonstrate satisfactory operation to the Owner or his representative. Do not start final design without the Owner or his representative's written approval. This requirement can be waived by providing verification of successful construction and implementation of the proposed design at three previous project locations.
10. Fully guard the tip chute and its counter-balance weights to protect operating personnel as required by OHSA -Section 1910. Apply primer and then one coat of "yellow" paint to all guarding that are not exposed to the weather (e.g. within the bag room). Guarding that is exposed to the weather shall be hot-dip galvanized.
11. Provide sufficient outer perimeter side guarding (nominally 6" high by 4' long, flared at the charge end) on flat plate make-up devices so that baggage does not fall off the device when they exit the discharge end of the tip chute.
12. Provide sufficient guarding around the tip chute so that regardless of position, baggage diverted by a high-speed diverter cannot leave the confines of the chute area without exiting at the discharge end of the chute.
13. Provide sufficient bed, side guard, and other guarding rigidity so that impact of baggage diverted by high-speed diverter does not deform or unduly deflect said items.
14. Provide an integral speed brake curtain with the counter-weight slide.
15. Provide sufficient dampening of tip chute to avoid excessive down force and any resulting noise levels.

L. Draft Curtains

1. Provide draft curtains at all wall and floor penetrations between conditioned and non-conditioned space.
2. Construct the draft curtains with two staggered layers of black 8" wide by 1/8" thick vinyl strips with anti-static beaded belting.
3. Provide stainless steel fascia in public areas.

M. Conveyor Impact Protection

1. Provide impact protection as located and detailed on the drawings or elsewhere as required to adequately protect conveyors, make-up devices etc. Construct the impact protection and supports of structural steel, heavy walled sections in shapes as indicated. Securely fasten all impact protection components to each other and to the floor.
2. Field verify, all dimensions shown on the drawings to insure proper fit with the equipment system interface.
3. Ensure that the impact protection is able to withstand the impact of a fully loaded vehicle (tug and cart) when backing into position at a speed of 2 miles per hour.
4. Apply primer and then one coat of "yellow" paint to all impact protection steel members that are not exposed to the weather (e.g. within the bag room).
5. Hot-dip galvanize all impact protection steel members that are exposed to the weather.
6. Design impact protection so that maintenance access to the protected equipment is not restricted.

N. High speed vertical paddle diverter (HSVPD)

1. The function of the high-speed diverter is to selectively transfer baggage across the main sort conveyors onto the designated sortation device using either a transverse or linear motion.

2. Each high-speed diverter shall be capable of sorting baggage at a sustained rate of 60 items per minute (upgradeable to 80 bags per minute).
3. The high-speed diverter must be capable of sorting all types of normal baggage, including but not limited to golf bags, etc. by imparting a smooth controlled impact on baggage, ensuring that damage does not occur to the items from impact, jamming, snagging or falling to the floor.
4. The design, manufacture, and installation of the high-speed diverter must conform to all sections of this specification as appropriate. Note that the design, manufacture and installation of the high-speed diverter must be such to ensure that the device is heavy duty and shall withstand the abusive environment of a high volume BHS operation.
5. The high-speed diverter must be designed and installed so that the high-speed diverter powered faced paddle(s) always returns to the exact same home position, with no variation in the home position. Additionally, the return of the HSVPD paddle to the home position must not influence the bag travel on the adjacent downstream conveyor, where it may cause bags to mis-track; for example, in the case of high-speed diversion of bags from the main line onto a 45° merge input belt, the HSVPD must not affect the bag travel after the bag has been diverted and the paddle(s) returns to home position.
6. Design the high-speed diverter so that trained maintenance personnel can easily replace the powered faced paddle belts.
7. Design the high-speed conveyor and the take away conveyor such that there is a 3" drop from the HSVPD conveyor to the take away conveyor. The transition plate shall be provided with rollers to aid in the bag transition to the take away conveyor.
8. Ensure sufficient sway bracing in both directions and vibration isolation on all supports.
9. Provide each HSVPD with one Safety Disconnect switch to control both the clutch/brake and motor. The 3 phase Motor Safety Disconnect Switch shall also be used to interrupt the feed and neutral circuit to any externally powered electric clutch/brake device. The following describes how this shall be accomplished:
    a. Supply 120 Volt AC power to the line side auxiliary contact in the Motor Safety Disconnect Switch (located at the motor) from the MCP.
    b. Wire from the load side of the auxiliary contact of the Motor Safety Disconnect Switch (located at the motor) to the terminal strip in the respective MCP.
    c. At the respective MCP, run two (2) parallel wires from the MCP terminal strip to the following:
        1.) One parallel wire from the terminal strip to the PLC input to indicate that the Motor Safety Disconnect Switch (located at the motor (is in the "ON" or "OFF" position.
        2.) The other parallel wire shall be the input voltage for the DC power supply that will supply DC power to the associated motor clutch/brake.
10. The sort line (conveyor line that the HSVPD is installed on) conveyor belting shall be "bare by bare" with low COF.
11. Provide adequate safety guards for each HSVPD, between manned areas (e.g., maintenance platforms, etc,) and the HSVPDs paddles. The HSVPD safety guards shall be easily removable and shall mount on the top of the HSVPD and adjacent conveyor side guards to provide a physical barrier between the manned areas and the HSVPD paddles. Fabricate the HSVPD safety guards with expanded metal, at least 12 gauge thick, and incorporate a formed 90° edge turned away from the guard face and another 90° edge turned down to eliminate sharp edges (i.e., similar to a conveyor side guard configuration).
12. The design of the HSVPD control system is described in the Special Requirements section of this specification (Part 3).

13. A qualified manufacturer shall fabricate high-speed diverter, with previous installations in BHS applications. Final approval of the qualified manufacturer shall be at the discretion of the Owner or his representative.

2.08 SPECIAL MECHANICAL EQUIPMENT REQUIREMENTS

1. The BHS Contractor is to be aware that certain portions of this project require the demolition of existing conveyor equipment as shown on the Contract Drawings. Accomplishment of this work shall have to be carefully coordinated with the ongoing operations of the airlines associated with the existing baggage system in the building area.
2. The BHS Contractor is responsible for conducting a thorough field check of the existing conveyors and their relationship within the existing system as well as their relationship with the configuration of the specified system.
3. Over-height restriction bars shall be installed on all conveyors equipped with overheight detection photocells, at the appropriate height to restrict passage of baggage exceeding the maximum bag height requirements. In all cases, the overheight bar support structure may be used for mounting of the overheight detection photocell. In public areas, the overheight restriction bar shall be installed on the non-public side of the associated fire/security door.
4. Ensure that the design and installation of all conveyor equipment provides maximum access for operation and maintenance personnel.

2.09 ELECTRICAL TECHNICAL REQUIREMENTS

A. Electrical Service to be Provided by the BHS Contractor

1. Power for the various subsystems shall be provided at locations shown on the Contract Drawings by the building Electrical Contractor. Each power drop point shall consist of cable in an appropriately sized junction box (supplied and installed by the Owner's Electrical Contractor) with approximately 20' of coiled cable. The full load ampacity rating (FLA) shall be as indicated on the contract drawings (it shall be the BHS Contractors responsibility to verify the FLA requirements and notify the Owner or his representative of any increase/decrease). Supply power shall be 480 volts, 3 phase, and 60 hertz. The BHS Contractor shall verify and advise the Owner and Engineer that the ampacity at each PDP is sufficient for the requirements of the system.
2. Contractor shall connect the junction box / coiled cable to a Power Distribution Box / Boards (supplied by contractor) as required.
3. Provide and install all mains cable required from nominated Power Drop Points (PDP) to the various BHS Distribution Boards and onward to the MCPs as necessary to meet requirements of the specification. The BHS Contractor shall be responsible for all electrical work "downstream" of the Power Drop Point locations including the BHS distribution boards, MCP and all other cabling in between. Size feeders from the power drops at 1.25 times the minimum NEC (or applicable local code) permitted size for the full-load amperage required. The BHS Contractor shall be responsible for all power connections from the various MCPs to all other BHS equipment (not including providing power to screening machines).
4. Furnish and install all services, feeders and disconnect switches for branch circuits to each control panel, with separate circuits for each subsystem as specified and provide and install all panel boxes, wireways, conduits, conductors, transformers, breakers/fuses, and any other equipment and materials required to complete the electrical power distribution for the operation of the system. Refer to NEC Article 300 for wiring methods.
5. PDP locations shown in the contract drawings show typical locations that the BHS contractor may

locate electrical field distribution panels.

6. During design of power distribution to the various BHS sub-systems, coordinate with the building electrical supplier on distribution of emergency power to required BHS subsystems to enable operation of the required BHS subsystems to support the Owner's operational policy in a power outage condition. Provide and install equipment as necessary to connect to these emergency power supplies that will be located adjacent to the various main power sources.
7. The amperage shown for each PDP in the subcontract drawings shall be confirmed by the bidder in his bid submission. The BHS Contractor shall, during the engineering phase, provide detailed power calculations for review and approval by the Owner or his representative in an effort to reduce the PDP amperage provided and thereby reduce the power provided to the system. The BHS Contractor shall coordinate the detailed power requirements including any reductions with the Owner or his representative.
8. Provide separate circuits for controlling programmable logic controllers (PLCs), powered fire/security doors, etc. Note that these circuits shall originate within the respective MCP.
9. Calculate the electrical power supply requirements on the basis of total connected load with a diversity factor. Size the conductors to ensure that the voltage drop does not exceed 3% at the farthest outlet of power, heating and lighting loads, or combinations of such loads. Also ensure that the voltage drop does not exceed 5% at the farthest outlet for both feeders and branch circuits.
10. Provide 120 volt, single phase, and 60-Hertz power for operation of the BHS control circuits.
11. Obtain the control power at each MCP by means of a transformer connected to the load side of the 480 volt input power.
12. All baggage systems that use programmable controllers shall be equipped with the appropriate number and size of power regulators to ensure that the power for the respective programmable controllers is properly conditioned. Regulators are to be of the type manufactured by the Sola Corporation (or approved equivalent).
13. All electrical components, devices, accessories, and equipment shall be listed, labeled and identified as suitable for use intended by testing agency acceptable to authorities having jurisdiction. This shall include MCPs and any control panels/cabinets, whether factory or contractor fabricated.
14. Power for the EDS screening machines is to be provided separately by Building Contractor.

B. Raceways

1. General

a. Enclose all power and control wiring, including low-voltage wiring, in Rigid Metal Conduit (RMC), Electrical Metallic Tubing (EMT), Liquid Tight Flexible Metal Conduit or wireways. Intermediate Metal Conduit (IMC) is not acceptable.

b. Horizontal runs of conduit shall not be supported by power turns, their safeguards, or by any side guard that is designated to be removable for the purpose of maintenance access. Rack such horizontal runs and support them from the building roof or mezzanine steel in locations not interfering with the BHS, maintenance areas, or walkway areas.

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

d. Avoid conduit runs on the floor. Provide minimum clearance of 6" below horizontal conduit to the floor. The Owner or his representative must approve exceptions to the above.

e. RMC and EMT Conduit runs must be mounted so as not to restrict maintenance access to the BHS

equipment, conveyors and system/conveyor components that required servicing.

f. Conduit runs must not be run or mounted on outside guards or perimeter chain guards of power turns, nor on merge conveyor deflector assemblies.

2. Rigid Metal Conduit (RMC)

a. Conform to all aspects of NEC Article 344 for RMC (or applicable local code).

b. Use a minimum 3/4" for all wiring.

c. Run all conduits parallel or at right angles to structural members and equipment.

d. Do not run conduits underground or in floor slabs unless provided for that purpose by the Building Contractor.

e. In public areas, make conduit runs inconspicuous by running under cover plates, behind conveyors or otherwise concealed from public view.

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

g. Use Rigid Metal Conduit in all areas of the BHS installation that are at elevations less than 8’-0” above the buildings local finished floor and in all areas that are exposed to vehicular traffic and possible damage by operating or maintenance personnel.

h. Use malleable iron or steel threaded fittings.

i. Include gaskets and covers for all fittings.

j. Use standard threaded couplings at all conduit joints.

k. Ensure that the ends of the conduit are cut square, reamed and joined butt-tight.

l. Electro-galvanize all conduit, elbows, fittings, couplings and nipples.

m. Make changes to conduit size only at pull boxes, distribution panels, or branches to motors. Do not use reducers for in-line reduction of conduit size.

n. Do not run communication, low voltage (less than 30 volts), or DC control wires in the same conduit with power wires.

o. It is acceptable to run 120 VAC minimum control wire and 480 VAC maximum power wire in the same conduit or wireway provided it is in conformance with local codes.

p. It is acceptable to run shielded 90 VDC clutch brake control wire and 480 VAC maximum power wire in the same conduit or wireway provided it is in conformance with local codes in lieu of running these clutch brake DC control wires in a separate conduit or wireway.

q. Remote control, signaling and power limited circuits shall be installed in compliance with NEC Article 725, (or applicable local code) as applicable.

r. Support conduit at intervals not to exceed 8'-0". Every individual conduit section must be supported. Install conduit supported from building walls with a clearance of not less than 1/4" from the wall to ensure against the accumulation of dirt and moisture behind the conduit, using one-hole malleable iron clamps and clamp backs. For parallel conduit runs provide trapeze hangers or wall brackets fabricated from preformed channel with conduit clamps. Make anchors in concrete of the expansion shield type. Limit conduit run on a given conveyor to that, which is required for that particular conveyor or directly adjacent (downstream/upstream) to that particular conveyor.

s. Ensure that metallic and non-metallic motor disconnect boxes, safety disconnect boxes and control stations, outlet boxes, junction boxes, pull boxes and cover plates are compatible with the RMC conduit used and conform to the National Electrical Code (or applicable local code) for minimum wiring space requirements and material thickness. Provide all boxes with screw fastened covers. Use NEMA 12 enclosures for interior equipment and NEMA 4 for all exterior equipment. BHS contractor shall only use metal boxes; non-metal boxes shall not be used.

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

3. Electrical Metallic Tubing (EMT)

a. Apply the above requirements for Rigid Metal Conduit to EMT except as noted below:

1.) Use rain and concrete type compression fittings with steel compression nuts.

2.) Use insulated throat type connectors with case hardened nuts.

3.) Use minimum size tubing of 3/4" diameter.

4.) Use EMT only in areas at elevations greater than 8' above the buildings local finished floor or in areas not exposed to vehicular traffic or possible damage by operating and maintenance personnel.

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

6.) Ensure that motor disconnect boxes, safety disconnect boxes and control stations, outlet boxes, junction boxes, pull boxes and cover plates are compatible with the EMT used and conform to the National Electrical Code (or applicable local code) for minimum wiring space requirements and material thickness. Provide all boxes with screw fastened covers. Use NEMA 12 enclosures for interior equipment and NEMA 4 for all exterior equipment.

b. Conform to all aspects of the more stringent between this specification and NEC Articles 300 and 358 for EMT (or applicable local code).

4. Flexible Metal Conduit

a. Conform to all aspects of the more stringent between this specification and NEC Articles 300 and 348 (or applicable local code) for flexible metal conduit and fittings.

b. Use liquid-tight flexible metal conduit for connection to motors, photocells, limit switches or any device, which may be subject to vibrations or require adjustment after installation. The use of non- liquid-tight flexible metal conduit such as “green field” is not acceptable.

c. Do not exceed 3' in length.

d. Every section of flexible metal conduit must be clamped/supported.

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

f. Use minimum 1/2" for power wire.

g. Use minimum 1/2" for control wire.

5. Wireways

a. Wireways may be used in place of rigid conduit provided the application conforms to the requirements of National Electric Code Articles 376 and 378 (or applicable local code).

b. Use wireways with hinged, solid covers.

c. Position wireways to permit access with the equipment fully operational.

d. Do not run communication, low voltage (less than 30 volts), or DC control wires in the same wireway with power wires.

e. It is acceptable to run shielded 90 VDC clutch brake control wire and 480 VAC maximum power wire in the same wireway provided it is in conformance with local codes in lieu of running these clutch brake DC control wires in a separate conduit or wireway.

f. Fasten covers using captive screws.

g. Do not use wireways in areas subjected to vehicular traffic.

h. Use lay-in type wireways to avoid the necessity of threading wires through end connectors.

C. Wire and Cable

1. General

a. Use stranded copper conductors of appropriate gauge, Type THHN or approved equal, with insulation rated for 600 volts. Use type XHHW only if required by code or the governing Jetport Authority prohibits the use of PVC insulation. Conform to all aspects of the more stringent between this specification and NEC or applicable local code.

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

c. It is acceptable to use multi-conductor cable for connecting portable electronic equipment. Refer to National Electrical Code (or applicable local code) for requirements on multi-conductor use.

d. Tag control and power circuit conductors with “machine” printed identification numbers at both ends of the wire. Tag method shall be of the sleeve or other permanent type submitted to and approved by the Owner or his representative. The use of multiple tags to create a single tag is not acceptable.

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

2. Minimum wire size

a. Power #12 gauge

b. Control #14 gauge

c. PLC I/O #16 gauge

d. Communication Circuits #18 gauge

3. Splicing

a. Splicing of 480VAC power wiring is unacceptable. All 480VAC wire pulls shall be from the MCP to the device (e.g. from MCP to the individual motor).

b. Splices are acceptable when parallel type connections are used for "hot" and "neutral" control wires (e.g. power wire for photocells, e-stop circuits etc. within a subsystem).

c. Do not splice signal wires between I/O panel and component.

d. Terminate control wires on terminal strips or on screw connectors at each component only.

4. Spare Conductors

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

b. Coil all spare conductors allowing sufficient length to permit future connection.

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

5. Wiring Identification

a. Color code all electric wire and cable as follows:

1.) MCP Power Wiring: Line Side

a.) Apply the following to all MCP power wiring from source to line and load side of Main Disconnect fuses for MCPs. Verify color-coding of phase conductors on the line side to ensure compatibility with normal electrical supply available at the Jetport. Terminate the neutral, if applicable, at the terminal board:

Item	Wire Color
Phase A (480 VAC)	Brown
Phase B (480 VAC)	Orange
Phase C (480 VAC)	Yellow
Neutral	Grey
Mechanical Ground	Green

2.) BHS Field Components Power and Control Wiring: Load Side

a.) Apply the following to power and control wiring from the load side of fuses in MCPs to all devices that are powered and controlled from the respective MCP as follows:

Item	Wire Color
Power (To Motors and Control Transformers)	1. Run numbered, colored insulation (Brown, Orange and Yellow) wires to match phases. 2. As dictated by local codes.
AC Control:	Red
DC Control:	Blue
AC Neutral:	White
Mech. Ground	Green

a.)

b.) Submit to the Owner or his representative for review and approval the wire color method to be employed for this project.

D. Grounding

1. Ground all electrical equipment to building ground mat by a dedicated equipment-grounding conductor installed in accordance with the applicable codes. Obtain from the appropriate Jetport authorities, local codes or the Owner's Electrical Contractor the extent and type of grounding, wiring method and points of connection required.
2. Appropriately sized insulated bushings shall be installed on all conduits and conduit fittings that enter and exit the MCP or j-box/pull box.
3. Include a green 600V insulated copper ground conductor in each conduit (raceway).
4. Refer to National Electrical Code Article 348 (or applicable local code) for flexible metal conduit grounding requirements.
5. Refer to National Electrical Code Article 250 (or applicable local code) to determine grounding conductor requirements and sizes.

E. Support

1. Mount conduit supported from building wall using uni-strut type mounting channels to provide clearance to the wall.
2. Do not weld conduit to structural members.
3. Avoid conduit runs to the floor. Provide minimum clearance of 6" between horizontal conduit and the floor and do not allow runs to cross any walk or access aisles.

F. Boxes

1. Provide outlet boxes, junction boxes, pull boxes and cover plates compatible with the conduit used. Provide boxes with screw fastened covers. Use NEMA 4 for all exterior equipment and NEMA 12 for interior equipment.
2. Conform to NEC Article 314 (or applicable local code) for minimum requirements for outlet boxes, junction boxes, pull boxes and cover plates.
3. Appropriately sized waterproof bushings/seals shall be installed on all conduits and conduit fittings that enter/exit the box(s).
4. Unused openings in boxes, raceways, cabinets, pull boxes etc., shall be effectively closed to afford protection substantially equivalent to the wall of the equipment.

2.10 ELECTRICAL COMPONENTS

A. Wiring Devices

1. Provide full size oil-tight operators.
2. As much as possible, use the same type sensors (photocells, limit switches, etc.) to minimize the number and type of spares. Select sensors with the same mounting system wherever practical.
3. Use plug-in type electrical components wherever available.

B. Control Devices/Stations

1. Control Device Locations

a. Control Stations, Control Devices, etc., shall be located as specified herein. The location of the Control Stations, Control Devices, etc., is to be such as to provide maximum possible access to the Devices for servicing of the devices. For example, all Jam Detector, Head End Sensor, etc., Photocell devices are to be mounted so that they are accessible from catwalks adjacent to conveyors. In certain areas, protective guarding may be required to protect the Control Station, Control Devices, etc. However, the design and installation of this protective guarding must not prevent quick access to the control devices for adjustment, servicing or replacements.

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

2. Control Device Mounting

a. The mounting of Control Stations, Control Devices, etc., shall comply with the basic requirements established in the Contract Drawings and as noted in the following:

1.) Control Stations in Public View

a.) All Control Stations located in the view of the public shall be flush mounted with stainless steel cover plates. Such stainless steel cover plates must be secured to the adjacent wall or conveyor trim member with either Truss or Oval Head Phillips stainless steel machine screws of appropriate size. Pan Head screws are not acceptable.

b.) All Control Stations located in the view of the public at load conveyors (i.e. ticket counter conveyor control stations) shall be mounted flush to the adjacent wall in a location that someone operating the Control Device shall not have to lean over the conveyor to access it (either upstream or downstream of the load conveyor). E-stop Control Devices shall be mounted inside the stainless steel trim shrouding above the toe plate. A one (1) inch hole shall be provided in the face of the stainless steel shrouding to actuate the E-Stop and a hole on the underside of the face (above the toeplate) shall be provided to reset the E-Stop. Note that the design, manufacture and installation of the stainless steel shrouding on the collection conveyor must reflect these requirements.

2.) Control Stations in Non-Public View

a.) All Control Stations located on load conveyors in non-public view shall be mounted on the horizontal portion of a Control Station mounting assembly bridging the load conveyor. This assembly shall be located and built so as to also act as an Over-Height Photocell Mount and Bag Restraint. The Contractor shall take into consideration the "cording effect" of baggage at the discharge end of a horizontal load conveyor feeding onto an incline conveyor when determining the location of such an assembly. The vertical element of the assembly may also be used for the mounting and protection of head end photocells, if applicable.

b.) All Control Stations located on Flat Plate make up devices in non-public view shall be mounted on a Control Station mounting assembly. Design, manufacture and installation of the Control Station mounting assembly for racetrack applications must be such as to provide a "solid", well braced mounting for the related Control Station and Control Devices. Note also that the Control Station mounting assembly must provide a minimum vertical bag clearance of 36" above the surface of the racetrack device. See contract drawings for specific details.

3.) Control Devices

a.) All photocells shall be mounted in a vertical attitude with the LED photocell status indicator clearly visible to operation and maintenance personnel from the side of the associated conveyor or conveyor equipment. Photocells that are used for jam detection; baggage tracking, and the like. are to be mounted so that the center of the photocell beam is 2-1/2” from the top surface of the conveyor belt.

b.) Limit switches that are used to sense the position of Fire doors shall be mounted as an external unit to the door adjacent to the track of the door so that the switch can detect when the door is in the fully open position.

c.) Indicating lamps, other than those associated with MCPs, are to be located as required to properly alert personnel.

d.) Shaft encoders used for determining conveyor speed must be directly coupled to either the head or tail pulley of the associated conveyor. Use of tension loaded friction drive types of shaft encoders is not acceptable.

e.) Start-up warning alarms (i.e., audible and visual) shall be located at strategic locations to alert operations and maintenance personnel of the imminent start-up of conveyor equipment. As a minimum provide start-up alarms at baggage input areas, on top of the MCPs and along the conveyor line right-of-ways (e.g., ceiling supported conveyors, etc.). Audible/Visual Fault Warning and Start-up Alarms may utilize the same control devices. However, the audible and visual indications shall differentiate between the two separate functions.

f.) Fault warning alarms (i.e., audible and visual) shall be appropriately located to alert operations and maintenance personnel of conveyor subsystem fault conditions. As a minimum provide fault alarms on top of the MCPs. Audible/Visual Fault Warning and Start-up Alarms may utilize the same control devices. However, the audible and visual indications shall differentiate between the two separate functions.

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

h.) Emergency Stop Switch Rotating Beacons: Emergency Stop Switch beacon with red rotating globe shall be mounted on top of the associated subsystem MCP.

3. Types of Control Devices

a. Push-Button Switches: All Momentary Contact Push-Button switches shall be of the Allen Bradley Series 800T type (or Square D 9001K series, or equivalent as reviewed and approved by the Owner or his representative). The color coding for the Push-Buttons shall be as follows:

Function	Color

Start/Re-Start (non-public locations)	Green (flush head)
Normal Stop (non-public locations)	Red (flush head)
Alarm Silence (non-public locations)	Yellow (flush head)
Lamp Test (non-public locations)	Gray (flush head)
Jam Reset (non-public locations)	Orange (flush head)
Others (non-public locations)	Black (flush head)

b. Illuminated Push-Button Switches: All Illuminated momentary contact push-button switches shall be of the Allen Bradley 800T - PA16 type switch with guards (or Square D 9001K series, or equivalent as reviewed and approved by the Owner or his representative). The color coding for the Push-Buttons shall be as follows:

Function	**Color**
Start (for initial start up conditions at public areas)	Green
Jam Reset	Amber
Emergency Stop Reset	Red
Over-Height/Over-Length Reset	White

c. Emergency Stop Push-Button Switches: All Emergency Stop push-button switches shall be of the Maintained Contact, "Push to Stop" Illuminated Red Mushroom Head switch, Allen Bradley 800T - FXP16RA1 type (or Square D 9001K Series, or equivalent as reviewed and approved by the Owner or his representative). Note that the Emergency Stop push-button switches must be equipped with a manual lockout clip manufactured by the switch manufacturer for locking the switch in the “conveyor off” position.

d. Selector Switches: All Selector Switches shall be of the appropriate series based on the application, as specified, and of the Allen Bradley 800T type switch (or Square D 9001K Series, or equivalent as reviewed and approved by the Owner or his representative).

e. Key Operated Switches

1.) All key operated Switches for application in Public Areas shall be of the type manufactured by the Best Lock Company (or Square D 9001K Series with Best Lock Company core, or equivalent as reviewed and approved by the Owner or his representative) but must use a six-pin lock cylinder and core. The Owner will provide the final Operational Core. The Construction Core, normally supplied with the lock, must be removed before the project will be accepted. The switch must provide a spring loaded center return.

2.) Key operated Switches for all functions other than in the Public Areas shall be Allen Bradley type 800T, (or Square D 9001K Series, or equivalent as reviewed and approved by the Owner or his representative).

f. MCP Indicator Lamps

1.) Indicator Lamps shall be of the Allen Bradley "Push to Test" Pilot Light type 800T - PST16, (or Square D 9001K series, or equivalent as reviewed and approved by the Owner or his representative) with appropriate color coded lens as noted below for MCPs with less than five Indicator Lamps.

2.) For MCPs with five or more Indicator Lamps, a common Lamp Test Push-Button must be employed to test Indicator Lamps.

3.) Additionally, for MCPs with five to ten Indicator Lamps, the Lamps shall be Allen Bradley #800T - PDST16 (or Square D 9001K series, or equivalent as reviewed and approved by the Owner or his representative) with appropriate color coded lens.

g. Non-Status Map Emergency Stop Switch Indicator Lamps: Certain Baggage Handling Systems shall require the installation of Emergency Stop Switch indicator Lamps adjacent to lanyard operated Emergency Stop Switches. Such Indicator Lamps are to be of the type manufactured by Crouse - Hinds, Cat. #BDA - 15GP, (or equivalent as reviewed and approved by the Owner or his representative) with Red Globes.

h. Audible Warning Alarms

1.) Start-Up Warning Alarms for mounting at Ticket Counter Control station locations shall be of the Sonalert device as manufactured by Mallory Company Stock #64F278 Type SC250E, or Allen-Bradley DEC/DEP Series alarm 855P-B10DEC22 for continuous tone or 855P-B10DEP22 for pulsing tone, to be determined by the Owner (or equivalent as reviewed and approved by the Owner or his representative). For those Control Stations located in higher ambient noise locations, an alarm of appropriate higher frequency and dB rating shall be used (or equivalent as reviewed and approved by the Owner or his representative). Selection must be made based on actual survey of the location.

2.) Start-Up Warning Alarms for other locations shall be of appropriate frequency and volume levels for the application location (such as baggage make-up areas, outbound transport line areas, oversize subsystem, etc.). Such Audible Warning Alarms shall be as follows:

a.) Public Areas: Edwards Horn Beacon #51 with Amber Dome. Allen-Bradley 855H Series horn with Amber Beacon, Catalog Number 855H-BCA10CDR5. Federal Horn #350 with 400F Light, Amber Dome and 400 HMK*AC Adaptor (or equivalent as reviewed and approved by the Owner or his representative).

b.) Baggage Make-up Areas: Edwards Bell #340-6N5. Allen-Bradley 855H Series horn, Catalog Number 855H-BA10CD. Federal Bell #46-500-WB (or equivalent as reviewed and approved by the Owner or his representative).

3.) Audible Fault Warning Alarms shall be of a horn type of appropriate frequency and volume level for the application location (such as baggage make-up areas, outbound transport line areas, etc.). Such Audible Fault Warning Alarms shall be as manufactured by Edwards Horn #876-N5, Allen-Bradley 855H Series horn, with Amber Beacon Catalog Number 855H-BCA10CDR5 or without Beacon 855H-BA10CD, or Federal Vibratone Horn #350-WB (or equivalent as reviewed and approved by the Owner or his representative).

i. Audible/Visual Combination Alarms: Combination alarms for start-up or fault warnings mounted to MCPs, EDS machines, or elsewhere as approved by the Owner or his representative, may be Allen-Bradley 855E Series with 120 VAC control.

j. Limit or Proximity Switches: Provide precision oil tight plug-in type limit switches with contacts rated for a minimum of 10 amperes continuous duty at 120 volts A.C. Limit switches that are used to sense the position of fire/security doors are to be mounted as an external unit to the door adjacent to the track of the door so that the switch can detect when the door is in the fully open position.

k. Lanyard Activated Switches

1.) Special attention must be given to the design and location of the supports for the cable lanyard so as not to be easily damaged by baggage equipment or personnel.

2.) Systems that will require the application of lanyard activated safety switches for either subsystem or system Emergency Stop Switches. Such Safety Switches must be of the "manual re-settable" type with padlock attachment as manufactured by Rees, Cat. #04944 series, Conveyor Components Corporation, (or equivalent as reviewed and approved by the Owner or his representative).

3.) Emergency stop lanyard operated limit switches and their associated lanyard cables are to be mounted along the catwalk for the length of the ML1 subsystem.

4.) CBRA clear bag subsystem to have an e-stop lanyard.

5.) Lanyard cables are to be color coded as follows:

a.) E-Stop Lanyard Red

l. Fire/Security Door Safety Disconnect Switches

1.) Provide safety disconnect switches of the 3-pole, heavy-duty type, horsepower rated and non-fusible with a quick-make and quick-break operating mechanism and a means of padlocking the switch in the OFF position.

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

3.) Each Fire/Security Door safety disconnect switch shall be identified with a permanently attached white phenolic plate, engraved with black characters, providing the identification of the door the disconnect is associated with. Dymo - type labels are not acceptable.

4.) Use NEMA 12 enclosures for interior equipment

m. Relays: Use general-purpose industrial, panel-mounted relays with convertible contacts rated at 10 amperes continuous current at 120 volts A.C. Ensure that all relays are capable of manual operation.

n. Timers: Provide solid state, motor driven timers or utilize timer functions by PLC logic. All timers are to be mounted within the appropriate MCP. Use of timer devices within photocells is not acceptable.

o. Magnetic Motor Starters (IEC)

1.) IEC starters shall comply by IEC, UL, CSA and VDE standards. NEC article 430 shall apply for group motor installation.

2.) Provide a separate IEC motor starter for each motor drive section.

3.) Provide one auxiliary contact on each starter and wire to PLC input module. Provide monitoring of tripped condition on the MDS or Touch Screen Terminal. Provide visible trip indication on the IEC starter

4.) The IEC rated contactors are to be sized one rating higher than recommended by the manufacturer.

5.) IEC starters shall be selected by motor full load current and the motor service factor.

6.) Provide IEC with lockout provision.

7.) Be provided with thermal overload protection on all poles.

8.) Provide overload relays of the manual reset type (unless they are already within the IEC motor starter).

p. Combination Magnetic Motor Starters

1.) In addition to the requirements listed for magnetic starters, equip each combination magnetic starter, if specified, with:

a.) An adjustable instantaneous trip circuit breaker interlocked with the enclosure cover with provisions for padlocking the disconnect switch in the "Off" position.

b.) An enclosure door capable of being opened only with disconnect switch in the "Off" position.

q. Soft Start Devices

1.) Provide a soft start device for all drive units within any flat plate baggage make-up as recommended by the manufacturer. The use of a VFD device instead of a soft start device is acceptable.

2.) Provide an electrical/electronic soft start device with adjustable starting curve from 0 to 10 seconds for any conveyor drive equipped with a 7-1/2 horsepower motor or larger.

3.) Ensure that the electrical control circuitry design provides that the soft start device is always used whenever the associated drive motor(s) are started, regardless of start condition; i.e., regardless if drive motors are started with a control sequence or with activation of the related motor safety disconnect switch.

4.) The approved soft start devices, noted in the acceptable manufacturers listing, must be sized for the specific application.

r. Electric Brakes

1.) Provide brakes on all incline conveyors and decline conveyors, if not equipped with a VFD, and for any other conveyors where coasting of the conveyor would be detrimental to the operation of the baggage system.

2.) Provide an electric brake for decline conveyors that are equipped with a VFD. Wire the brake separately from the Variable Frequency Drive power source to prevent conveyor coasting.

3.) Provide dry friction, spring set, solenoid release type brakes integral with the drive motor.

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

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

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

7.) Motor brakes that are installed on the end bell of the motors are to be equipped with an external means of "manual release" that would permit maintenance personnel to operate the motor in case of a failure of the brake.

s. Variable Frequency Drives (VFD)

1.) A programmable Variable Frequency Device (VFD) shall be utilized to control the operation of three-phase induction AC motors for queue, power turns, merge conveyors and all conveyors in all bag tracking zones (sortation and EDS) where coasting of the conveyor would be detrimental to the operation of the baggage system. Dynamic braking shall be provided for all conveyors within the CBIS bag tracking zones.

2.) For incline conveyors, on which bags are being tracked, that are equipped with a Variable Frequency Drive unit “anti roll back” provisions shall be provided on the associated gear box to prevent conveyor coasting.

3.) Provide an electric brake, wired separately from the Variable Frequency Drive power source, for decline conveyors, on which bags are being tracked, to prevent conveyor coasting.

4.) Type of VFD utilized shall be UL listed and IEC compliant.

5.) VFDs shall be typically installed within the respective Motor Control Panel (MCP). To conserve MCP space the BHS Contractor can propose to install the VFD remotely at the drive unit, the Owner or his representative must approve this type of configuration.

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

7.) Provide a local keypad control for start, stop, speed reference and reverse functions.

8.) Provide where required for faster stopping, dynamic braking resistors.

9.) VFDs shall be capable of permitting the appropriate number of engagement cycles per minute for the specific application under full load with no objectionable heating, overload tripping or other VFD faults. BHS Contractor shall factor this when designing the system and provide VFDs and dynamic braking resistors of a larger power rating if required to meet the application’s requirements.

10.) The BHS Contractor shall factor in heat dissipation when designing the MCP and if excessive heat is anticipated from the braking resistors, then mount them in a separate NEMA 12 (for interior equipment) rated panel.

11.) When using VFDs, VFD rated shielded cable shall be used. Use Belden, O'flex or equivalent cable. The shield should be connected to both the motor and the PE (Potential Earth) ground on the AC drive.

12.) For cable length of 50 ft or more between the drive and motor, a minimum of 1 additional amp needs to be added to the drive rating to handle cable-charging current. For Cable greater than 100 ft in length, a minimum of 2 amps need to be added to the drive rating for cable charging current.

13.) If the transformer which is powering the MCP or MCC is greater than 10 times the drive rating, an input line reactor shall be provided for each AC drive.

14.) Enunciate all individual variable frequency drive (VFD) failures on the fault reporting system. Automatic resetting of certain faults shall be permitted; however, all such faults shall be enunciated and logged regardless of whether or not they have been automatically reset.

15.) The BHS Contractor shall submit to the Owner or his representative catalog cuts of the type of VFD proposed for review and approval.

t. Photocells (Photoelectric Sensors)

1.) Provide photocells of the self-contained, retro-reflective type using an infrared modulated light source with sensitivity adjustment and LED status indicator that is readily visible. Retro-reflective type photocells are to be used for applications where the distance between the photocell and the reflector is less than 10'.

2.) Photocell applications that require a scan distance of 10' or greater are to use a separate transmitter and receiver rather than the single retro-reflective photocell.

3.) Use photocells with quick disconnect cable for ease of replacement; the cable shall be UL recognized, 18AWG; one-piece molded design and be highly visible.

4.) Due to wiring constraints and noise on low voltage lines generating false triggers, DC type photocells are not permitted.

5.) Mount photocells to structural members or side guards using an adjustable bracket as supplied by the photocell manufacturer so that the photocell is mounted in a vertical, not horizontal, attitude. Alignment and status LEDs shall be easily visible for maintenance personnel. All sensors and cabling shall be firmly anchored and protected from equipment and personnel impact and from random forces imposed by maintenance personnel servicing the equipment or staff working in the area. Mounting and protection devices shall inhibit tampering with sensors and their setting by non-maintenance personnel.

6.) Photocell mountings are to be directly attached to the conveyor structure as required. Use of shims between the conveyor structure and the photocell mountings is not acceptable. No penetrations through the side guards or attachment by means of magnets or other non permanent attachment methods shall be permitted for photocell mountings or mounting brackets.

7.) Hex head 1/4" - 20 bolts of appropriate length and related 1/4" - 20 hardware (flat washers, lock washers and nuts) are to be used for the mounting of the photocells. Use of round head bolts is not acceptable.

8.) Mount reflectors to side guards using brackets providing both vertical and rotational adjustment. No penetrations through the side guards shall be permitted for reflector bracket mounting.

9.) Where holes through side guards are required, the holes shall be a maximum of 1.5" in diameter and located so that the center of the photocell beam is 2.5" above the conveyor belt. The holes in the side guards shall be dimpled away from baggage flow to minimize the possibility of snagging a bag and causing a jam. Oblong openings in the conveyor side guards are not acceptable.

10.) Only one side guard opening per photocell and one side guard opening per related photocell reflector would be accepted. Any unused photocell/reflector openings in the side guards must be properly filled with a welded circular blank, ground smooth and properly painted.

11.) Locate photocells on the side of a conveyor having the lesser chance of contact by operating personnel. Guard photocells if susceptible to personnel contact. The photocells are to be located on the catwalk side of conveyors to ensure maintenance access.

12.) Do not attach the white phenolic plate photocell device ID plate to the plug-in type photocell or its

wired base. Mount the ID plate on the side guard adjacent to the photocell.

13.) Provide photocells as required by the functional needs of the BHS. Photocells shall indicate a reliable life of over 10 million cycles, and be repetitive and unaffected by environmental conditions such as vibration, rain, humidity, cold, heat, dust and sunlight. Provisions shall be made to effectively accomplish the sensing of any of the typical types of airline baggage. Photocell installation shall minimize vibration and shall provide protection for both the sensor and its associated wiring. Specifically, care shall be exhibited in the mounting of the photocell and its control wiring to minimize the hazard of damage from the moving of baggage, contact with associated components or by personnel working on or in the vicinity of the system.

14.) Use liquid-tight flexible metal conduit for connection of photocells to minimize vibration and shall provide protection for both the sensor and its associated wiring.

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

16.) For applications that require critical fail-safe operation (e.g. for EDS Applications), the following components must be used:

a.) The BHS Contractor is responsible for developing and programming PLC logic to ensure that the PLCs are continuously crosschecking outputs from the photocells. The purpose of this code is to ensure failsafe operation of photocells, photocell output wiring, I/O cards, I/O racks, PLC communications, and PLCs themselves. This code shall be written in such a manner that the system will stop appropriate conveyors and alert personnel in the event that the photocell, I/O card, I/O rack, any communication cable or wire breaks, or PLC failure occurs. This code should also include programming to account for long baggage or multiple bags that may appear overlength due to the absence of baggage gaps (stop conveyors if a bag length exceeds the maximum system bag length). In addition, the Contractor is responsible for implementing software programming filters to prevent erroneous conveyor stoppage due to the distance between photocell mounting locations and bag straps (that may instantaneously break the photocell beam). All applications must be submitted for review and acceptance to the Owner or his Representative prior to installation.

b.) (For applications requiring throughput of 10 bags per minute or less) – Allen-Bradley Area Access Control (AAC) units may be used. Catalog number 440L-T4F90018-Q for Transmitter and 440L-R4F90018-Q for Receiver.

c.) (For applications requiring throughput of greater than 10 bags per minute) – Allen-Bradley Safety Light Curtain units may be used. Catalog number 440L-P4D0300-N for this Point of Operation Control unit.

d.) As an option to (b.) or (c.) above: redundant Allen-Bradley Series 9000 transmitted beam photoelectric sensors with a diagnostic output may be used. The BHS Contractor is responsible for implementing PLC safety controls to prevent unintended use in case of a failure.

u. Shaft Encoders

1.) Shaft encoders used for determining conveyor speed must be directly coupled to either the head or tail pulley of the associated conveyor and shall be of appropriate industrial type.

2.) Install appropriate safety guarding on all exposed parts associated with the conveyor drive's rotating shaft and direct drive gearbox, in compliance with OSHA Standards 1910.219. Ensure that the proposed safety guarding does not restrict maintenance access and it is easily removable, as the location requires, for maintenance access. Submit shaft encoder attachment and guarding details to the Owner or his representative for approval.

3.) Use of tension loaded friction drive types of shaft encoders is not acceptable.

4.) The BHS Contractor is responsible for ensuring the shaft encoder model chosen is applicable to meet the subsystem tracking criteria based on conveyor belt speed/resolution required (i.e. shaft encoders

utilized for tracking within an EDS system (slow speed tracking area) may be a different model compared to those required for sortation system tracking (high speed tracking area)). Submit to the Owner or his representative, the manufactures data for the proposed shaft encoder(s) for approval.

C. Electrical Device Identification

1. The electrical control stations, their related control devices, field wired control devices shall be identified with a permanently attached white phenolic plate, engraved with black characters, providing the identification of the control station, control device etc. Dymo-type labels are not acceptable. Do not attach the white phenolic plate to any field device that can be easily replaced due to failure ((i.e. plug-in type photocell or its wired base) as this would also require the removal and reattachment of the ID plate), attach the plate to the side guard or non-removable structure adjacent to the device.

2. The electrical control stations, their related control devices, field wired control devices and the electrical control devices mounted within the BHS related motor control panels (MCPs) shall use the following device identification format and designations. The format and identification that are used in this specification are to be used throughout the BHS project and are to appear on the designated equipment and the entire project related documentation.

   a. Control Stations

      1.) Control Stations shall be identified with the prefix CS followed by the actual Conveyor or BHS Equipment Identification Number to which the Control Station is related. For example, CS/TC2-6 identifies a Control Station located on Ticket Counter Subsystem #1 related Conveyor #6. Note that when there is more than one Control Station associated with a Conveyor or BHS Device, alpha designators will also be used. For example, CS/TC2-6A, CS/TC2-6B, CS/TC2-6C signifies that Ticket Counter, Subsystem #1 related Conveyor #6 has three Control Stations. The "A" prefix identifies the Station related to the charge end of the Conveyor while the last or highest letter indicates the Station closest to the discharge end of the Conveyor.

      2.) Each Control Station shall be identified with a permanently attached white phenolic plate, engraved with black characters, providing the identification of the Control Station. Dymo- type labels are not acceptable.

   b. Control Station Devices

      1.) Control Station Devices shall be identified as follows:

Control Station Device	Identification
Start Re-Start Push-Button	SPB
Normal Stop Push-Button	PBS
Emergency Stop Push-Button	EPB
Reset Push-Button	RPB
Selector Switch	SSW
Key Operated Switch	KSW
Sonalert Warning Device	ALM
Bag Advance Switch	BAS
Alert Light Reset	LPB
Lamp Test Push-Button	TPB
Sortation Controller Jam Reset Push-Button	CRB
Alarm Silence Push-Button	APB
Door Close Push-Button	CPB

Door Open Push-Button	OPB
Forward Jog Push-Button	JFB
Reverse Jog Push-Button	JRB
Jog Push-Button	JPB
Jog Selector Switch	JSW
Colored Indicator Light (the first letter of the lamp color will appear instead of the underscore)	LT_

2.) For example: The designation CS/TC2-6/RPB identifies a Reset Push-Button in the Control Station located at Ticket Counter Conveyor TC2-6.

3.) Note that the above Control Station Device designations are to appear on all electrical drawings, including wiring and schematics.

4.) Control Station Control Devices (push-buttons, etc.) identification descriptors shall be clearly identified by permanently attached white phenolic plates, engraved with black characters, except emergency stop devices which are to be red with white letters, showing their operational relationships to the system(s) or subsystem(s).

5.) All e-stop pushbuttons shall clearly indicate all conveyors affected by that e-stop (i.e.: TC2-1/TC2-8 indicates that the E-stop will stop conveyors TC2-1 through TC2-8). Dymo - type labels are not acceptable.

6.) All Jam reset pushbuttons shall indicate the conveyor segments, which are controlled by that jam reset control station.

7.) Control Station Control Device Function I.D. Tags must be positioned for ease of reading. Align the tag's legend so that it is legible (oriented) from the operator's access side of the control station.

c. Field Wired Control Devices

1.) Photocells shall be identified as PE followed by the Identification of the Baggage Handling Device or Conveyor on which the Photocell is mounted. For example: PE/TC2-6 identifies a Photocell located on Transfer Conveyor TC2-6.

2.) Limit Switches shall be identified as LS followed by the identification of the Baggage Handling Device or Conveyor to which the Limit Switch is related. For example: LS/TC2-2 identifies a Limit Switch on Ticket Counter Conveyor TC2-2.

3.) Warning Alarms shall be identified as WA followed by the Identification of the Baggage Handling Device or Conveyor to which the Warning Alarm is related.

4.) Lights shall be identified as LT followed by the identification of the Baggage Handling Device or Conveyor on which the light is mounted. For example: LT/OS1-1 identifies a light located adjacent or mounted on Oversize Bag Conveyor OS1-1.

5.) Hour meters shall be identified as HM followed by the identification of MCP to which the hour meter is related. For example: HM/MCP-l identifies an hour meter on motor control panel MCP-l.

6.) Manual Encoding Consoles shall be identified as EC followed by the identification of the Baggage System Conveyor to which the Console is related. For example: EC/ME1-25 identifies a manual-encoding console related to Manual Encoding Conveyor ME1-25.

7.) Emergency Stop Lanyards shall be identified as EL followed by the identification of the Baggage System Conveyor on which the Emergency Stop Lanyard Limit Switch is mounted. For example: EL/ML1-2 identifies an Emergency Stop lanyard related to Mainline Conveyor ML1-2.

8.) Shaft Encoders shall be identified as SE followed by the identification of the Baggage System Conveyor on which the Shaft Encoder is mounted. For example: SE/ML1-2 identifies a Shaft Encoder mounted on Mainline Conveyor ML1-2.

9.) Hand Held Scanner Guns shall be identified as SG followed by the identification of the Baggage System Conveyor to which the Hand Held Scanner Gun is related. For example: SG/ME1-7 identifies a hand held scanner gun related to Manual Encoding Conveyor ME1-7.

10.) Security Card Readers shall be identified as SR followed by the identification of the Baggage System Conveyor to which the Security Card Reader is related. For example: SR/TC2-1 identifies a security card reader related to Ticket Counter Conveyor TC2-1.

11.) Motor Safety Disconnect Switches shall be identified as "MSD" followed by the identification of the Baggage System Conveyor to which the Motor Safety Disconnect Switch is related. For example: MSD/TC2-09 identifies a Motor Safety Disconnect Switch related to Ticket Counter Conveyor TC2-09.

12.) Field Wired Control Devices (Security Card Readers, Photocells, Limit Switches, etc.) are to be clearly identified by permanently attached white phenolic plates, engraved with black characters with the control device I.D. Dymo type labels are not acceptable.

13.) All field installed Junction Boxes are to be provided with white phenolic plates engraved with black characters. The I.D. tags are to be located, so as to be easily read from the adjacent maintenance access areas. The I.D. tags must be consistent with the associated subsystem identifications noted on the wiring schematics. For example the second junction box from MCP-TC2 would be "JB/TC2-02".

d. Control Devices within Motor Control Panels and Workstations

1.) The identification of control devices and components such as relays, timers, transformers, power supplies, overloads, fuses, PLCs, etc., within motor control panels, workstations and computer cabinets must be identified with I.D. tags.

2.) The I.D. tags must be constructed of a white phenolic plate engraved with black characters. Dymo type labels are not acceptable. The I.D. tags must be located so that they can be easily read when the related motor control panel, workstation or computer cabinet door is opened.

3.) The I.D. tags are not to be mounted on the covers of the Panduit wireways within the related cabinet or control panel.

4.) The I.D. tags for motor starters must contain the conveyor I.D. For example: The motor starter I.D. tag for conveyor TC2-1 would be "TC2-1M".

2.11 MOTOR CONTROL PANELS (MCP)

A. General

1. All control equipment for the newly installed conveyors shall be housed within new motor control panel(s) for the associated subsystems. The BHS Contractor is responsible for ensuring adequate capacity within the panel(s) for all necessary control devices.

2. Provide motor control panels that are UL listed employing NEMA 12 enclosures with fully gasketed doors for interior use (or applicable local codes). Include a fusible switch with Class J or R fuses for the incoming power supply and interlock its door(s) to prevent accidental opening with the power on. The door opening mechanism must have a manual over ride provision to permit the opening the door by qualified personnel with the power on.

3. Provide a plexiglass Safety Shield with standoffs (or similar suitable protection provision) over the fuses for the incoming 480v.

4. The exterior of the MCP must be painted. The interior of the panel or cabinet including the mounting panel shall be painted white.

5. Ensure that all Motor Control equipment complies with NEMA Standard ICS-1, ICS-2, UL publication 845 and other applicable standards of NEMA, UL, IEEE, ANSI and National Electrical Safety Codes (or applicable local codes).

6. Provide thermostatically controlled cooling fans or air conditioning units within the MCP cabinet to monitor and prevent internal temperatures from exceeding 125°F or component environmental limits, whichever is less based on an ambient temperature of 100°F (configurable). Provide replaceable or cleanable filters on the intake vents. Configure, through appropriate controls functionality, the cooling equipment to run when the respective MCP internal temperature reaches 100°F and provide an audible and textual alarm at the MDS or Touch Screen Terminal applicable when the temperature exceeds 130°F (configurable).
7. Provide integral MCP air conditioning units should they be required to prevent the internal temperature of the MCP from reaching 125°F. Provide and install condensing unit drain tubes to the nearest drainage line and coordinate hookup of same with building contractor.
8. Prior to the installation of overload heaters on the controllers, submit a motor schedule listing motor horsepower, voltage, phase, source of feed, circuit breaker size, disconnect size, conduit and wire size and overload heater size selected to be used.
9. Base interrupting rating of all circuit breakers, fused disconnect switches, motor control centers, and panel boards on short circuit calculations and ensure they are compatible and coordinate with base contract equipment. Refer to National Electrical Code Articles 110 and 430 (or local applicable code) to determine short circuit and overload requirements.
10. Mount fuses or circuit breakers for each magnetic starter directly above the magnetic starter.
11. A laminated card showing motor schedule with horsepower, fuse size and heater size shall be affixed to the inside of the MCP door.
12. The working space in front of the MCP panel shall be a minimum of 36". In all cases, the workspace shall permit at least 90 degree opening of the MCP doors. Refer to National Electrical Code Article 110 (or local applicable code) to determine working space requirements.
13. For any MCPs that are not located on a raised curb or raised floor, provide a concrete or galvanized steel plinth, pedestal, legs or similar means to raise the MCP a minimum of 4 inches above the floor to minimize the possibility of any ground water damage to the MCPs located outside of the BHS control room.
14. Appropriately sized waterproof bushings/seals shall be installed on all conduits and conduit fittings that enter/exit the Motor Control Panel(s).

B. Installation requirements

1. Comply with the following design and installation requirements:
    a. Wire the line side of fuses or circuit breakers to a line side terminal strip for their incoming supply.
    b. Wire the load side of the magnetic starter to a load side terminal strip for the outgoing load.
    c. Connect all control wires to terminal strips designated for control wiring.
    d. Make vertical runs of power and control wiring within the panel on either or both of the right or left sides of the backboard.
    e. Run horizontal runs of power and control wiring between the horizontal rows of starter/fuse block units.
    f. Enclose all vertical and horizontal wiring in “Panduit” - brand plastic wireways.
    g. Make minimal wire runs to and from these wireways only to the nearest adjacent fuse block starter or terminal block.
    h. Use of “latching relays” is not acceptable.
    i. Use of “alternating relays” is not acceptable.

j. Any “plug in” type device such as a relay, IEC starters or clutch/brake power supply must be equipped with a spring clip type restraint to prevent the “plug in” device from becoming loose in its socket.

k. Splicing of control or power wiring within any MCP is not acceptable. All internal and external “field” wiring must be terminated on the appropriate MCP terminal strips.

l. Appropriate sized waterproof bushings shall be installed on all conduits or conduit fittings that enter the related MCP.

m. All fuses will be of the appropriate type and size of the FRN or FRS dual element type.

C. Panel Identification

1. Each Motor Control Panel must be identified with an I.D. Tag mounted on the outside face of the Panel Door to the immediate left of the MCP Main Disconnect. The Tag shall identify:

a. MCP Designation

b. Related Baggage Subsystem

c. Related Conveyors or Devices Controlled by the MCP

2. The I.D. Tag shall be secured to the MCP door surface with a minimum of four rivets combined with an appropriate adhesive. Large tags shall require a minimum of four rivets, one for each corner of the tag.

D. Shop Drawings

1. Submit shop drawings to show:

a. General Layouts of new subsystem MCPs

b. Power, wiring and schematic diagrams

c. Outline and wiring diagrams of all special devices

d. Manufacturer’s data for all components

E. Utility Outlet

1. In each enclosure or cabinet include a minimum of one appropriately fused grounded duplex receptacle utility outlet meeting locally applicable standards of 120 volt, 20-ampere capacity conveniently located within the panel.

2. The outlet is to be fed from the line side of the MCP, workstation, or computer cabinet power source so that the outlet power will remain on regardless of the condition of the MCP, workstation, or computer cabinet power.

3. The hot wire providing power to the outlet shall be yellow. All terminations of this wire shall be guarded in order to protect personnel from accidental contact. Mount a warning on the outside of the panel, next to the disconnect switch stating: “CAUTION - THIS CONTROL CABINET CONTAINS YELLOW WIRES WHICH WILL REMAIN “HOT” WHEN THE DISCONNECT SWITCH IS TURNED OFF.”

F. Lighting

1. Equip each enclosure or cabinet with an appropriately fused fluorescent lamp extending at least three quarters of the width of the panel. Operate the lamp by a switch located inside the enclosure on the latch side of the primary door so that the light becomes illuminated whenever the enclosure or cabinet door has been opened.

2. The lamp(s) is to be fed from the line side of the MCP, workstation, or computer cabinet power source so that the fluorescent lamp will remain on regardless of the condition of the MCP, workstation, or computer cabinet power.

3. The hot wire providing power to the lamp shall be yellow. All terminations of this wire shall be guarded

in order to protect personnel from accidental contact. Mount a warning on the outside of the panel, next to the disconnect switch stating: "CAUTION - THIS CONTROL CABINET CONTAINS YELLOW WIRES WHICH WILL REMAIN “HOT” WHEN THE DISCONNECT SWITCH IS TURNED OFF."

G. Control Devices

1. General

b. All MCPs are to be equipped with the following control devices regardless of the type of status monitoring being employed:

1.) System Ready Indication Lamp: The MCP shall be equipped with a Green Indicator Lamp, which shall become illuminated to indicate that the system is ready for start-up and no faults are indicated on the MDS or Touch Screen Terminal.

2.) MCP Re-Start Push-Button Switch: A green momentary contact start push-button switch is to be provided for each system or subsystem that is controlled from the MCP. The MCP Re-Start Push-Button Switch shall not be able to start the subsystem from a non-operational mode. It shall only be able to Re-Start the subsystem if the MCP fault has been cleared.

3.) MCP Emergency Stop Push-Button Switch: Each MCP shall be equipped with a red illuminated maintained contact mushroom head push-button switch for each system or subsystem controlled from the MCP.

4.) Jam Indication: Amber Indicator Lamp shall be used to indicate a Jam condition. The Jam Indicator Lamp shall become illuminated whenever a Jam Detector within the subsystem has sensed a Jam Condition. The Indicator Lamp shall remain illuminated until the Jam Condition has been corrected.

5.) Motor Overload Indication: Blue Indicator Lamp shall be used to indicate Device or Conveyor Groups in which one or more Motor Overloads have tripped. The Motor Overload Blue Indicator Lamp shall become illuminated whenever a Motor Overload Condition develops and shall remain illuminated until the tripped Overload has been reset.

6.) Hour Meter: Each MCP shall be equipped with an Hour Meter that shall record the amount of time (in hours) that at least one of the conveyors or devices controlled by the MCP is in operation.

7.) Alarms

a.) Start-Up/Fault Warning Alarm(s): Each MCP shall be equipped with one amber rotating beacon and one audible horn to indicate imminent subsystem start-up or faults (jams, motor overloads, etc.). The design of the control circuitry shall be such so that multiple faults will always activate the audible and visual alarms; i.e., if a jam condition has activated the fault alarms and the alarm silence push-button has been depressed but the actual fault has not yet been corrected, a second fault occurring after the alarm has been silenced shall again activate the alarm.

b.) Emergency Stop Warning Alarm(s): Each MCP shall be equipped with one red rotating beacon and one audible horn to indicate an Emergency Stop situation in the subsystem.

8.) Alarm Silence Push-Button Switch: Each MCP shall be equipped with a yellow momentary contact “Alarm Silence” push-button switch. Activating the Alarm Silence Push-Button shall silence the Audible Warning Alarm. However, the appropriate Indicator Lamp shall continue to be illuminated until the Fault Condition (jam, motor overload, e-stop, etc.) has been corrected.

H. System Status

1. Touch Screen Terminal

a. Supply, install and program Touch Screen Terminal such as an “Allen Bradley”, family of “PanelView” terminals (or equivalent as approved by the Owner or his representative).

b. Touch Screen Terminals to be located at each panel grouping including:

1.) North end outward face of MCP grouping near column line Y6.5

2.) South end outward face of MCP grouping near column line Y6.5

3.) Oversized MCP grouping

4.) Makeup bagroom MCP grouping

5.) Manual Encoding grouping

c. The Touch Screen Terminal shall be constructed as a NEMA 12 for indoor use.

d. The Touch Screen Terminal shall be capable of accurately and clearly depict the BHS subsystems that are controlled by the associated MCP. The terminal shall be configured to display system status as described below, in both text and pictorial format. Submit to the Owner or his representative their functional design for approval.

e. The graphics portion of the terminal shall display, in real time, dynamic pictorial format, the operational status of the conveyors and make up devices that are connected to the system PLCs. Framed icons and specific conveyor I.D.s representing conveyor sections shall change color according to the following scheme. This shall immediately highlight problem areas so that the problems that arise may be corrected in the minimum amount of time:

Condition	**Color**
Normal Operation – Conveyor Drive On/Running	Green
Normal Operation – Conveyor Drive Off/Timed Out	Black
Conveyor stopped due to “Cascading”	Magenta
Conveyor Full Condition	White
Emergency Stop Actuation	Red
Overlength/Overheight Condition	Flashing White
Motor Overload	Blue
Shaft Encoder Fault	Cyan
Conveyor Jam Condition	Yellow
Diverter Fault	Yellow
Divert All	Flashing Green
Vertical Sort Conveyor Failed Up	Yellow
Vertical Sort Conveyor Failed Down	Yellow
EDS Device Failure	Red
BHS/EDS Interface Fault Condition	Flashing Red
PLC Communication Loss (Individual Components)	Red
Equipment Out of Service	Brown
Fire Alarm	Flashing Red
Over Temperature	Flashing Red
EDS Device Failure	Red
BHS/EDS Fault	Flashing Red
Manual Encode Out of Service	Flashing Red

f. The textual portion of the terminal shall display, in color coded text format, the operational status of the conveyors and make up device that are connected to the system PLCs. The terminal provides color indications of a predetermined fixed area of the system. The text portion of the terminal shall not interfere with the graphical display area. The textual portion of the terminal shall automatically scroll to show the most current fault. The textual display must also have a scroll back function to display faults that have scrolled off the display. The condition and the specific conveyor I.D representing the conveyor sections and system devices change color according to the following scheme. This shall immediately highlight problem areas so that the problems that arise may be corrected in the minimum amount of time:

Condition	**Color**	**Text Displayed**
Normal Operation – Conveyor Drive On	Green	Running
Normal Operation – Conveyor Drive Off	Black	Timed Out
Conveyor stopped due to “Cascading”	Magenta	Cascade Stopped
Conveyor Full Condition	White	Full
Emergency Stop Actuation	Red	E-Stopped
Overlength/Overheight Condition	Flashing White	Oversize
Motor Overload	Blue	Overload
Shaft Encoder Fault	Cyan	Shaft Encoder Fault
Conveyor Jam Condition	Yellow	Jam
Diverter Fault	Yellow	Failed Extended
Divert All	Green	Push All
Vertical Sorter Conveyor Failed Up	Yellow	Failed Up
Vertical Sorter Conveyor Failed Down	Yellow	Failed Down
EDS Device Failure	Red	EDS Failure
BHS/EDS Interface Fault Condition	Red	Interface Fault
PLC Communication Loss (Individual Components)	Red	Communication Error
Equipment Out of Service	Brown	Out of Service
Fire Alarm	Red	Fire Alarm
Over Temperature	Red	Over Temperature
Missing Bag Jam	Yellow	Missing Bag Jam
Manual Encode Out of Service	Flashing Red	Manual Encode Out of Service

g. The Touch Screen Terminal shall be connected to an audio/visual alarm, which will be activated when a system alarm is triggered (i.e. jam condition, E-stop etc.).

h. Provide the Touch Screen Terminal with EPROM or similar to provide memory backup.

2.12 BHS WORKSTATION AND COMPUTER CABINETS

A. General Design Requirements

1. There shall be a control room(s) that houses the BHS workstations, the BHS Sortation Control Servers and the MDS server consoles. These consoles shall be designed to reduce worker's fatigue.
2. The BHS Contractor shall supply a system capable of supporting all the specified electronics.
3. The system shall be comprised of floor mounted base pedestals, below the work surface base modules, (minimum of 14U per module), and above the work surface, top modules assembled together to form an operator console.
4. The system shall have a minimum 1-inch thick MDF core, laminated work surface. The work surface shall be not less than 18" deep overall and should include a 3" deep wrist support covering the work surfaces entire front width.
5. Modular top compartments shall allow for a minimum of 9" slope away from the operator for all electronics placed above 30" height from floor level.
6. Add-on top modules shall allow for a vertical or 12-degree or 15-degree tilt towards the user for all electronics placed above 6 feet in height from floor level.
7. Top modules shall be provided with removable equipment finishing masks or surrounds, cut to the size of the face of the specified electronics.

B. Standards

1. The system shall comply with Underwriters Laboratories (U.L.) listing 62Y4. Copy of the certificate of approval to be submitted upon request.
2. The system shall comply with Electronic Industry Association, (EIA), specifications for rack mounting ANSI/EIA standard RS-310.

C. Modular Pre-Engineering Construction

1. All components within the console system shall be:
   a. Of pre-engineered modular construction i.e. constructed from a series of independent sectional components.
   b. Be available from pre-defined set of manufacturers' model numbers.
   c. Has been in common production for at least two (2) years prior to the date of submission.
   d. Alterations to the design, either prior to or following installation, will be accomplished without the need for either welding or carpentry work.
   e. Cables or conduits shall be able to pass through the complete width of the system without obstruction.
   f. Modules may be supplied larger than 19" EIA specifications to accommodate specific electronics but all modules must be capable of supporting EIA standard 19" width rack mounted equipment, whether or not the originally specified electronics are of 19" width EIA dimensions.
   g. All modules shall be constructed of a steel superstructure framework with external attachable side panels in steel or wood.

D. Self Supporting Skeleton Framework

1. The self supporting skeleton framework shall:
   a. Be installed onto the site in advance of any external finishing panels. The framework shall be fully capable of supporting all specified electronics without the need for attachment of any external panels.
   b. Be supplied with four sets of standard EIA rack rails per module, measured in standard rack unit (U) sizes, i.e. inner rack rails and outer rack rails in pairs, one pair of each type mounted at the front and rear of each modular section. Outer racks rails shall be removable.
   c. Be capable of being supplied to site in knock down (flat packed) form and be capable of assembly using

interlocking tie bars and secure with bolts, without welding or carpentry work.

d. Front and rear elevation individual modular frame sections shall be pre-welded, before delivery to site, and constructed of 14, 16 and 18 gauge sheet metal. Front and rear frame sections shall be secured together by use of removable14 gauge interlocking the bars and 1/4-20 bolts. All welds exposed to the front shall be filed smooth and sharp contours eliminated.

E. Base Pedestals

1. Pedestals to be at least 2.5" in height and capable of supporting fully loaded top module cabinets, with a maximum loading of 1000 lbs per pedestal.

2. An 18-gauge stainless steel kick plate cover shall be attached to the front section of pedestal.

3. A central through cable way shall be provided within each pedestal to allow access from under a raised floor into the enclosed console or vertical rack assembly.

4. Each pedestal shall include adjustable levelers providing for an adjustment of +/- (1 inch) per leveler, fitted to the pedestals or together with heavy-duty (2.5 inch) plate casters, (four each per pedestal).

5. Once the console is placed in the desired position it shall become possible to adjust the leveler, to a position, which exceeds the casters, own fixed position from the pedestals base.

F. Steel Exterior Finishing Panels

1. Exterior steel finishing panels of minimum 20 (1.0mm) gauge sheet metal shall be provided and attached to the self supporting superstructure framework. All fastening to be unseen from external view.

2. Side and rear finishing panels shall be either slide on or lift off type to facilitate ease of access for servicing, and shall not require any further mechanical support to provide a secure connection to the system. For permanent connection, additional external fastening shall be supplied.

3. Steel or wood finishing panels may be applied following final termination test and commissioning of the specified electronics or earlier as directed, to facilitate a timely and efficient installation and to minimize potential damage to the exterior of the system by others.

G. Finish and color

1. All exterior and frame steel components, including drawers, blank panels, and shelving shall be zinc oxide wash primer with a baked enamel paint finish of the following specifications:

a. Side, top, and rear panels, drawers, shelving and blank filler panels are to be in the color approved by the Owner or his representative.

b. Self-supporting frames and work surface supports are to be supplied in the color; approved by the Owner or his representative.

c. All wooden components are to be supplied with a high-pressure laminate covering the MDF core.

H. Mounting Hardware

1. Mounting hardware for the specified electronics shall be available upon request. Panel bolts; washers, and clips with captive nuts suitable for use with EIA standard punched rack rails shall be included.

2. Slide kits, where appropriate, (including drawers), shall be of ball bearing operation. Friction or roller type slides are not acceptable.

I. Instructions

1. Fully detailed assembly instructions in the English language shall be supplied with both written and pictorial descriptions for each item/model numbered component.

J. Utility Outlet

1. In each cabinet include a minimum of one grounded five receptacle utility outlet of 120 volt, 20-ampere capacity conveniently located. The outlet is to be fed from a 120 VAC power source external of the workstation or computer cabinet power source so that the outlet power will remain on regardless of the condition of the BHS power.

K. Lighting

1. Equip each enclosure or cabinet with a fluorescent lamp extending at least three quarters of the width of the panel. Operate the lamp by a switch located inside the enclosure on the latch side of the primary door so that the light becomes illuminated whenever the enclosure or cabinet door has been opened. The lamp(s) is to be fed from a 120 VAC power supplied by BHS contractor.

L. Cooling Fans

1. Provide cooling fans whenever necessary to prevent internal temperatures from exceeding component environmental limits based on an ambient temperature of 100°F. Provide replaceable or cleanable filters on the intake vents where fans are used.

2.13 CONTROL SYSTEM DESIGN

A. General Design Requirements

1. This control system specification is intended to define the overall functional requirements of the system. Definitive architecture and design is the responsibility of the BHS Contractor and is subject to review and approval by the Owner or his representative.

2. The term “Control System” shall be understood to cover the control of all conveyors and sortation devices, as part of the BHS. The Control System consists of both BHS computer and PLC control systems. The BHS computer system shall act as the interface between the PLCs, the Owner’s (and/or user Airlines’) reservation system, EDS Systems, and any other external computer/control system that requires interface to the BHS. The BHS Contractor shall coordinate the required computer interfaces/protocols with the Owner and/or his representative, or the User Airlines.

3. The design philosophy adopted for the control system is one of hierarchical control. Centralized supervisory and maintenance control shall be accomplished by fully redundant workstation computers. All the Owner’s Outbound conveyor and sortation subsystems shall be controlled by centralized programmable logic controllers (PLCs) with Warm back-up for redundancy purposes. The outbound system status will be monitored by the central MDS workstation.

4. Baggage encoding shall be accomplished utilizing the ATR, scan gun and manual-encoding console. Baggage tracking shall start at the ATR, BMA and manual encoding position.

5. The BHS Contractor shall clearly identify the philosophy on which this proposal is based and clearly identify in detail the proposed control system architecture, the major components to be utilized and the methodologies employed for software development. In addition, the following philosophy shall be adopted in the BHS control system design:

a. No single fault can bring down the entire system i.e. no single point of failure

b. The system can be easily and economically enhanced to meet the future requirements in the next fifteen (15) years (e.g. add/increase hard drive(s), RAM capacity, increase operating speed (CPU upgraded) etc.)

6. Submittal of the proposal shall acknowledge the functional intent of the control system specification. Understanding the design shall be the result of modifications/refinements to the minimum requirements established herein. These changes shall not be the basis for increased cost requests.

7. Complete and submit, for the Owner or his representative’s review and approval, a comprehensive and

detailed system description. This description shall include full details of operational procedures and control system provisions associated with the BHS, including but not limited to the following:

a. Control system development and implementation master schedule

b. Schedule of system hardware employed (main elements)

c. Interfaces to the Owner's (and/or user Airlines') reservation system, or airport information management system, as required.

d. Interfaces to EDS devices

e. Interfaces to BMAs

f. Interfaces to ATRs

g. Hand Held Scan Guns for Manual Encoding

h. Start-up/shutdown procedures

i. Description of conveyor control logic outlined by subsystem

j. Data input and output routines (i.e., management/maintenance information systems)

k. Automatic operational/maintenance/defect/status routines (including format)

l. Audio/Visual indications

m. Control station layouts/functions/operations

n. Fall-back/Anti-grid lock procedures

o. Redundancy schematics/provisions

p. Power supply requirements (including UPS schematics/redundancy and layout)

q. BHS Computer operator interface routines

r. Typical programming blocks

s. Maintenance Diagnostics System (MDS) – i.e., screens

t. MIS Reporting Functionality with Sample Report Formats

u. Communications Highways – Redundancy, Schematics and product specifications

v. Proposed overall system architectural diagram clearly identifying both upper and lower level controls with respective data communication highways; at a minimum all system PLCs (for the security screening requirements, automated sortation, tracking and system status), all computers/PLCs with functions of each clearly identified (i.e.: sortation, GUI), printers, UPS', Hubs (Ethernet, serial), Drivers, ATR Scanner Arrays and all associated array components (i.e., tachometer boxes, photocells, multiplexers) Manual Encoding Stations, proposed networking. Additionally, provide a schematic diagram with an outlined description that will clearly define the approach that will be taken to satisfy the specified requirements for BHS redundancy.

8. The BHS Contractor shall be available on-site to attend all meetings as required and will actively project manage the BHS design, design review process, documentation process, etc. The BHS Contractor shall also be required to attend a minimum of three mandated control system meetings at the job site or the Owner's office to review the Control System Functional Specifications and Electrical Control System design. Material to be reviewed at the meetings shall be supplied by the BHS Contractor at least two weeks prior to the meetings. The control system meetings attendance will include as a minimum representatives from the BHS Contractor, the General Contractor, CM and the Owner or his representative. The meetings shall review the following discussion items:

   a. Design Considerations - Meeting No. 1

      1.) Computer and PLC System Architecture

2.) Baggage System Computers including Redundancy requirements

3.) PLCs including Redundancy requirements

4.) PLC/Computer Systems - Power Requirements (including UPS requirements) and MCP sizes

5.) BHS Computer Interface Requirements

a.) Hardware Requirements

b.) Software Requirements

c.) EDS Security Systems Interface Requirements

d.) BMA Hardware, Software and Interface Requirements

e.) Interface Requirements to the Owner's (and/or user Airlines') Reservation Network

f.) ATR Hardware, Software and Interface Requirements

g.) Fire/Security Door and Security Card Swipe Interfaces

h.) Production/Testing Schedule

i.) Redundancy Requirements

b. Design Review - Meeting No. 2

1.) Updates to previous meeting

2.) Maintenance Diagnostics System (MDS) Review

a.) Specification Requirements

b.) Problem Resolution

3.) Subsystem control functions Baggage Flow/Logic/PLC Control. As a minimum review the following:

a.) Start-up/Shutdown Procedures

b.) Jam Detection and "Restart" Procedures

c.) Cascade Operation

d.) Emergency Stop and "Restart" Procedures

e.) Audio/visual indications and locations

f.) Fire/Security Door and Security Card Swipe Procedures

g.) Anti-grid Lock Procedures for EDS and Sortation Subsystems

h.) Fallback Procedures

i.) General Control Logic per Subsystem

4.) EDS Subsystems. As a minimum review the following:

a.) Tracking requirements throughout the EDS system for all levels of screening

b.) Start up/shut down procedures

c.) Test Mode

d.) Insert Mode

e.) Bag ID# Assignment

f.) BMTT

g.) Fail safe measures

h.) EDS Device prioritization

i.) Fail Safe measures

j.) EDS Reports

k.) DID design

l.) Anti-grid lock measures for EDS and Sortation Subsystems

5.) Maintenance Information System (MIS) Review

a.) Reports to be developed as defined within this specification.

6.) Electrical System Drawing Review

c. Design Review - Meeting No. 3

1.) Updates to previous meeting

2.) Electrical System Drawings Review

3.) Outstanding Issues

4.) Final review of BHS/EDS Interface

5.) Subsystem Control Elements

6.) Maintenance Diagnostic System (MDS) Review: Sample Screens

7.) Maintenance Information System (MIS) Review: Sample Reports

8.) Electrical System Drawing Review

9. Sortation/Tracking Methodology

a. The design and sortation methodology employed for the sortation process shall be structured on the following, which includes a series of multi-level operational alternatives.

1.) Operational Alternatives

a.) Level 1: 10-digit IATA bag tag with computer interfaces to the Owner's (and/or user Airlines') host reservation system/bag tag server system.

b.) Level 2: Operational/Destination/flight number tag with independent sort correlation tables located within the PLCs for tracking from the scanner arrays and manual encoding stations (both BHS sortation computers failed).

2.) 10 Digit IATA Bag Tag:

a.) The sortation system shall be designed to process baggage utilizing 10-digit IATA Bag Tags and information from the computer interfaces to the Owner's (and/or user Airlines') reservation/bag tag server system.

b.) Provide the ability of sorting baggage utilizing all the 10-digit IATA bag tag information as detailed within this specification.

c.) The system sort rule requirements shall include the ability to sort 10 Digit IATA Tags by carrier code. This type of operation will only be utilized if the BSM link fails between the sort system and the DCS or if the carrier BSMs are not available. In both cases, if the system detects an IATA 10 Digit BSM tag, it shall be possible to sort based on the carrier code.

3.) Special Operations Bag Tag (Fallback):

a.) This sortation system shall be designed to also process baggage utilizing pre-printed operations bag tags that will employ up to ten numeric characters. The purpose of the special operations bag tag shall be to provide direct coding to a number of individual and future destinations as follows:

(1.) Any outbound make up device

(2.) Problem bag/resolution area

(3.) Manual encoding

4.) Manual Encoding (Keyboard Entry):

a.) Bags received at manual encode station shall be processed through the manual keyboard entry of information as read directly from the bag tag by the encode station operator. This information shall include any one of the following formats:

(1.) Direct entry of 10 Digit IATA Bag Tag Number

(2.) Direct entry of numerical information from special operations tag.

(3.) Direct entry of airline two alpha character codes or three digit IATA numeric airline code, flight number and associated flight

(4.) Direct entry of make up device number.

5.) Manual Encoding (Hand-Held Scanner):

a.) Hand scanner guns shall be capable of reading all tag types incorporated in this document.

b.) The manual encode station design and operation shall provide for manual scanning of the 10 Digit IATA Bag Tag or the Special operations Bag Tag for sortation of the bag to the proper area or make up device as based on information received from the computer interface to the Owner's (and/or user Airlines') reservation system or bag tag server systems or information directly entered into the Baggage Handling System Computer Control System.

c.) The design methodology employed for the sortation process of originating baggage shall be based on a tracking process from the scanner array or manual encoding station up to and including the single decision point at the sortation device. Make-up assignments for each flight shall be made and downloaded to the BHS control system.

6.) Make-up device.

a.) Each flight shall be assigned to a make-up device (i.e., flat plate device). By receiving this information the BHS control system shall be able to route each bag to the appropriate make-up device at the decision point (i.e., high speed vertical paddle diverter) based on its flight number and assigned make-up device.

b.) The sortation process shall utilize the following destination assignments by all system functions (sortation computers, manual encoding stations, etc.):

(1.) Primary Makeup – Standard Makeup flight assignment.

b. The control system shall be designed to support all levels of sortation processing outlined herein.

c. Bags routed to make up devices will be routed in such a manner as to take the shortest route.

d. In the event of a failure of communications between the reservation network and the BHS Computers, it shall be possible to manually enter and edit all required sortation information (e.g. flight schedule, make up assignments, etc.) at the BHS "PC" type workstations on pre-formatted, operator-friendly screens.

10. Control System Elements

a. The control system (comprised of the High Level Controls and Low Level Controls) shall comprise (as a minimum) the following elements:

b. The following elements are considered to be a part of the High Level Controls:

1.) Sortation Allocation Computers (SACs) which allow for the following functions:

a.) Automatic switching to a "hot back up" fully redundant SAC.

b.) Interfaces to the User Airlines/Owners reservation system, BHS workstation(s) and baggage system PLCs.

c.) Provide real-time sortation control for the BHS.

d.) Provide direct interface with the sortation PLCs.

e.) Software program(s) as required to accomplish the functions specified herein.

2.) MDS Computers which allow for the following functions:

a.) Automatic switching to a "hot back up" fully redundant MDS computer.

b.) Collect and store data from the sortation and field PLCs to include in reports and status displays at the BHS workstation.

c.) Software program(s) as required to accomplish the functions specified herein.

3.) Sortation PLCs configured in a "warm back-up" mode which will allow for the following functions:

a.) Maintain a current flight table for sortation purposes in case of failure in a "fall back" mode of operation.

4.) BHS workstation which allow for the following functions:

a.) Software program(s) as required to accomplish the functions specified herein.

b.) Keyboard units for command and data input to the sortation control system.

c.) Video Display Units (VDU) for data output.

d.) High-speed line and laser printers.

e.) Communication modems.

f.) Transfer switches/interface modules/selector switches.

5.) Communications highways

6.) Local Area Networks (LANs)

7.) Manual Encoding Stations with hand held Scan Guns

8.) ATR arrays with decoders and multiplexers, and interfaces to host computer/ PLCs

c. The new control system shall comprise (as a minimum) the following elements which are considered to be a part of the Low Level Network:

1.) Subsystem MCPs

2.) Programmable Logic Controllers (PLCs), which control the BHS by communicating with the device, level equipment (photocells, motor starters, encoders, etc.)

3.) Remote I/O located in the subsystem MCPs grouped by mainline.

11. Hardware: All control systems hardware for the BHS Computer and the BHS PLC systems, and associated purchased software shall be supplied by manufacturers whose products are supported locally, and can demonstrate a minimum of five (5) years experience in providing control systems for conveyor systems of similar size. The Owner or his representative must approve any equipment that does not meet this requirement.

12. Computer/Controls Electrical Supply

a. The supplied computer/control systems and equipment shall be compatible with, and operate reliably and effectively with, the normal electrical supply typically available. The equipment shall not be unduly sensitive to fluctuations in supply voltage which may typically vary by plus or minus ten percent (10%) of nominal values. Electrical power supply filters/conditioners and regulators shall be supplied for all equipment, which cannot meet the specifications stipulated.

b. All BHS Computers and all PLCs for outbound and EDS subsystems for which baggage tracking is required shall employ an Uninterruptible Power Supply (UPS) system(s) capable of storing data for a minimum

period of two (2) hours should a power outage occur. All tracking data shall be stored in the PLCs during a power outage so that when power is restored and the conveyors begin running again, baggage will be sent to the appropriate output.

13. System Design Parameters
    a. The system design shall pay particular attention to the following requirements (listed in random order):
        1.) High throughput capacity
        2.) Energy conservation
        3.) Satisfactory environment
        4.) Operational flexibility
        5.) Component and system reliability (including back-up provisions)
        6.) High storage capacity upstream of merge points and EDS devices to absorb input peaks, etc., without system saturation.
        7.) Multiple flow paths to permit continued operations despite equipment failure or momentary peaks.
        8.) Default capability (anti-grid lock) to ensure that in the case of saturation of any subsystem a back-up and fail-safe alternate process path or discharge point is available (i.e., in no case shall total system saturation occur). The BHS Contractor shall provide "anti-gridlock" software.
14. Environment: All communication and equipment must be capable of functioning in an industrial environment. Where special environmental conditions are essential for correct equipment operation (e.g. computer hardware), such requirements control must be clearly identified in the submittals identified in this specification. Factors such as dust, air contamination, and heat from local sources, abrasives, moving or falling objects, or vibration shall also be considered. Advise of the necessity for these provisions as well as the specific requirements for each system.
15. Responsibility for Supply and Installation
    a. Supply and install all Baggage Handling Control Room and Control System hardware. This includes control consoles and mounting structures for the monitors.
    b. The General Contractor shall supply hardware, which is designated in this specification document to be provided by the Owner.
    c. The BHS Contractor shall be required to coordinate the requirements of the control system elements in the console with the console supplier, the Owner or his representative.
16. Responsibility for Programming
    a. Program the BHS Computers and PLCs for all conveying, sortation, and reporting functions associated with the project. Program the control system interfaces between the BHS and any other interfacing system.
    b. Program all monitoring system functions, associated with the BHS project. These functions shall include:
        1.) The provision of audible and visual system alarms at the workstation(s) (e.g. both on the computer monitor and on the printers).
        2.) Real time reaction to a failure and the capability of choosing alternate paths from the monitoring system.
    c. Programming techniques, data structures, and documentation shall be acceptable to, and approved by, the Owner or his representative. Details of the above shall be made available to the Owner or his representative.
    d. The Owner shall be supplied with the as-built programming documentation for the BHS computers, PLCs or system monitoring computers as follows:
        1.) Two complete (duplicate) CD sets covering all applicable computer, PLC and system monitoring programming documentation.

2.) Two complete (duplicate) sets of hard copy documentation (both programs).

3.) Software for the BHS computer systems as well as the BHS PLC control system including all PLC ladder logic shall be provided in both searchable .pdf format and software versions.

4.) The system software shall be written using as much non-proprietary software as possible.

5.) Delivered software shall include both executable files and fully commented source code for all applications (with the exception of purchased "off the shelf" software). The BHS Contractor shall also include all 3rd party software required to view or edit the source code. If the BHS Contractor wishes to invoke "prior intellectual property" rights and withhold source code for any system software a "software escrow account" for all withheld source code; as well as documentation required to reconstruct the executables, must be established with an reputable escrow service company at the BHS Contractors expense. This software escrow account must provide the Owner access to the source code and documentation for a minimum of 10 years. Access to the escrowed information will be authorized in the event of the BHS Contractors inability to correct design errors in the software, contract default, insolvency or termination of business activities.

17. System Redundancy

a. Failure of primary redundant equipment shall not degrade the response time of the control system for all equipment required to be configured in hot backup mode. In the worst-case scenario where every piece of primary equipment has failed there shall be no impact on system performance whatever the combination of the failure.

b. The BHS shall reconfigure itself automatically after redundant hardware takes control (the secondary system will become the primary, the failed system will become the secondary when it comes back on-line). The switch over handled by the system shall be hot (SAC and MDS) or warm (outbound PLC's) for the reconfiguration. The BHS shall report any hardware failure, power failure, communication loss, etc., raise a critical alarm and inform the maintenance personnel through both display on the text monitor(s) and by an audible alarm.

c. When the system is running on the UPS(s) during a power failure, the BHS shall monitor the UPS(s) battery level, raise a critical alarm and inform the maintenance personnel through display on the text monitor(s) and audible alarm when the battery level becomes critical, this will allow the BHS Control Room operator sufficient time to do a systematic shutdown of the BHS computer system. The system should monitor the state of the UPS at all times to insure that the required power backup functionality is always available, raise an alarm on the MDS if the battery level becomes critical.

d. Backup equipment where provided shall be used as redundant equipment. All hardware, software, networking and system architecture shall comply with the requirements for a redundant system.

B. Computer and PLC Control System Architecture

1. General

a. The Control System Architecture for the Terminal Expansion Outbound BHS and In-line EDS security systems shall be one of centralized PLC design (with centralized or remote I/O) and centralized BHS computer design. The control system will primarily be controlled by new PLCs, these PLCs interface with three types of equipment:

1.) BHS field devices (motors, sensors scanners, encoders, etc.)

2.) MDS computers

3.) Sortation Allocation Computers (SACs).

b. The BHS conveyor control system shall be based on multiple Programmable Logic Controllers (PLCs), interconnected to each other by the BHS low-level data communication highways. The BHS has been designed with two main power feeds i.e. if one power feed fails at least 50% of the bag system will remain in operation with its own redundant PLC

c. Local area networks (high level communications) shall be employed to provide data messaging between the

BHS computers.

d. The BHS computers shall serve four primary functions:

1.) Database processing

2.) Interfacing to the Owner's (and/or Airlines') reservation system

3.) Monitoring of the status of the system

4.) Statistical information storage and presentation i.e. Reports

e. The Control system architecture presented herein is intended to convey the minimum functional system requirements. The BHS Contractor shall consider the following:

1.) Centralizing the entire Owner's outbound BHS computers (primary and warm back up) and PLC equipment at the computer/operation room and utilizing remote and/or centralized I/O.

2.) BHS computer system equipment (primary and hot back-up) located at the computer/operation room and outbound BHS PLCs (configured in warm back-up) and I/O located within the Motor Control Panels.

3.) Utilization of multiple PC based computers.

4.) The BHS contractor shall provide startup warning alarms and sufficient startup delay to comply with OSHA standards on all new and existing conveyors.

5.) The BHS contractor will be responsible for all necessary controls (photoeye, belt tachometers, control stations, etc.) for new conveyors.

2. Baggage System Computer System Functional Description

a. The primary function of the Baggage System Computers is the control of the baggage flow in the BHS. Three modes of operation shall be established.

1.) Level 3 - Primary Operation

a.) Originating: Interface to the Owner's (and/or Airlines') reservation system (host computer system), which shall conceptually provide correlation of flight number to outbound baggage make-up devices from sort correlation tables.

b.) Translation of data received from Manual Encoding Console (MEC).

c.) Translation of data received from the Scanner Arrays (ATR)

d.) Translation of data received from Manual Encoding Hand-Held Scan Gun(s)

e.) Tracking verification.

2.) Level 2 - Primary Operation

a.) Interface between the Flight Correlation Table and the manual encoding station.

b.) The Baggage System Computer: System to provide sort correlation table to determine make-up device. On this basis, the baggage system computer shall determine the proper routing for the bag automatically. Database queries to determine correlation between ten digit tag information and flight details are not performed at this level.

c.) Translation of data received from Manual Encoding Console (MEC).

d.) Translation of data received from Scanner Array (ATR) and Manual Encoding Hand-Held Scan Gun.

e.) Tracking verification.

3.) Level 2 - Back-up Operation

a.) This back-up operation is used when both sortation computers are inoperable and the sortation

must be accomplished through the PLC level.

b.) Interface between Tag Correlation Tables, scanner arrays and the manual encoding stations.

c.) Translation of data received from encoding stations.

d.) Translation of data received from scanner arrays and scan guns

e.) Tracking verification.

4.) Level 1 - Back-up Operation

a.) Interface between the Tag Correlation Tables, scanner arrays and the manual encoding station. Flight or sortation output details are manually entered.

b.) Translation of data received from manual encoding console.

c.) Translation of data received from scanner array (ATR) and MEC scan gun.

d.) Tracking verification.

b. The Baggage System Computers shall also accomplish the following management information system tasks:

1.) Online statistical report generation

2.) Online maintenance report generation

3.) Offline sort table generation

4.) It shall be possible to both view on screen and print any report.

c. Each Baggage System Computer shall be identical in that emulation of any subsystem or function can be accomplished from any workstation.

d. In the case of main power supply failure the system must protect the complete database by means of battery powered data storage, such that re-entry of data is not required after power has been re-established. The battery powered storage system shall give a minimum storage period of 2 hours. The system is to automatically perform a safe shutdown when the UPS registers a low power situation.

e. A simple means to test computers for online capability and subsystem control (if a failure is suspected) shall be provided by means of an operator initiated self-testing routine i.e. using pull down menus. In addition, computers shall carry out automatic self-testing routines each time they are switched on for operation.

f. Provide a means to monitor Computer System Performance. Provide a warning on the MDS when the computer system may be close to a “Gridlock” situation, i.e. less than 20% memory capacity.

g. Processor and data storage capacity shall be sized to permit up to a 33% increase of processing and storage capacity. Further capacity increase shall be possible by addition of expansion modules.

h. The process computers shall have the capability of storing, sorting and processing up to a minimum of one million (1,000,000) current bag tag number records (originating). The BSMs may not be stripped of unused fields but rather stored as issued from the Owner’s (and/or user Airlines’) system.

i. Fallback Procedure: In the event of a baggage sortation controller failure, each outbound subsystem shall be configured in such a manner as to assign any number of associated make-up devices as a default. This will allow for continued operation, despite the loss of baggage tracking and sortation ability.

3. Sortation Allocation Computers/MDS Computers

a. The sortation control system shall comprise all equipment that will be used for the tracking of all baggage input into the system baggage load points through to the make up devices, based on information previously entered by an operator and information dynamically received from the ATRs, manual encode (ME) station or the hand held scanner device.

b. The sortation control system equipment and function shall provide for both visual as well as hard copy fault and production monitoring at the workstation, as noted elsewhere in this section of the specification, for the entire outbound baggage system.

c. Application codes and configuration data shall preferably be executed directly from RAM reads instead of loading from mechanical devices such as hard disk. These application programs stored in the RAM should allow remote access for modification and the ability to download revised codes. Only voluminous operational field switching and status data shall be copied and archived to hard disk.

d. The task of the servers is the data administration on the entire control system. The servers handle the storage and retrieval of configuration data, graphics, and field switching records, BHS status, Flight information, BSM and BPM messages and other databases information. The computer systems require the use of "off the shelf" windows based operating system for both sortation allocation computers and MDS computers.

e. The following applications, as a minimum, shall have their own (hot backup) redundant set of servers:

1.) MDS computers

2.) SAC computers

f. Redundant sortation controller servers shall be located in the baggage control room (BCR) or dedicated server room as directed by the Owner or his representative. These servers form a redundant arrangement with direct link data communication through the cluster with a heartbeat connection. Each set of servers keep identical data (data to include, but not limited to BSMs, Flight tables, sort tables, etc.) so that in the event of a server failure, all data for operations are already resident and up to date with virtually no break except for time required for re-configuration. Failure of either main or backup server shall initiate a critical alarm.

g. A dual redundant file server/ host computer configuration shall be provided for each sortation server set. In normal operation Server 1 will be the master. Should Server 1 fail due to a fault then, Server 2 shall take over control automatically with no loss of data or data integrity. Server 2 will then be the master and once server 1 comes back on line it will become the backup.

h. The redundant servers must be configured as high availability and in any case of failure switchover shall be seamless. The server configuration shall feature hot swappable components (hard drives, fans, power supplies and memory. Data storage shall feature as least the equivalent to RAID Level 5 redundancy.

i. Provide the latest available "state of the art" technology that will fulfill the system performance requirements, at time of procurement for the server hardware:

1.) Hard disk storage shall be sized for storage of minimum 1-years storage of all data records with a 50% spare capacity. This may need to be upgraded from specified minimum at BHS Contractor's cost to cater for the specified archiving needs if found insufficient. The BHS Contractor shall also take into consideration the total BSM messages received per day in sizing the hard disk space required.

2.) Video adaptor card that supports at least 1024x768 resolution at 16 bit colors at refresh rate of 80hz

3.) Monitor: Two –(2) Flat 21" SVGA color monitor supporting all the video card (or Two –(2) 21" Flat Panel LCD Monitors)

4.) Dual processors, minimum of 2Ghz each

5.) Minimum 4 GB RAM expandable to 16 GB

6.) High speed network interface cards (10/100Mbps)

7.) DVD +/- R/W Drive or equivalent

8.) Keyboard and bus mouse.

9.) Dual hot-swappable power supplies with UPS.

10.) Dual hot-swappable fans

11.) All operating systems, diagnostic software, anti virus software, disk management software tools, software drivers for Hard disk arrays, CD-ROM drivers, etc, shall be provided.

j. All computer hardware shall be stored in standard off the shelf computer rack shelving systems that are made for industrial computer component racking.

4. Workstation System and Equipment

   a. The Operator Workstations shall provide the operator interface to the Sortation Control and MDS systems. Operators shall be able to input and update sort correlation tables, including make-up number for each flight, early, current, hot, and late times on a flight by flight or global basis from any workstation. Operators shall also be able to produce statistical reports as specified herein. The Operator Workstations shall also serve as the Operator interface to the MDS allowing operators to monitor the status of the system, respond to faults, configure equipment control, etc. Production of custom reports from the databases maintained by the Sortation and MDS computers shall be possible with the use of off-the-shelf software supplied as part of the system.

   b. The workstations shall require log-on procedures with predefined user names and associated passwords. The workstations shall enable and disable certain functions depending on user name. Each Operator Workstation shall operate independently of the others, however, it shall be possible to determine the status of and users logged on to any other workstation (with appropriate user name and password).

   c. There shall be two (2) Operator Workstations in the control room, each shall be provided with two monitors and other hardware (e.g. CPUs, keyboards, etc.) as described elsewhere in this specification. Each Workstation shall be capable of controlling the BHS. It shall be possible to configure either workstation independently in any of the modes listed below. Switching between modes shall take a maximum of five (5) seconds.

   d. Modes:

      1.) When accessing the MDS application - both monitors acting in concert to graphically display the entire system with a floating pointer between the two monitors. When zooming in on a section of the system, only the monitor that displays that section of the system in the overview screen shall show the larger scale area of the system requested by the operator while the other screen shall remain showing its half of the overview screen. In this mode, a three-line text bar shall appear at the bottom of one of the monitors to display system faults in text. The textual display shall scroll showing the most recent, unacknowledged or uncorrected, highest priority faults.

      2.) When accessing the MDS application - one monitor graphically displaying the entire system and one monitor providing a textual display of alarms. It shall be possible to configure the text display to display alarms based on different sort criteria such as highest priority, unacknowledged/uncorrected, by alarm time stamp, etc. It shall be possible to configure either screen as the text or graphics monitor.

      3.) When accessing other applications - one monitor graphically showing the system status with a five line text bar appearing at the bottom of one of the monitors to display system faults in text. The textual display shall scroll showing the most recent, unacknowledged or uncorrected, highest priority faults. The graphical display shall be that display which was left on that monitor when changing from the MDS application to another application. The other monitor shall provide the display for the application being accessed at the Operator Workstation and the keyboard and mouse shall provide input for the current application. It shall be possible to configure either screen to display the above information.

      4.) When accessing other applications - one monitor providing a textual display of alarms. The configuration of the textual display shall be that configuration which was last defined for the textual display in the MDS application. The other monitor shall provide the display for the application being accessed at the Operator Workstation and the keyboard and mouse shall provide input for the current application. It shall be possible to configure either screen to display the above information.

   e. All aspects of the BHS shall be controlled and monitored by the BHS workstations. The BHS workstation computer equipment shall be housed in workstation type cabinet(s) located in the control room.

   f. The MDS computer system shall be off the shelf, currently supported by the vendor. The type of computer equipment included in the bid shall be clearly identified. It should be noted that the below listed requirements are minimum requirements, all hardware and software to be provided shall be considered to be “state of the art” at the time of the bid award. The minimum hardware specification for the workstations comprises the following:

      1.) Processor: 2.4 GHz or higher.

2.) Minimum 4 GB RAM expandable to 16 GB

3.) Minimum 2 MB Cache

4.) Hard disk drive (HDD): Mirror Fast SCSI-2 hard disk with redundant I/O channel. Minimum of two –(2) devices with each having a minimum storage capacity of 72 GB (10K rpm).

5.) Video adaptor card that supports at least 1024x768 resolution at 16 bit colors at refresh rate of 80hz with support for dual monitor

6.) Two –(2) Flat 21" SVGA color monitor (or Two –(2) 21" Flat Panel LCD Monitors)

7.) High speed network interface cards (100 Mbps or better)

8.) Minimum 2 x 100 MB Ethernet ports

9.) DVD +/- R/W Drive or equivalent

10.) Keyboard and bus mouse.

11.) High Speed Line Printer

12.) High Speed Laser Printer

13.) Built-in I/O should have serial interface ports, parallel interface ports and USB ports.

g. A detailed description of the workstations shall be submitted to the Owner or his representative prior to determining bid award.

h. All operating systems, diagnostic software, anti virus software, disk management software tools, software drivers for Hard disk arrays, DVD/CD-ROM drivers, etc, shall be provided.

5. Workstation Control System

a. The design and operation of the Workstation Sortation Control System is to be modeled after the design and operation as basically described herein.

b. The description of operation and required equipment is provided as a basic guideline and should not be construed as being all-inclusive.

c. The Workstation Sortation Control System software/logic shall be structured on "off the shelf" products that are readily available. The license for these products and any non "off the shelf" software/logic used for this specific baggage sortation control system shall become the property of the Owner. Such Ownership will assure that the Owner will have all logic/software source codes, diagrams, passwords, keys, listings, and all other appropriate documentation to fully maintain and modify this system after the expiration of the Warranty Period.

d. The Workstation shall be protected with a continuously running computer virus protection program. The BHS Contractor shall submit details of the anti-virus protection program (i.e. manufacturer) to the Owner or his representative for approval.

e. To accommodate the normal daily flight schedules, this system shall be capable of running 24 hours a day, 7 days a week, 52 weeks per year. It is understood that there will be periods during the day/night (dependent on the flight schedule) when the BHS system will not be processing baggage to allow periodic maintenance etc. of the computer systems.

6. Workstation Basic Functions

a. All workstations shall house the same software and be interchangeable with any workstation. This process shall be as simple as unplugging one workstation and plugging in the replacement.

b. All workstations (with the correct security level) shall have the ability to program the PLCs

c. The Workstation is composed of multiple computing nodes configured in a redundant, independent arrangement to provide the following basic functions:

1.) Collect data from the PLCs to include in reports and status displays.

2.) Provide Operations and Maintenance Reports, both printed and on-screen, reflecting system status in the areas of the following. It shall be possible to print any viewed message on the screen. Reports shall be capable of selecting and printing weekly, monthly, and yearly updates. Specific report requirements are detailed elsewhere in this specification, however, in general, reports for the following shall be required:

   a.) Throughput (number of bags processed for each subsystem). Selectable in 0 to 60 minute intervals.

   b.) Equipment operating/malfunction performance summary for each subsystem and individual item

   c.) System communications behavior

   d.) Flight and Tag Table information

   e.) Manual encoding report

   f.) Makeup report

   g.) EDS Report

   h.) ATR report (if applicable)

   i.) Day end report (selectable as Print Daily, Weekly, Monthly, Yearly)

   j.) Active flight report

   k.) Permanent flight report

   l.) Sort area assignment report

   m.) Bag tag not found report

   n.) BSM report

   o.) Computer and PLC status report

   p.) Individual PLC status report

   q.) Any additional reporting as required by TSA

3.) Allow access to Sortation Table Menus to:

   a.) Modify Tag Tables (this does not include the ability of editing the BSM database)

   b.) Access 10-digit tag database

   c.) Modify Flight Tag Tables

   d.) Hold and release all flights

   e.) Update late sort devices

   f.) Change flight status (closed, open, re-opened, canceled, etc.)

   g.) Import/Export flight tables

   h.) Filter all available information in an easy-to-understand manner

   i.) All pertinent information held in the Sortation Table Menus shall be reflected in the manual encoding stations during normal operation (fallback mode is the exception).

4.) Display system status and fault conditions on graphic screens, text screens, and printers, indicating the following (this listing is not to be construed as being all inclusive):

   a.) Communications Integrity

   b.) Tach/Shaft Encoder Status: Tach out of limits

   c.) HSVPD Status: Overload, Failed Extended, E-Stopped, Failed at home, Divert All, etc.

d.) Vertical Sorter Status: Overload, Failed Up, E-Stopped, Failed down, Jammed, etc.

e.) Conveyor Status: Timed out, Running, Cascade, E-Stopped, Jammed, Overload, Reversed, etc.

f.) Oddsize Conveyor Status: Timed out, Running, Cascade, E-Stopped, Jammed, Overload, Full, , etc.

g.) BMA Array Status: Array failure, statistics per array. Provide audible fault annunciation at the BHS Computer workstation for any failure that occurs at the BMA array. Failures include photocell failure, tach failure, head failure, etc.

h.) EDS Device Status: Timed out, Failed, Restart, etc.

i.) ATR Scanner Status: Array failure, head failure, statistics per array and per head. Provide audible fault annunciation at the scanner array monitoring system (within the control room) or the BHS Computer workstation for any failure that occurs at the array. Failures include multiplexer switch over, photocell failure, tach failure, head failure, etc.

5.) Monitor PLC I/O to sense bag movement; issue sort directives to PLCs to direct bag movement.

6.) Interface Manual Encode Consoles to accept operator hand scanned and keypad input and drive the MEC display to provide operator feedback for induction of bags into the sortation system.

7.) Interface to hand-held scanners to process 10-digit bar coded tags (in lieu of MEC-entered flight and tag information).

8.) Provide for system re-route/re-configuration.

9.) Allow maintenance and supervisory personnel password protected access to PLC programming software. Provide two (2) levels:

a.) Monitor mode

b.) Program mode

10.) 4-digit baggage tag sortation.

11.) Provide a visual indication (e.g. hour glass) to indicate that the computer processors are processing and are running. Display status of a process or processor that is predicated on another process or processor.

d. Main Menu Options

1.) The following list depicts the menu structure available to an operator from the remote Workstation. Menus are displayed as pop-up windows when the operator presses the associated letter or uses the cursor and enter keys to make choices. The escape key allows one to back out of a menu or dialog box. Some menu choices lead to interactive dialog boxes where the operator may be prompted to enter additional data, i.e., Flight Table information.

2.) Additionally, accompanying text identifies and describes each available Main Menu option. This same text is also to be displayed when corresponding items are chosen from the Help Menu screen.

3.) Main Menu Options and Help Menu Screen. The following are samples of the types of main menu and help menu screens that should be available, the BHS Contractor shall submit to the Owner or his representative examples of the screens that are to be utilized for review and approval:

a.) Using the Keyboard

b.) Utilities

c.) Operations Report

d.) Maintenance Report

e.) Problem Resolution Text

f.) Sortation Tables

g.) Sortation File Utilities

h.) Others as required to provide specified function

4.) Using the Keyboard/Mouse: The workstation system uses the keyboard or mouse to make menu selections and to accept data from the user.

5.) Utilities

a.) The Utilities Menu is a group of commands that are used for general-purpose needs. The options for this menu are noted below:

(1.) Clear all Statistics: Clears ALL of the statistics that are kept by the workstation, the sortation controller(s), and the programmable logic controllers. These statistics are kept on a daily basis. Once they are cleared, they cannot be recovered without a password entry and second level confirmation.

(2.) Change System Date: Used to set the system date on the workstation system.

(3.) Change System Time: Used to set the system time on the workstation system.

(4.) Coordinate System Times: Used to update the system time on all system sortation, computer and programmable logic controllers.

(5.) Change Sort Device: Used to take sort devices, or sort device HDS IN/OUT of service and reassign to alternative sort device.

(6.) Off Line Editor: Used to access the Off-Line Flight Table editor to make changes to the flight tables or add flights.

(7.) Change Alarm Printout Spacing: Used to change the spacing between alarm messages on the alarms printer.

(8.) Exit to PLC Programming Software: Used to exit normal operational mode and enter into a password protected, maintenance function, for PLC programming and diagnostics functions.

(9.) Run Diagnostic Tools: Used to automatically run computer and software diagnostic tools to check on functionality of workstation computers and software.

(10.) Others as required to provide specified function

6.) Operations Reports: The Operations Reports are used to monitor the daily functions of the system. Reports may be printed to the printer or displayed on the screen or can be transferred to a file in CSV format. Specific report requirements are defined elsewhere in this specification.

7.) Maintenance Reports: The Maintenance Reports are used to monitor the status of the pieces of equipment in the system and to diagnose any problems that might arise. Reports may be printed to the printer or displayed on the screen. Specific report requirements are defined in the Management Information System (MIS) section in this specification.

8.) Problem Resolution Text

a.) Problem Resolution Text is a tool to help correct problems that arise with the conveyor system. When a fault occurs, it will have a number next to the description that appears on the system alarm printer.

b.) A selection can be made from the Problem Resolution option on the Main Menu for the appropriate text.

c.) The text will state the problem, followed with the proper primary action that should be taken. As is appropriate, additional actions for correction of the problem will also be listed in the text.

d.) A brief listing of the problems includes the following. However, this listing is not to be construed as being all inclusive:

(1.) Jammed Bag

(2.) HSVPD Jam

(3.) Chute Jam

(4.) Vertical Sorter Failed Down/Up

(5.) Motor Overload

(6.) HSVPD Failed at Home

(7.) Belt Tach/Shaft Encoder Failure (tach out of limits)

(8.) Missing Bag Jam

(9.) PLC Communications Line Failure

(10.) Manual Encode Console (MEC) Out of Service (e.g. Disc. Off).

(11.) MEC Communication Line Failure

(12.) Off-Line Update Failure

(13.) Etc.

e.) Operator shall have the ability to change, edit, and save all problem resolution text.

9.) Override Capability: It shall be possible, through appropriate operator input at the operator workstation to individually override automatic control of a conveyor thereby allowing the conveyor to run despite a sensor or other such failure. An appropriate graphical and text display shall be provided for conveyors in this "override" mode of operation. Override control of security critical components such as diverter to security screening shall require appropriate high level password protection. Any overridden condition of a security critical component shall be prominently annunciated on the MDS. Start up warning and e-stop functionality shall remain intact despite an override condition. Public area conveyors shall not have override capability. Coordinate the specific override requirements and functionality with the Owner or his representative

10.) Sortation Tables: The Sortation Control "Sortation System Tables" menu gives access to the Flight and Sort Assignment Tables for the sortation system, the Owner or other airlines. Using this menu, one can add, edit or delete flights and assign those flights to the system sort devices. In addition to the editing functions, one can also manage the saving and restoring of the Sortation System Tables on the hard drive of the sortation controller.

11.) Sortation File Utilities

a.) The Sortation File Utilities are a set of commands, which can be used to manage the sortation table fields on the sortation controller system. These utilities include the following functions:

(1.) Read Flight Table from ACTIVE: Instructs the sortation controller system to read the Flight Table stored in the ACTIVE initialization record and use it for sortation of bags.

(2.) Write Flight Table to ACTIVE: Instructs the sortation controller system to make current Flight Table permanent and use it in a daily ACTIVE initialization and start-up procedure.

(3.) Write Tag Table to ACTIVE: Instructs the sortation controller system to make the current Tag Table permanent and use it in a daily ACTIVE initialization and start-up procedure.

(4.) Read Flight Table from disk: Instructs the sortation controller system to read the Flight Table from any of hard or floppy disks on any workstation into memory. The operator shall be prompted to select a specific disk drive.

(5.) Read Tag Table from disk: Instructs the sortation controller system to read the Tag Table from any of hard or floppy disks on any workstation into memory. The operator shall be prompted to select a specific disk drive.

(6.) Write Flight Table to disk: Instructs the sortation controller system to write the Flight Table it is holding in memory to any of hard or floppy disks on any workstation. The operator shall

be prompted to select a specific disk drive.

(7.) Delete Flight Table from disk: Instructs the sortation controller system to delete the Flight Table from any hard or floppy disks on any workstation. The operator shall be prompted to select a specific disk drive.

(8.) Flight Schedule Download: Instructs the sortation controller system to download the current flight schedule to any workstation. The operator shall be prompted to select a specific disk drive and to confirm selection.

(9.) Flight Schedule Import: Instructs the sortation controller system to import the current flight schedule to the flight table. The operator shall be prompted to confirm selection.

7. SMS Paging Functions

   a. Provide paging and SMS (text message) functionality to alert staff carrying pagers and/or mobile phones of critical system alarms.

   b. Contractor shall allow for up to 100 different messages to be sent to up to 20 different pagers or mobile telephones for this purpose (pager and telephones by others).

   c. Calls to the pager/mobile phone messaging service shall be automatically initiated within 10 seconds of the fault occurring.

   d. It shall be possible to configure (in the alarm definition table) up to any number of the system alarms to be categorized as one of the 100 different messages referred to above. It shall also be possible to configure up to six different tiers of messaging so that as an example, alarm messages such as baggage jams are sent to operations staff only whereas control failure alarm messages are sent to separate controls staff.

   e. The **Error! Reference source not found.** shall propose the messages, categorizing of alarms and what are the alarms to send to what tiers to the **Error! Reference source not found.** for review and approval.

C. Reservation Network Interface Functional Description.

1. The computer network is based on the utilization of intelligent workstations for check-in counter to flight assignments and make-up device to flight correlation (as well as other functions not related to the BHS). This information shall be downloaded to the BHS control system whenever relevant new information is entered at a workstation.

2. The BHS shall also receive flight schedules and updates to flight departure/arrival times from host computers whenever there is relevant new information.

3. The BHS Contractor shall provide any equipment necessary to interface with reservation network such as but not limited to: computer interface cards, token rings and RS-232 cabling, etc. that is required to connect the BHS computer system to the host network and reservation computer systems.

4. The BHS Contractor shall be responsible to coordinate the specific host and reservation computer network information and requirements with the Special Systems Contractor and the Owner.

D. EDS Security Screening Devices

1. The System shall interface directly with the EDS security screening devices. Allow for the transmission of data pertaining to individual bag security status (e.g. cleared, suspect, etc.). The Control System shall allow for bag routing contingent on security status.

2. Allow for the initiation of an EDS security screening report to be included with the provided MIS reports. The security screening report shall include information regarding the number of bags assigned each security status (e.g. cleared, suspect, etc.), and the resulting bag routing.

E. Building Fire System

1. The BHS System shall interface directly with the building fire system (via the Owner's network). The BHS Contractor shall be responsible to coordinate with the Fire Marshal for the location of all fire zones

and for the shut down of conveyors, fire doors, etc. impacted by a fire alarm.

2. Clearly display alarmed fire zone(s) on the MDS display
3. Provide the ability to override a fire alarm signal if the alarm is proved to not be an actual alarm thereby keeping the BHS operational.

F. Programmable Logic Controller (PLC) Functional Description

1. Provide Programmable Logic Controller(s) (PLCs) for direct interface between all input and output devices in the BHS. Wire emergency stop circuits through mechanical control relays which, when interrupted, will remove all power from the output modules of the PLC.
2. Provide each PLC with an EPROM or similar safeguard to provide memory backup.
3. Provide PLCs with Ethernet capability for connection to external devices, such as workstations, etc.
4. Provide each PLC with a minimum of 35% excess memory or capacity for 25% expansion and each I/O with space for adding 25% more modules.
5. Input/output (I/O) modules shall have a visual indication of the status of each I/O point. The status displayed shall be for both signals input into each I/O module and the output signal from each I/O module
6. Provide a fully annotated printout as well as a software copy of the up-to-date PLC software and program.
7. All PLCs shall employ a battery back-up system capable of storing data for a minimum period of two hours, should a power outage occur.
8. In the event of an emergency stop or a power outage on a subsystem, the PLC shall retain all baggage tracking information such that upon restart of the conveyors, the subsystem shall route bags to the appropriate location(s).
9. Provide primary and backup PLCs. Each of the Owner's Outbound System PLC/subsystem shall be provided with a warm back-up redundant fully programmed PLC, containing the same software/control functions of the respective primary PLC/subsystem. The minimum requirements for primary and back up (Warm back-up) PLC are described in the "Programmable Logic Controller Functional Description" section of this specification.
10. The PLC scan-times for periodic tasks and continuous tasks shall be monitored by the system controls and displayed on the MDS with three different LED indications (e.g., normal, above normal and critical). Above normal and critical PLC scan-time conditions shall be reported to the MIS. MDS and MIS reports shall be available at acceptance testing.
11. The primary function of the Programmable Logic Controllers (PLCs) shall be the control of all conveyors including, but not limited to:
    a. Tracking of baggage on conveyors from shaft encoders and strategically located photoelectric sensors for verification.
    b. Tracking shall be of shift register methodology; the use of FIFO shall not be implemented.
    c. Jam detection
    d. Normal Start/stop routines
    e. Auto-Stop/Auto-Start timing circuits and start-up routines
    f. Actuation of diverters, vertical sorters etc.
    g. Cascade stop control

h. Inch-and-Store control, start/stop routines

i. Control of associated feed conveyors

j. EDS/BHS interfaces

k. Confirmation of bag received on make-up devices

l. Scanner Array/Scan Gun/Manual Encoding Interfaces

m. Statistical reporting to the Owner's host computers

n. Selection of alternate flow paths in the event of a failure

o. Self-diagnostics

12. All PLCs interface modules and I/O cards shall be located in MCP cabinets as specified herein.

13. Commonality of PLC manufacturers shall be maintained utilizing the minimum number of individual models.

14. All BHS equipment associated with the outbound system shall have fully programmed redundant PLCs that are configured in "warm back-up mode". In the event of a primary component failure the warm back up has to be manually switched to become the primary component. Warm Back-up refers to a control component that is concurrently tied into the I/O structure along with the associated primary component. In the event of a primary component failure, the warm back-up component shall retain the latest current status of the related system and shall assume full operation after manual intervention. Up until primary component failure, no output from the back-up unit is transmitted. In the event of a failure, the warm back-up processor shall take over control of the system after it has been manually switched to become the primary component. The configuration of the PLCs shall ensure that all bag tracking information shall be continuously updated to both the on-line as well as the warm back-up unit. Only the on-line PLC shall be controlling the operating baggage system. It shall be possible to reset the failed processor without affecting baggage processing so that the system is once again in a fully redundant configuration. Failure of a processor shall be annunciated at the MDS and Touch Screen Terminal both visually and audibly.

15. Baggage Computer System Level 2 - Back up operation

a. This back up operation is used when both sortation computers are inoperable and the sortation must be accomplished through PLC level.

b. This level must be automatically switched on.

c. When the scanners, hand laser guns or the manual encoding stations input 4 digit fallback tag numbers to the PLCs the following events will occur:

1.) The PLCs will correlate the 4 digit fallback tag data with the pre-assigned destination. This correlation table will be programmable so the destination can be operator selectable.

2.) The PLCs will sort, track and route the bags to its pre-selected destination.

d. Store the flight schedule in the manual encoding console or PLC so that sortation by flight number can be processed if the sort controllers are down.

e. The ability to sort from the manual encoding consoles by makeup number shall be available in the event that the sort controllers are down.

f. In the event that the sort controllers go down, the graphical and textual displays shall show an alarm that displays "PLC Control."

G. Baggage Tracking Verification

1. Sortation System Baggage Tracking Verification

a. The system shall accurately track baggage to its output location. The BHS Contractor is responsible for ensuring the shaft encoder model chosen is applicable to meet the sortation subsystem tracking criteria based on conveyor belt speed/resolution required (i.e. shaft encoders utilized for tracking within an EDS system (slow speed tracking area) may be a different model compared to those required for sortation system tracking (high speed tracking area)).

b. All bag tags read by the laser scanner arrays shall be verified for proper destination. In the event that a bag does not have a proper destination, transport the bag to manual encoding.

1.) If a bag gets out of its respective "tracking window", that bag shall be tracked as an "unknown bag" to the default output (or re-circulation line). The Baggage System Computer System shall generate appropriate fault messages indicating the "unknown bag".

2.) If a bag has been successfully read/encoded but fails to appear at any tracking photocell, that bag shall be identified as a missing bag by the tracking control system. Three – (3) missing bags in succession at the same tracking photocell shall cause the tracking control system to automatically stop the associated conveyors and declare a "missing bag jam". Note that all missing bag occurrences shall be reported regardless if they are singular or multiple occurrences.

2. EDS Baggage Tracking Verification

a. The system shall accurately track baggage in the EDS matrix to its final decision location. The BHS Contractor is responsible for ensuring the shaft encoder model chosen is applicable to meet the EDS subsystem tracking criteria based on conveyor belt speed/resolution required (i.e. shaft encoders utilized for tracking within an EDS system (slow speed tracking area) may be a different model compared to those required for sortation system tracking (high speed tracking area)).

b. All bag tags read by the ATR arrays shall be verified for proper destination (if CAPPS selectee and alarmed they go to level 3).

c. If a bag gets out of its respective "tracking window", that bag shall be tracked as an "unknown bag" to level 3. The Baggage System Computer System shall generate appropriate fault messages indicating the "unknown bag".

d. If a bag has been successfully read by the BMA or tracked from the level 1 device but fails to appear at any tracking photocell, that bag shall be identified as a missing bag by the tracking control system. Three – (3) missing bags at a tracking photocell shall cause the tracking control system to automatically stop the associated conveyors and declare a "missing bag jam". Note that all missing bag occurrences shall be reported regardless if they are singular or multiple occurrences.

e. All baggage dimensioned by the BMA arrays shall be verified for proper destination. If a bag has been successfully dimensioned by the BMA or tracked from the EDS device but fails to appear at any EDS subsystem tracking photocell, that bag shall be identified as a missing bag by the tracking control system. Three missing bags at a tracking photocell shall cause the tracking control system to automatically stop the associated conveyors and declare a "missing bag jam". Note that all missing bag occurrences shall be reported regardless if they are singular or multiple occurrences.

H. Automatic Tag Reader Array (ATR)

1. The Automatic Laser Tag Reader Array (ATR) shall operate without malfunction within a temperature range of 32° F to 122° F (0-50°C) with a relative humidity of 0 to 99% non-condensing. If the scanner array or components cannot operate within this range, provide enclosures with the proper environmental control devices such as but not limited to heating, cooling, ventilation, and filtering of airborne contaminants to provide an operating environment to conform with the manufacturer's electrical, and mechanical requirements. If the enclosures are fitted with access covers that must be removed for maintenance, hinge such covers and utilize integral fasteners.

2. Design the Scanner Array to meet or exceed the Bureau of Radiological Health Safety specifications for Class II laser devices. This project requires the use of diodes for the generation of the laser beam.

3. Consider the accuracy, reliability and maintainability in the selection of the Scanner Array. Make the

Scanner Array (and its major sub-assemblies) of modular design.

4. Design the Scanner Array to be an array of moving beam scanners capable of decoding a minimum of 80 tags per minute being transported at speeds of 400 fpm with a minimum separation of 6" between items.
5. Ensure that the scanner is capable of line (unidirectional) scanning with a 54" height above the top of belt, a throw of 25 to 60", and a 35" depth of field.
6. If the decoders are not contained in the laser head, provide a minimum of two (2) decoders per eight (8) laser heads. Link the decoders directly to the baggage system computer system, local PLC, or remote I/O interface, where applicable.
7. The arrangement of the laser heads within the scanner array provides two heads for top coverage of the field of scan above the conveyor, two additional top heads - one scanning at an angle 45° towards the upstream portion of the system - one scanning at an angle 45° towards the downstream portion of the system, two laser heads (one on each side of the conveyor) to provide side scanning and two laser heads mounted under the conveyor to provide bottom scanning. Provide additional laser heads as needed to achieve specified laser read rates as specified in this document.
8. Each of the laser heads shall be identically equipped to provide single zone optics.
9. Do not exceed error and “no-read” rates of 0.1% and 1.0% respectively.
10. Include the following in the scanner’s standard operating features:
    a. A communications interface modem compatible with a RS232 or RS422 serial port, user selectable.
    b. A selectable baud rate from 9600 to 33600 capable of driving 1,000' of transmission line.
    c. Read heads with Automatic Dynamic Focusing to provide for a larger depth of field as noted above to ensure that baggage tags within the cross section of the conveyor (the field of scan) are successfully read.
    d. Dynamic clamps or other signal enhancing hardware or software on individual read heads.
    e. Visual diagnostics (i.e., CRTs display) at the BHS Control Room to provide maintenance data and statistical information about the scanner array’s performance. Employ either one separate statistical gathering network for all read heads or a single date line for each read head linked to the decoder for this purpose. As an alternate approach, display Scanner Array statistical data at the baggage system computer system.
11. Provide provisions for a laptop computer interface local to each scanner array.
12. Do not allow any single failure to cause a total scan array shut down. However, report multiple failures of reads from a scanner array.
13. Each scanner array shall be divided into 2 sub-arrays (still contained in the same array). Scanner heads 1, 3, 5 and 7 should have their own photocell, shaft encoder, shaft encoder trigger box and multiplexer. Scanner heads 2, 4, 6 and 8 shall have identical equipment to the other half of the array. Scanner head numbering starts at the left bottom head (looking downstream) and is numbered clockwise. Scanner head 7 is upstream of the conveyor break and scanner head 8 is downstream of the conveyor break.
    a. For scanner arrays of greater than 8 heads, coordinate the head numbering with the Owner or his representative.
14. Each multiplexer shall have a dedicated communication port on the sort controller computer. In addition:
    a. In the redundant configuration there will be two (2) communication lines per array connecting to two (2) serial communication ports on the sort controller computer.
    b. The multiplexer host communication port will also be connected to the PLC equipment for fallback sortation (Level 2 - Backup Operation) as described herein.

15. Design the read head array frame to allow for tilt and rotation of individual read heads +30° off axis. In addition, ensure that the mounting frame allows the position of the individual read heads to be shifted +/- 6" off axis whether parallel or perpendicular to the direction of baggage flow. Variations from the above stated requirements will require the review and approval from the Owner or his representative.
16. Protect the laser beam window apertures, where recessed, by a transparent surface-mounted lens cover to facilitate cleaning of dust and dirt. A laser beam window aperture with an integral sealed lens is also acceptable.
17. Equip upward-looking laser units (i.e., below conveyor) with blower units to remove dust and debris from the laser window apertures.
18. The scanner system must be capable of reading bar coded baggage tags as specified herein.
19. Prior to selecting a scanning device, demonstrate that the selected scanner system will successfully read bag tags specified in this section herein.
20. Any proposed alternate bag tag specification differing from that listed above will be subject to review and approval of the Owner or his representative.
21. Scanner Arrays shall be equipped with data reconstruction software or similar enhancement software and shall have been previously installed on at least two other locations for an operating period of not less than one year.
22. Report any Scanner Array failure to the system monitoring system. Also report when ten consecutive no-reads have occurred.
23. All scanner heads shall have the ability to operate in self-card mode for setup and testing of Scanner Array.
24. No scanners shall be set up in self-card mode for normal operation.
25. All scanners shall be configured in the trigger mode of operation. The Trigger mode shall only send one message for each tag read per trigger cycle.
26. The Scanner Array will detect when a photocell or belt tach failure occurs and enunciate the fault condition both at the scanner array locally as well as at the workstation computer.

I. Manual Encoding Console

1. General
   a. The manual encoding console shall be an Allen Bradley model 6181-Touch Screen type (or equivalent as approved by the Owner or his representative). The manual encoding computer shall utilize high performance processors, memory, and additional components based upon currently available technology
   b. Manual encode consoles shall be easily interchangeable/replaced and require no software changes/modifications by maintenance personnel for the BHS computer system/data highway to recognize the replacement.
   c. Locate Manual Encoding Consoles as shown on the Contract Drawings.
2. Design, fabricate and install a manual encoding console for the manual encoding of:
   a. Baggage whose tag was not read by the Laser Scanner Array
   b. Baggage that has lost its baggage tag
   c. Baggage that has unreadable or damaged baggage tags
3. The security levels of the manual encoding stations shall correspond with appropriate security levels detailed in the system workstations. A username and password shall be required to enable manual encoding operations at that station, with different options available to specified users. Appropriate

security features should prevent any failure or unexpected operation causing a partial or complete restart of the console.

4. The manual encoding console is to be configured as follows:

   a. Electrical Requirements

      1.) Power input to be 120 VAC, 60 Hz, single phase.

      2.) Power fluctuations normally experienced in industrial and airport environments shall not adversely affect the operation of the manual encoding console. The manual encoding console must be designed to operate in an airline baggage room environment. Separate condition of the line power feeding the console shall not be required.

      3.) All wires and cables attached to the manual encoding console must be adequately protected.

   b. Data Communications Interface

      1.) Electrical interface to be EIA RS-232C or RS-422.

      2.) Date format shall be bit-serial ASCII and must be able to work with 7 or 8 data bits.

      3.) Baud rate shall be selectable: 9600, 14400, 28800, 36600 or 56,000 baud.

   c. Transmitted/Received Data

      1.) The manual encode console must be programmable to functionally interface with the program in the BHS sortation controller or sortation computer system.

      2.) The manual encoding console shall have a display of a minimum of two lines of 16 characters each.

      3.) Data entry requires a numeric keypad of digits 0 through 9 in addition to the 4 to 8 special function keys to satisfy operational requirements of the BHS sortation controller or sortation computer system.

      4.) In the event that a manual encoding console is being utilized to encode more than one conveyor line, the current line being encoded shall be clearly displayed.

      5.) In the event that the manual encoding console is turned off an audible and visual alarm shall be provided at the MDS.

   d. Environmental Requirements

      1.) The design and installation of the manual encoding console must take into consideration the abusive work environment in which the device must function. The device must be of rugged construction to withstand this environment.

      2.) The manual encoding console must be capable of operating in temperature ranges from 50-110 °F (10 to 45 °C).

      3.) The manual encoding console shall have provisions for interfacing with hand held scanners that would be used to read bar coded baggage tags at the manual encode station. The manual encoding console shall display the numeric information read by the hand held scanner as well as transmit this information to the BHS sortation controller/sortation computer system.

      4.) The manual encoding console is to be supported on a height adjustable, pivoting, swivel, floor mounted pedestal.

   e. Functional Requirements

      1.) Manual encoding shall be accomplished through touchscreen entry of related airline, flight and destination information into the encoding console. As an example: an encoding operator would enter an appropriate airline two-digit alpha or numeric code followed by the flight number into the console. The airline and flight number would be transmitted to the sortation controller/computer, which in turn would then echo back the encoded airline designation and the flight number and the destination served by the specific flight on the encoding console digital display. A “clear key” on the console would permit the clearing of any information that had been incorrectly encoded into the console.

2.) After the display of the flight number, the operator would activate one of the "dispatch keys" associated with the appropriate destination. Activation of the destination related "dispatch key" would start the related encoding queue conveyor so that the bag would be conveyed and merged onto the respective sortation conveyor subsystem for routing to the assigned sort device. It must be noted that activation of the "dispatch key" will also cause the system sortation controller/computer to begin the bag tracking process.

3.) If the manually encoded bag travels through a fixed scanner array, the bag must be tracked so that it is not processed as a "no read" situation by the scanner array due to the potential of the bag not having any machine readable bar coded tag.

4.) The manually encoded bag that travels through a fixed scanner array must not be double counted in the baggage sortation controller/computer system generated baggage reports even if the manually encoded bag has a scannable bar coded tag that is read by the scanner array.

5.) The design of the sortation controller/computer logic shall provide the display of certain operationally critical messages on the manual encoding console touchscreen. While a listing of some of the messages is provided below, the list is not to be construed as all inclusive:

   a.) Adv Bag to Photocell: Displayed whenever a bag has first interrupted the encoding station queue conveyor head end sensor photocell and then has been unblocked.

   b.) Release Pending: Displayed whenever another keyboard entry of information has been keyed in and the previous bag has not been released.

   c.) Bag Already Identified: An attempt has been made to identify a bag that has already been identified.

   d.) Merge Jam: The downstream conveyor is jammed where it merges onto the mainline

   e.) Mainline Stopped: The downstream conveyors are stopped due to a mainline failure

   f.) Shutdown: Prompt user to confirm shutdown of console, logoff user and provide option to cancel shutdown procedure (in the event shutdown button is accidentally pressed)

6.) The manual encode console shall be capable of keyboard entry of:

   a.) 10-digit IATA bag tag number

   b.) Numeric information from special operations tag (makeup tag).

   c.) Airline two or three alpha character code or three digit numeric Airline code

   d.) Flight number, associated flight destination and sector sort location

   e.) Make Up Device Number/Special destination.

7.) Manual Encode Conveyor Subsystem Status

   a.) The touchscreen manual encode console shall also have the ability to graphically display the status of the manual encode conveyor subsystem. The status of individual conveyor segments is color coded (i.e. E-stop - red, Motor Overload - blue, Jammed - yellow, etc.) The status display shall be dynamic, changing colors as the equipment status changes. Graphic display of the manual encode subsystem is enabled by the "Status" key on the touchscreen console. The status display shall be consistent with other system status displays (i.e. MDS).

8.) List Flights

   a.) The manual encode console shall have the ability to display a scrollable lists of flights in the active flight table. The list is a read only (i.e. users are unable to change the contents of the active flight table from within the display). Fast scrollable (by page) and slow scrollable (by individual flight) options shall be available.

   b.) When the flight list is displayed it shall display airline code, flight number, destination city and primary makeup assignment for all active flights.

c.) The flight list can be ordered to sort in two ways:

(1.) Flight: Sort be flight number

(2.) City: Sort by City destination

d.) The above lists shall have the capability of being filtered as follows:

(1.) All: All flight records in the active flight table are displayed.

(2.) 4 HR: Will display active records to all flights that are either on-hold or that will depart within four (4) hours of the current time.

J. Scan Gun

1. All Manual Encode Stations shall be equipped with a hand held laser bar code scanning gun type device for the reading of bar coded baggage tags. The scanning gun shall be Symbol Technologies model number LS4004/RS232 (or approved equivalent).
2. Mount scan guns on a vibration isolated oscillating arm structure. Connect the scanner itself to the arm with an umbilical, spring loaded flexible connector which will allow the operator free and easy access for encoding (similar to a pneumatic system connector used in automotive garages). Ensure that the gun can be retracted from the fully extended position to the home position without damaging the unit.
3. Ensure that the scan gun depth of field is a minimum of 18".
4. Employ a communications link as required to interface with the appropriate PLC and utilize an appropriate baud rate so as to ensure rapid communications with no perceivable encoding transaction delay time.
5. Bag tags shall have machine readable bar codes consisting of a 10-digit code or 4-digit code. Therefore, the scanners supplied shall be capable of reading bag tags with bar codes having specifications as described elsewhere. Any proposed alternate bag tag specification differing from that listed above will be subject to review and approval of the Owner or his representative.
6. Prior to selecting a scanning device, demonstrate that the selected scan guns will successfully read the various configurations of bag tags.

K. Baggage Dimensioning Device

1. General

a. The Baggage Dimensioning Device shall operate without malfunction within a temperature range of 15° F to 120° F (-10 to 50°C) with a relative humidity of 0 to 90% non-condensing. If the Baggage Dimensioning Device or components cannot operate within this range, provide enclosures with the proper environmental control devices such as but not limited to heating, cooling, ventilation, and filtering of airborne contaminants to provide an operating environment to conform with the manufacturer's electrical, and mechanical requirements. If the enclosures are fitted with access covers that must be removed for maintenance, hinge such covers and utilize integral fasteners.

b. Type of Baggage Dimensioning Device selected shall be UL listed and CE compliant.

c. Consider the accuracy, reliability and maintainability in the selection of the Baggage Dimensioning Device. Make the Baggage Dimensioning Device (and its major sub-assemblies) of modular design.

d. The Baggage Dimensioning Device must be capable of sizing length, width, height and volume of any item with the baggage characteristics specified within Part I of this specification regardless of the orientation of the item on the conveyor belt.

e. Design the Baggage Dimensioning Device capable of accurately sizing a minimum of 80 items per minute being transported at speeds of 400 fpm with a minimum separation of 3" between items.

f. The Baggage Dimensioning Device shall accurately size 99% of all items that pass through the array. Any

item that is detected by the bag present photocell but not sized by the Dimensioner shall be treated and acted upon as an out of gauge item by the BHS.

g. Submit to the Owner or his representative the Baggage Dimensioner system control, interface and redundancy procedures for review and approval.

h. The continued operation of the Baggage Dimensioning device is very critical to the operation of the BHS for this project as such, do not allow any single failure to cause a total Baggage Dimensioning array shut down, i.e. there shall be a fully automatic redundant "Hot Back-up" dimensioning device, photocell, photo cell array, belt tach etc.

i. The Baggage Dimensioning system will detect when a photocell or belt tach failure occurs and enunciate the fault condition both at the dimensioning array locally as well as at the workstation computer. Report any Baggage Dimensioning Device failure to the BHS system monitoring system.

j. Provide as a minimum a RS232 or RS422 serial port, user selectable.

k. The type of belt tach selected shall be shaft mounted.

l. Provide provisions for a laptop computer interface local to each baggage-dimensioning device.

m. Supply appropriate communications software for the collection and analysis of statistical data for maintenance purposes. Provide to the Owner or his representative copies of all operating and diagnostic programs.

n. The types of Baggage Dimensioning that are acceptable for this project are:

1.) Over the Belt Type Dimensioner

2.) Light Curtain Type Dimensioner

o. Prior to selecting a Baggage Dimensioning Device, demonstrate to the Owner or his representative that the proposed baggage dimensioning system will successfully size all items as specified above.

2. Over the Belt Type Dimensioner

a. Design the Baggage Dimensioning Device to meet or exceed the Bureau of Radiological Health Safety Specifications for Class II laser devices.

b. Protect the laser beam window apertures, where recessed, by a transparent surface-mounted lens cover to facilitate cleaning of dust and dirt. A laser beam window aperture with an integral sealed lens is also acceptable.

c. To prevent the possibility of two items that are touching each other being sent to the sortation system, the Baggage Dimensioning array shall be able to detect multiple bags (one or more with wheels that are touching (seen as one (1) object) and treat them as an out of gauge item (regardless of actual length measured). In lieu of a single photocell to detect bag present the use of a 12" photocell array mounted in a gap in the conveyor sideguard is acceptable.

3. Light Curtain Type Dimensioner

a. Break in the conveyor bed section and side guard shall be a maximum of one (1) inch.

b. The device frame shall be installed/supported by a very stable platform.

c. Equip upward-looking array (i.e., below conveyor) with blower units to remove dust and debris from the window apertures

L. Coded Baggage Tags

1. General Requirement

a. The bar coded baggage tag format shall comply with applicable recommendations of IATA/ATA Baggage Working Groups, where such recommendations exist. Baggage tags shall be of the man readable and machine-readable demand printed type. On-demand tag printing systems and equipment, and baggage tags shall be provided by the Owner and will be consistent with IATA/ATA recommendations regarding baggage

tag type and format.

b. For the machine readable portion of the baggage tag, a bar-code symbol shall be used comprising two identical bar code patterns set at a 90° angle to each other (in an orthogonal format) to maximize read rate at the scanner location. The bar code shall use the Interleaved 2-of-5 code, with ten (10) numeric characters, with a width ratio between wide and narrow bars not exceeding 2:1, and with a narrow bar width not exceeding .020".

c. The scan guns provided at the manual encoding stations shall be able to read the bar code format described in this section as well as the small, peel off bar codes found on most bag tags typically used for baggage reconciliation.

2. Baggage Tag Format

a. 10 Digit Bar Coded Baggage Tag

1.) The 10-digit bar coded tags shall be of the on-demand printed type, employing ten (10) numeric characters and shall be of the self-adhesive or cohesive strap type. Bag tags may be of the direct thermal or thermal transfer type. Tags shall incorporate a tag number, information area, routing area, an identification/claim portion (except expedite tags), and removable stubs. The man-readable part of the tag shall contain information such as the flight number, three letter destination code and passenger name. Other optional information may be printed as required in man-readable form, such as intermediate transfer station three letter codes.

2.) Bar Code Construction

a.) It is intended that the Uniform Symbology Specification (USS) for Interleaved 2 of 5 published by Automatic Identification Manufacturers, Inc. (AIM) be used as the base specification for bar coded baggage tags. This specification is available from AIM affiliates in Europe, Japan, the Pacific, and the USA. One deviation from the USS 2 of 5 specification is described as follows:

(1.) Since it is the desire of the airline industry to accommodate the widest range of scanning equipment, the specified wavelength band should extend from 630 -670 nanometer (nm). This shall allow the use of laser scanners based either on Helium-Neon technology, or solid-state laser diodes.

(2.) Note: The USS Interleaved 2 of 5 specifications only requires that reflectivity measurements be made at 633 nanometers.

b.) Large sortation/identification bar code (both on-demand and preprinted tags) shall conform to the following specifications (large sortation/identification bar code shall be readable via fixed laser array and hand held scanner):

(1.) The symbology used for large sortation bar code shall be the Interleaved 2 of 5 type.

(2.) The width of the face material shall be 2 inches (50.8 millimeters).

(3.) The narrow bar (element) size shall be .020 inch (0.508 millimeter) with an acceptable tolerance of plus or minus 5 percent. The wide element to narrow element ratio shall be no less than 2:1.

(4.) The text height (bar code height) shall be 1.88 inches (48 millimeters).

(5.) The quiet zone, as measured on the face material, shall be a minimum of 7 times the width of the narrow bar element (.140 inch, 3.56 millimeters). A quiet zone 10 times the width of the narrow bar element is preferred (.200 inch, 5.080 millimeters).

(6.) Bar code orientation may be horizontal, vertical, or orthogonal (both). The orthogonal configuration is preferred for a higher read rate.

(7.) The print contrast signal shall not be less than 80 percent when measured at 633 nanometers.

c.) Small identification bar code (both on-demand and preprinted tags) shall conform to the following specifications (small identification bar code shall be readable via hand held scanner):

(1.) The symbology used for small sortation bar code shall be the Interleaved 2 of 5 type.

(2.) The width of the face material shall be 2.00 inches (50.8 millimeters).

(3.) The narrow bar element size shall be .010-.015 inch (0.25 - 0.38 millimeter). The ratio between wide and narrow elements shall be between 2.2:1 and 3:1.

(4.) Tag text height (bar code height) shall be a minimum of .254 inch (6.35 millimeters).

(5.) The quiet zone, as measured on the face material, shall be a minimum of 7 times the width of the narrow bar element (.070 - .105 inch or 1.778 - 2.667 millimeters). It is preferred that the quiet zone be 10 times the width of the narrow bar element (.100 - .150 inch or 2.54 - 3.81 millimeters).

(6.) Bar code orientation may be horizontal, vertical, or orthogonal (both). The orthogonal configuration preferred.

(7.) The print contrast signal shall not be less than 80 percent when measured at a wavelength of 633 nanometers.

b. 4 Digit Sort Information (Fall-Back Tag) (Device Number Tag) (Special Operations Tag)

1.) The bar coded baggage tag utilized by a number of the Owner/user airlines shall contain the bags flight/makeup number encoded in the machine-readable portion of the tag.

2.) This tag is of the man/machine-readable type employing a minimum of 4 and a maximum of 10 digits. The purpose of the tag will be to provide direct coding to a number of individual and future system destinations as follows:

a.) Any outbound make up device

b.) Problem bag resolution area

c.) Lost bag/storage area

d.) Manual encoding

3.) The bar code is printed in an orthogonal pattern with 40 mil bars in an Interleaved 2 of 5 formats.

4.) Tag stock and bar code print quality are to conform to ATA/IATA standards.

5.) In the event that a different number of characters are used for the tag (compared to the standard IATA sortation tag), ensure that the scanner system is capable of differentiating between the two types of tags. Also ensure that no possibility exists for a scanner to misinterpret, for example, a partial scan of a 10-digit code as a valid scan of a 4-digit code. Provide the sort table with the capability for the entry of ten (10) special function tags and their destinations.

6.) 4 Digit Sort Information shall have priority over all other tags in any instance where the fall back tag and any other type of tag are read at the same time by the ATR.

M. Baggage Source Message (BSM) Data and Format

1. General

a. The BSM is a computer-to-computer message designed to provide information for processing of baggage by automated baggage systems.

b. The Owner shall generate a Baggage Source Message (BSM) in accordance with the latest version of IATA Recommended Practice 1745. The messages are sent, received and processed those systems in order to achieve automated baggage sortation, passenger and baggage reconciliation, and other baggage services.

c. Baggage information included in these messages is linked with the unique 10-digit bag tag number defined as the License Plate (refer to IATA Resolution 740).

d. The BHS Contractor shall be responsible for obtaining a copy of the latest versions of the IATA Recommended Practice 1745 and IATA Resolution 740 and conforming to the format requirements

contained within.

e. The BSM will normally be sent as a result of a check-in transaction, which may be local, on-line through check-in or on receipt of an Edifact (interline) through check-in message.

2. Type:

a. Version 1

1.) Within each message section, elements and data items are shown as either mandatory, conditional, optional or not used.

a.) Mandatory (M) – shall be included in the message

b.) Conditional (C) – shall be included in the message if specified conditions are met

c.) Optional (0) - may be included at the discretion of the Owner. The BHS Contractor shall be responsible to coordinate with the Owner for the Optional Elements

d.) Not Used (N) – data item shall not be used

3. Standard Message Handling

a. The sortation system must be able to receive and react to all standard messages. Examples are BSM; BPM; BNS; BUM and BPM. The system shall have the ability to process BSMCHG and BSMDEL messages.

4. Applicable BSM Data

a. All element fields contained within the received BSM shall be retained for sortation and report generation purposes (for present or future owner requirements).

b. All BSM data elements must be retained in the BSM database. The BSM database shall have the ability to record that a duplicate BSM has been sent e.g. two (2) or more BSMs referencing the same tag number (add/delete excluded).

c. The BSM must be time stamped upon receipt by the BHS sortation computers. The time stamp shall be included in the BSM database.

d. In the case of a queue, the locally generated BSMs shall be processed first.

e. All actions of a bag (identified by the BSM) must be recorded as a Baggage Processing Message (BPM). This shall include, but not be limited to, pushed bag, scanned bag, manually encoded bag, arrived bag, etc.

5. BSM Elements

a. The BHS shall look into the dot element to determine the correct sortation for each bag.

b. The system shall have the capability to sort baggage by any of the following BSM elements/fields including those designated as “Optional”:

ELEMENT	TITLE	MESSAGE EXAMPLES	BSM	BPM
	STANDARD MESSAGE IDENTIFIER (SMI)	BSM; BPM; BUM; BNS; BCM	M	M
	SECONDARY LEVEL MESSAGE IDENTIFIER	BAM; FRO; FCM; DBM; LSM	N/A	N/A
	CHANGE OF STATUS INDICATOR	CHG or DEL	C	N/A
.A	MESSAGE ACKNOWLEDGEMENT DETAILS	.A/QF006097/BSNVACK or .A/LH3730024/BSM/NAK/FLT DEPARTED	N/A	N/A
.B	BAGGAGE IRREGULARITIES	.B/OFF0220001123456/	N/A	C

.C	CORPORATE OR GROUP NAME	.C/SITA TOUR	0	0
.D	UNUSED	N/A	N/A	N/A
.E	BAGGAGE EXCEPTION DATA	.E/RUSH	0	0
.F	OUTBOUND FLIGHT INFORMATION	.F/LH127405MAY/JFK/F	C	C
.G	UNUSED	N/A	N/A	N/A
.H	UNUSED	N/A	N/A	N/A
.J	PROCESSING INFORMATION	.J/R/43S/12OD32/02APR/1545L/B2	N/A	0
.K	DEFAULT MESSAGE PRINTER	.K/69C626	0	0
.L	AUTOMATED PNR ADDRESS	.L/QRE7Q6	0	0
.M	UNUSED	N/A	N/A	N/A
.N	BAGGAGE TAG DETAILS	.N/0001123456002	M	C
.O	ONWARD FLIGHT INFORMATION	.O/UA423/02APR/DEN/F	C	0
.P	PASSENGER NAME	.P/ISMITH/HM	0	0
.Q	LOAD SEQUENCE NUMBER	.Q/023	N/A	C
.R	INTERNAL AIRLINE DATA	.R/FREE TEXT	0	0
.S	RECONCILIATION DATA	.S/Y/23A/C/234/333/Y	C	0
.T	BAGGAGE TAG PRINTER ID	.T/221322	0	N/A
.U	LOADING DATA	.U/AVE12345NE/11R/T/Y/NRT/Y/ .N/009/04MAR/SEL	N/A	0
.V	VERSION AND SUPPLEMENTARY DATA	.V/ITYYZ/PARTI/1234567890/A	M	M
.W	PIECES AND WEIGHT DATA	.W/K/2/38/8 or W/L/2/84/16 or .W/P/3	0	N/A
.X	BAGGAGE SECURITY SCREENING	.X/LEVELI; X/HANDSEARCH; .X/XRAY; etc.	0	0
.Y	FREQUENT TRAVELLER NUMBER	.Y/BXJ2238	0	0
.Z	UNUSED	N/A	N/A	N/A
	END OF MESSAGE IDENTIFIER.	; ENDBSM; etc.	M	M

6. BSM Retention

   a. The BSM data shall be retained until such time that the possibility of a duplicate bag tag number is minimized. The retention time shall be configurable by the System Manager, default set to 72 hours. After this period BSMs shall be retained in a historical database for a period of 30 days, operations and maintenance personnel shall have access to the historical data for customer baggage reconciliation etc.

   b. The System Manager responsible for baggage operations shall control manual or automated deletion of the BSM message. The system shall provide flexible controls such as deletion of BSMs based on their age in hours within the BSM database or the check in location.

7. Quality Control Displays

   a. The Owner shall also be able to monitor at the MDS the BSM database as follows:

      1.) Distribution of check-in time with date.

      2.) Receipt of the BSM by the sort computer with time and date.

      3.) Frequency of duplicate BSMs, with breakdown by originating station.

8. "Dot Element" Additional Requirements

   a. The following descriptions of "dot element" BSM information are listed below. However, with the consideration that further improvements or modifications may be implemented, this should not be construed as an all-inclusive list of parameters.

      1.) . S, .F (Standby Passenger Information)

         a.) The sortation computer must have the ability to translate the information within the .S and .F fields to determine if the bag is for a standby passenger. The system must also be capable of sorting all standby passenger bags to a specific sortation makeup (to be assigned at any workstation). All workstations must include the ability to view an overall summary and specific details about these bags, as well as print out the summary. Sortation of standby passenger baggage shall be by flight with the ability to assign each flight to a separate makeup. A report shall indicate the amount of standby bags for each flight and the makeup to which they were sorted.

      2.) . X (Baggage Security Screening Information)

         a.) The sortation computer must have the ability to translate the information within the .X field and verify the contents to determine if the bag requires additional security screening. The system must also be capable of sorting all security-screening bags to a specific sortation makeukp (to be assigned at any workstation). The system shall check the data immediately following the .X field. If the system sees .X/SEL then the system shall route the bag to the security pier (if defined). If the system sees any other information following the .X field, the bag shall not be routed to the security pier. The BPM message shall not be changed as a result of the modification. All workstations must include the ability to view an overall summary and specific details about these bags, as well as print out the summary. The BHS system must not base sortation upon whether or not the .X field is populated, but rather make decisions based upon information held within the .X field message. This programming shall effect the system decisions if/when the bag is re-read at scanner arrays (if applicable) or manual encoding stations based upon whether or not it needs to be sent through a secondary screening device and whether or not it has already been sent through a secondary screening device. The BHS contractor shall be responsible to insure that all bags assigned to a secondary screening process are sorted to the correct screening destination, and following the screening that all bags are sorted to their final destination.

      3.) . O (Outbound Flight Information for Down line Destinations – "Through-Flight" Logic)

         a.) The sortation computer must have the ability to translate the information within the .F field to determine the down line destination information and provide the ability to sort within defined parameters (assigned by the Owner or his representative) set at the workstations.

            (1.) All workstations must include the ability to view an overall summary and specific details about these bags, as well as print out the summary.

N. Network

1. General

   a. The BHS high-level and low-level data communication networks specifications and requirements as mentioned in this specification are written based on the best hardware, software and network concepts/designs that are available in the market today. It is the responsibility of the BHS Contractor to install the latest and best hardware, software and network concepts/designs that is available in the market at the point of installation.

b. The BHS Contractor shall provide the Owner or his representative with the following information with regards to the network design issues at the point of bidding:

1.) Performance of the network

2.) Security: No single point of failure

3.) All the protocols to be used

4.) Quality of service in terms of bandwidth management

5.) Installation and site management

6.) Evolution of the network devices

7.) Knowledge transfer

8.) Network architecture and design

2. High Level Network

a. The BHS high-level network is a critical component that powers the information and application infrastructure. Therefore, it shall be designed to be fully resilient with high requirement for good network and information security.

b. The BHS high-level network shall be designed to have good security, high performance, fully fault tolerant and compliant to open standards. The security measure shall address security at the port level, network equipment protection, network access protection through a combination of Virtual Private Network and Firewall, access to mission critical application and authentication mechanism used by mission critical applications. The performance and resiliency of the network design shall provide a completely reliable network where equipment or physical links failure should not cause or disrupt the availability of the network. It is also mandatory for the network to be based on open standards that are established, as this will ensure that the network is always able to accommodate newer equipment with superior performance when available. In addition, the use of IP addresses on the networks shall be well managed.

c. Protection against virus and trojan programs is extremely crucial to ensure minimal disruptions. Hence, there shall be anti-virus and content checking protection for all entry and exit points on the network. These security protections shall be installed at every interface that links to the network and also protect points of entry and exit for all LANs that hosts critical applications. The BHS Contractor shall submit details of the virus protection program (i.e. manufacturer) to the Owner or his representative for approval.

d. The network shall also be a fully resilient network and every measure shall be taken to ensure that the network availability is at its highest possible. In order to accomplish this provision of multiple source of electrical power supply, unlimited power protection, multiple routing of network cables inclusive of optical fiber, high availability network equipment and intelligent use of load balancing hardware shall be necessary.

e. The main network equipment for the network backbone shall have no single point of failure. There shall at least be two (2) network switches for the network backbone. There shall be multiple links between the network switches in a manner that failure in one (1) network link shall not disrupt the entire network backbone. In addition, each link shall use link aggregation technology, which is also known as port trunking. Through link aggregation, multiple physical links shall be grouped to work, as one (1) logical link and loss of a physical link shall not disrupt the logical link.

f. The optic fiber cables that form the main backbone shall not have the same cable-laying route and shall be routed a minimum distance of 15 feet apart from one another. This shall ensure that in the event of cable mishap all optic fiber cables that form the backbone will not be lost.

g. All network cabling (UTP and fiber optic) shall be carried in conduits and none shall be laid in an unprotected manner. This shall ensure that pests do not attack unprotected network cables.

h. All network cables should be clearly marked for easy connection tracing.

i. Network Switches

1.) The network switches for the backbone shall have the following features:

a.) Good use of high performance Application Specific Integrated Circuits (ASIC) chips for high performance switching and routing

b.) There shall be no single point of failure in the hardware design of the network switch

c.) The network switch shall have a chassis that accommodate multiple slots

d.) There shall be a hot standby for the Supervisory modules in the network switch

e.) All modules and power supply shall be hot pluggable

f.) No degradation of performance when gathering switching statistics

j. Workstations and PLC ports shall belong to all LANs because they need to speak to all application servers.

3. Low Level Network

a. For the BHS low-level network use a Data Communications Highway (DCH) (or approved equivalent) as an industrial network to link together distinct, remote stations. Each station may consist of a programmable controller (PLC), a computer, or an intelligent RS-232-C device (interface module). The DCH shall provide high-speed communication and fast data acquisition. It shall be of rugged construction and well suited to a bagroom environment.

b. The central trunkline of the Data Communications Highway shall consist of adequate cabling capable of high-speed inter-communication between up to 200 devices via interface modules. The central trunkline shall have the capability of being up to 15,000' long, with the remote stations being as far as 100' away from the trunkline. The network shall display a high degree of noise immunity and rejection from electromagnetic and radio frequency interference (EMI/RFI).

c. The DCH shall utilize a time-sharing method of communication control, thus eliminating the possibility of any one-interface module from dominating the network. The DCH shall allow for inter-communication of many types of ASCII devices, including, but not limited to:

1.) PLCs

2.) Maintenance Terminals

3.) CRTs/Displays

4.) Computers

5.) Printers

6.) Modems

7.) Hand Held Bar Code Laser Scanner Guns

8.) Manual Encoding Consoles

9.) Fixed Bar Code Scanner Arrays

d. For the communication use a synchronous data stream from one interface module to another or to the primary baggage system computer, and provide data transfer, message acknowledgments, and error recovery. The data shall refer to ladder rungs; register data, I/O status, and other information.

e. Provide RS-232 D-shell connectors with captive retaining screws, “D” concentric twist-lock twin-axial connectors, or approved equipment. In any case, ensure that they provide easy connection to control and interfacing devices, and display a high degree of noise immunity and rejection from EMI/RFI.

f. Ensure that expansion may be accomplished by interface module-to-interface module linking with no limit.

g. Use standard protocols with error recovery on all DCH transmissions for error checking.

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

i. Provide repeaters as required along the length of the communications highway to boost signal strength.

j. Provide data ports at strategic points on the communications highway to allow for system monitoring by

personal computers.

k. At a minimum, configure the DCH as a ring or provide redundant trunkline to ensure a single break in the trunkline does not render the system inoperable.

l. Network Architecture

1.) ControlNet (or approved equivalent) may be installed as an industrial network to link together and provide high-speed communications between distinct remote components of the (outbound) BHS. The network must have a maximum scan time of 0.5 ms and be capable of receiving, processing, and transmitting information within 50 ms or as required to facilitate baggage tracking. The network must be capable of operating in a warm backup configuration without any degraded functionality. The optic fiber cables that form the main backbone shall not have the same cable-laying route and shall be routed a minimum distance of 15 feet apart from one another. This shall ensure that in the event of cable mishap all optic fiber cables that form the backbone will not be lost

2.) A communications bridge (for example ControlLogix Gateway (or equal)) must be incorporated to provide interfacing between distinct communication interface modules. This bridge must be capable of providing a link between the High Level network (BHS computers, Owner and/or user Airlines' reservation system, etc.), Data Communication Highway, and the BHS control network (PLCs etc).

3.) The network communication speed must not be less than 5 M bits/sec. The network architecture should be designed to optimize data transfer between network devices to fulfill the required time constraints.

4.) At a minimum, shielded cable shall be used as the physical media to connect components of the network. Cable must be capable of normal use in high noise environments. NEMA approved cable taps, connectors, and adapters suitable for use in a bagroom environment must be used. Fiber optic cable should be used wherever possible.

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

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

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

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

9.) An Allen Bradley redundant ControlNet system (or equivalent as approved by the Owner or his representative) must be utilized.

10.) Network switch must be the Owner approved Cisco switch No more than 32 I/O points may be assigned to each I/O module.

O. Maintenance Diagnostic System (MDS)

1. Provide a centralized diagnostic system for use by trained operations and maintenance employees to accomplish the following:

a. Display and locate any system malfunction or failure through text or graphic simulation of the entire system and text display.

b. Visually monitor the sortation system operational configuration, including conveyor flow direction, operational status (On/Off/E-Stop/Overload, etc.) and operating mode (cascade, indexing, etc.).

c. Isolate location and cause of equipment failures.

d. Initiate fallback procedures. (Submit fallback procedures to the Owner or his representative for approval).

e. Display status of fire/security doors (open, closed, malfunctioning, etc.).

f. The MDS system designed and installed by the BHS Contractor shall be such, that the Owner's maintenance personnel can easily modify/add subsystems, display faults, modify/add reports etc. in the event that additional/modified subsystems are installed as part of any future project (i.e. very user friendly).

2. Use the BHS Computer System to run this application.

3. The diagnostic monitors shall identify the following conditions (this listing is not to be construed as being all inclusive):

   a. Emergency Stop Actuated (identify location)

   b. Motor Overload Tripped (identify location)

   c. Excessive actuation time of a conveyor sensor (other than in a normal queue/accumulation condition) to identify a probable jam condition or similar operational problem (identify location).

   d. Photocell failure (identify location)

   e. HSVPD not in home position (identify location)

   f. Vertical Sort Conveyor not in home position (identify location)

   g. System configuration (Mode Of Operation)

   h. Operational status

   i. Failure of tracking encoder/pulse generator

   j. Over Temperature Warning for any computer or PLC cabinets

   k. Fire Alarm System Faults (if the BHS is tied to the fire system for local code compliance)

   l. PLC Failure (identify location)

4. System Graphic Screens

   a. Each of the two (2) workstations shall have a minimum of two (2) 21" system graphic monitors or more as required that shall accurately and clearly depict the entire BHS.

   b. The graphics screen shall display, in near real time, dynamic pictorial format, the operational status of individual conveyors and sort devices that are connected to the sortation control system and system programmable logic controllers. Framed icons and specific conveyor I.D.s representing the conveyor sections shall change color according to the following scheme. This shall immediately highlight problem areas so that the problems that arise may be corrected in the minimum amount of time.

Condition	Color
Normal Running Mode	Green
E-Stopped	Red
Fire Alarm	Flashing Red
Over Temperature	Flashing Red
Communications Loss (Individual Components)	Red
Jam	Yellow
Overlength/Overheight	Flashing White
Motor Overload	Blue
Cascade Stopped	Magenta
Timed Out	Black
Out of Service	Brown
Failed at Home	Yellow

Vertical Sort Conveyor Failed Up	Yellow
Vertical Sort Conveyor Failed Down	Yellow
Divert All	Flashing Green
EDS Device Failure	Red
BHS/EDS Interface Fault Condition	Flashing Red
Data Communications Error	Yellow
Shaft Encoder Fault	Cyan
Added Bag Fault	Yellow
Oddsize Running Mode – Forward or Reverse	Green with Arrow indicating direction of travel
Oddsize Pier/Conveyor Full	White
Fail Extended	Yellow

c. Graphics Manipulation

1.) The system operator shall have the capability to zoom in on any portion of the BHS on any of the two graphics monitors.

2.) Each portion of the BHS, split between the two screens, shall have predefined sectors for the purposes of the dynamic zoom function. Once selected, the individual conveyor shall be displayed in greater detail, with all functionality as described previously, such as color depiction of conveyor status. In addition, textual descriptions of all related status shall be displayed (i.e., motor disconnect on/off, motor starter normal/overload, conveyor running/E-stopped/ cascaded/jammed/ timed out, etc.).

3.) In the zoom steps, the overall system normally displayed on that associated graphics monitor shall be shown on a reduced scale in the corner of the screen with the zoomed sector shaded for reference. This reduced display shall disappear upon return to the overall system display.

4.) A single keystroke or mouse click shall return the operator to the previous zoom display.

5.) Should one graphics monitor fail, the second shall display the entire system with all zoom functionality as described above by means of an operator initiated command on the textual operator interface monitor.

d. Text Monitoring

1.) It shall be possible to configure the MDS application at the BHS workstations to provide system status in text format.

2.) In a manner similar to the graphic screens, the text format shall use dynamic text to represent conveyor sections status. The fields next to the conveyor I.D.s noted above change color and value according to the following scheme:

Condition	**Color**	**Text Displayed**
Normal Running Mode	Green	Running
E-Stopped	Red	E-Stopped
Fire Alarm	Red	Fire Alarm
Over Temperature	Red	Over Temperature
Communication Loss	Red	Communication Loss
Jam	Yellow	Jam
Missing Bag Jam	Yellow	Missing Bag Jam

Overlength/Overheight	White	Oversize
Motor Overload	Blue	Overload
Cascade Stopped	Magenta	Cascade Stopped
Timed Out	Black	Timed Out
Out of Service	Brown	Out Of Service
Failed at Home	Yellow	Failed Home
EDS Device Failure	Red	EDS Failure
Communication Error	Yellow	Communication Error
Fail Extended	Yellow	Failed Extended
Divert All	Green	Push All
Added Bag Fault	Yellow	Added Bag Fault
Oddsize Forward Running Mode	Green (with arrow)	Running Forward
Oddsize Pier/Conveyor Full	White	Full
Shaft Encoder Fault	Cyan	Shaft Encoder Fault

e. Large Screen Graphics Display System

1.) The BHS Contractor shall provide as a minimum, 1 wall mounted "flat screen" video monitor. The size of each screen shall be 40-inch minimum (measured diagonally) and will be adequate to ensure legibility of screen contents from all viewing locations within the control room. The monitors can be either burn-in resistant LCD or Plasma with burn-in protection. The monitors shall display in real time, dynamic pictorial format, the operational status of the conveyors and sort devices for the entire Portland International Jetport Outbound Baggage Handling Systems (no zoom capability).

2.) The BHS Contractor shall supply and install all hardware, appropriate framing, necessary mounting provisions, software, cabling, etc necessary for the complete installation of these units, including, where applicable, suitable equipment enclosures.

3.) The actual screen layouts presented by the monitors will be selected by Control Room personnel from any of the workstations, and will be capable of displaying graphic or text images that are selectable and different than those displayed in the Workstation Monitors. It shall also be acceptable for the BHS Contractor to provide a separate controller specifically for the large screen display in lieu of having any of the workstation monitors providing control.

4.) The monitors shall be able to display either full system status screens (equivalent to a "mimic" panel sometimes used in large BHS control rooms), for instance displaying the graphics image from one of the Operator Workstation Monitor graphic displays.

5.) The display quality shall permit easy identification of screen contents from all areas of the Control Room from which viewing is possible, under all conditions of ambient lighting of the Control Room environment.

a.) All screen graphic layouts must be able to be displayed on the monitors.

b.) The images displayed by the Large Screen Display unit shall be computer generated, and therefore a hard-wired "mimic" displays shall not acceptable for this application.

f. Printers

1.) All printed messages shall be date and time stamped. Fault Alarm messages are to provide date and time of occurrence and date and topic of fault clear. Reports are to provide date and time of printing. All times shall be given in military time, e.g., one o’clock in the afternoon shall be printed as 13:00:00.

2.) A total of two printers are required for each Workstation. One high-speed line printer shall be used to

print alarms and one high-speed laser printer shall print reports.

3.) Provide a local means of troubleshooting faults at each printer.

4.) A means to manually clear the printer queue (buffer) shall be provided.

5.) All dates printed out shall be in the order of Month/Day/Year.

6.) The BHS Contractor shall submit to the Owner or his representative the proposed printer(s) manufacturer's literature for review and approval.

5. Provide the capability to archive all records of statistical data on DVD (tape or CD-ROM is allowable if required by the Owner). Provide means of restoring archived data and view it in the original report format that it was generated in. Operations personnel shall have the ability to retrieve the reports and print them from the redundant hot back-up computer without affecting in any manner any active data or operations.
6. The MDS shall have the capability to render individual subsystems, check-in counter conveyors, and conveyors of the baggage system available or unavailable.
7. The MDS display must have an indicator to notify the operator that the display screens are not locked up.
8. The MDS shall be active for new equipment, as it becomes operational.
9. Diagnostics Reporting
   a. Realistic graphical representations shall be employed to portray the equipment with details up to the actual position of all equipment installed position, metering positions, settings, indication, lamps, alarm messages, etc. Operation shall be accomplished by touch screen commands.
   b. Automatic alarms will come up for the following events:
      1.) Fault of any redundant component
      2.) Fault of a individual conveyor (to distinguish overload and jam conditions)
      3.) Fault of a component of the control and monitoring system
      4.) Fault of a communication line of the control and monitoring system
      5.) Number of faulty conveyors pass the alarm threshold (2 variable thresholds)
      6.) Duplicate or faulty BSM messages
      7.) Bag sent to problem bag output
   c. All alarm filters shall be user definable and easily changed through drag and drop type interface with objects programming.
   d. All alarms shall be logged into the historical database and printed out in the alarm printer. The following events will be written in the log:
      1.) All fault of the BHS (overview and details)
      2.) All faults of the control and monitoring system
      3.) All control commands for the BHS
      4.) Changes of the system configuration
      5.) Changes of an alarm threshold
   e. Alarm Condition
      1.) An alarm condition is defined as the occurrence of a new situation, which requires acknowledgment by the operator. Thus an alarm can be:

a.) A logged equipment status has changed its status

b.) An alarm monitoring inhibited point has timed out and returned to normal alarm processing

c.) Another operator initiated or specified events

f. Alarm Handling

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

2.) It shall be possible for an operator to inhibit the alarming or the logging of an alarm condition for an equipment status point. Limit violation alarming shall have dead bands in determining return-to-normal conditions.

3.) It shall be possible to delay the alarming for a process variable for a defined period of time. So it shall be verified that an abnormal condition detected is permanent. The condition must persist for a specified time period.

4.) It shall be possible to automatically show the graphic of a selected alarm by selecting the alarm in the alarm list.

5.) Maximum use of the display generator capabilities shall be made to annunciate alarms by means of color and flashing. A new alarm shall be displayed with a quick flashing in a specified color (0.5 sec duty cycle) as an active alarm; but an acknowledged alarm shall have steady alarm color.

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

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

i. An alarm line containing the latest alarms (between 2 and 4) shall always be visible on the operator workstations. It shall provide the same features as the alarm list.

j. An alarm category shall be a set of options on the processing of alarms, return-to-normal, and information events/messages.

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

2.) An alarm category specifies processing for each type of alarm, return-to-normal, informative event / message. The processing options shall include but not to be limited to:

a.) Insert the message text in the chronological history file

b.) Print the message on alarm printer

c.) Acknowledgment required for this message

d.) Generate an information event message on acknowledgment

e.) Sound the audible alarm at operator workstation

3.) Each alarm category shall also specify the conditions under which an alarm or return-to-normal message shall be removed from alarm display lists. The alarm removal options shall include but not to limited to:

a.) Remove the alarm message upon acknowledgment

b.) Remove the alarm message if acknowledged and the point returns to normal

c.) Remove the return-to-normal message when it is acknowledged

4.) It shall be possible to generate group alarms. A group alarm is the linkage of several individual alarms to a common alarm.

k. Alarm Reporting Requirements

1.) The alarm reporting capabilities are to include but are not limited to:

a.) Alarms shall be time stamped and logged into the alarm and event logs in chronological order.

b.) Unacknowledged point alarms and return-to-normal messages shall be presented in the alarm section of the operator workstations.

c.) The appropriate alarm fields in the graphic displays shall flash or be clearly marked as an alarm condition whenever they are displayed.

d.) Point alarms and return-to-normal messages shall be added to the relevant latest alarm display lists. If the alarm lists are currently being displayed, they shall be dynamically updated with the alarm message. Colors shall be used to highlight unacknowledged messages.

e.) Point alarms can be defined to sound an audible alarm at the operator workstations.

l. Alarm Acknowledgment

1.) The acknowledgment of either an alarm or return-to-normal message shall perform several functions, including but not limited to:

a.) Acknowledgment shall prevent the alarm message from appearing in the alarm section of the operator workstations.

b.) Acknowledgment shall cause the symbols and messages associated with the alarm to stop flashing or change appearance on all displays on which they appear and on the map panel. They shall continue to appear in an alarm condition by changed color and shape unless the alarm signaled a return-to-normal.

c.) Acknowledgment shall cause the silencing of the audible alarm.

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

e.) All workstations shall show an acknowledged alarm after that alarm is acknowledged from any workstation location.

2.) The acknowledgment of either an alarm or return-to-normal message shall be performed in several ways, including but not limited to:

a.) Sequentially as alarms appear in the alarm section of the operator workstations.

b.) Individually, by selecting then acknowledging the symbol or message for the individual alarm on the appropriate operator display or alarm display list. If more than one alarm is active for the same process variable, then all these alarms shall be acknowledged together.

c.) All alarms shown on a latest alarm display list with a global acknowledgment command.

d.) Individually within the graphic operator displays

m. Alarm Inhibiting

1.) The inhibiting of either an alarm or return-to-normal message shall perform several functions, including but not limited to:

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

b.) The appropriate displays shall show the current value.

c.) Alarm conditions caused by the point shall not be logged.

d.) The audible alarm shall not be sounded.

e.) The symbol for the alarm shall not flash on the graphic display.

f.) The alarm message for the point shall not appear on the latest alarm display lists.

g.) There shall be a special monitoring inhibited alarm summary that shall list all points that have been inhibited.

2.) The inhibiting of either an alarm message shall be performed individually, by selecting the symbol for the individual alarm on the appropriate operator display or alarm display list.

n. The graphics screens for every application contain context sensitive on-line help for every function. Both operation and displays are designed for personnel who lack computer training. HTML type help navigation of related topics shall be provided. The operator can call up detailed information from the database by clicking the mouse on the lighting elements in the graphic image or by entering search codes on the keyboard. The detailed information is displayed in list and mask form.

o. The BHS Contractor may require dialing in from remote location to perform diagnostics on the application software, check on systems configurations and integrity of database.

p. A system Upset Condition is defined for use in evaluation of sort computer performance. It is the change during a one (1) second interval of fifty (50), percent of all the system's field wired discrete inputs. During a system upset condition, the logging printer shall print out all occurrences, but the printout need not be completed faster than the normal logger printer speed will allow. No messages shall be lost during the system upset.

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

1.) In order to meet this system update time, it shall be determined all data throughput related designs in the hardware and software such as, but not limited to PLC communications window size, PLC scan frequency, server master and communication processor's throughput, disk performance and display update speed.

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

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

r. When a request is made by the operator to retrieve a different alphanumeric or graphic operator display or window, the new display shall appear on the operator workstation displays within two (2) seconds including update of 50 dynamic data fields based on the implemented database.

s. The sort computers must correctly follow the calendar date. The date keeping function shall incorporate leap year dates. Turn of the century and millennium date must be correctly and automatically followed.

t. Hardware reliability information of all major individual hardware for this project, including the Mean Time Between Failures (MTBF) and its standard deviation for all the equipment are required for all this equipment.

P. Maintenance Information System (MIS)

1. Provide the statistical information gathering and report generation capability to display and print certain defined information considered essential to the successful operation of the system.

2. Use the Baggage System Computer System to run this application.

3. Provide six (6) levels of usernames with password protection against unauthorized access to the system:

Level	**User**	**Access**
Level 1	Handling Agent	Ability to view, print and achieve reports regarding

		passenger and flights handled by the agent logged on
Level 2	Operator	Access to normal operational modes
Level 3	System Engineer	Access to all operational modes
Level 4	System Manager	Access to all operational modes plus ability to change software
Level 5	System Administrator	Access to all operational modes plus ability to change software and assign user names and passwords
Level TSA	TSA Manager	Access to all TSA only operational modes

4. Provide a standard "Report Generator" to permit compilation of additional statistical reports. Requires Level 4 and 5 protections for use of this function.
5. Use Baggage System Computer terminal(s) (keyboards, monitors, and printers) as input/output devices for the MIS system.
6. Employ a user-friendly Human Machine Interface (HMI) with menu-driven routines to permit access to the system.
7. The type of MIS employed by the BHS Contractor shall have the functionality (be user friendly) to allow the Owner to easily modify/generate/develop Operational and Maintenance reports to meet their own needs.
8. Provide ability to view all reports on screen as well as in printed format.
9. Provide ability to save, in buffer storage, and print on a first-in, first-out basis up to 20-flight closeout Reports or end of day reports in the event the printer is busy at any given time.
10. Provide ability to produce daily, hourly, weekly, monthly, quarterly, and annual reports as well as reports based on a user defined interval.
11. Provide a means to reset all non-SSI statistics and counters. This shall be accessible at levels 3, 4 and 5.
12. Provide a means to reset all SSI statistics and counters. This shall be accessible at level TSA.
13. Provide the capability to archive all records of statistical data on DVD (tape or CD-ROM is acceptable if required by the Owner).
14. Provide the ability for the sort allocation planning to be accomplished in Gantt Chart graphical presentation format.
15. Generate the following reports
    a. **Tag Report:** Printout of all tag numbers during the operational period.
       1.) Present:

TAG REPORT

									Time Sorted	*Date* Late Flt#
Dummy # Cleared	BSM#	Name	Flight#	Airline	Time	Read	Bag Type	MU		
0902666789 EDS1	4001512137	Smith, John	145	**	08:00	ATR	outbound	MU 1	MU 1	246
0903666790 PTRI-16	4001512138	Johnson, Jane	234	**	10:08	ATR	outbound	MU 2	MU 2	356

0905565423 OSR	4001512139	Jones, Tom	3445	**	13:48	ME1	Originating	MU 1	MU 1	3455

2.) This report shall be sortable by:

a.) Ascending/descending tag numbers

b.) Ascending/descending flight numbers

c.) Alphabetical passenger names

3.) Provide the ability to search the report for any text in any field.

4.) Print and display the report on demand.

5.) Show every occurrence of a tag being read.

b. **EDS ID Report:** Printout of all PLC ID numbers during the operational period.

1.) Present:

EDS ID Report

	Time Assigned	Screened	Time	Time	Time Delivered	*Time* Time Removed	*Date*
Dummy #	Dummy #	by	Screened	Cleared	to ETD	at ETD	Bag Type
0902666789	08:00	ED2	08:02	08:03	------	-------	In-Spec
0903666790	08:03	ED3	08:04	------	08:06	08:07	In-Spec
0905565423	08:07	------	------	------	08:09	08:10	OOG

2.)

3.) This report shall be sortable by:

a.) Ascending/descending Dummy #

b.) Ascending/descending Time (any time field)

c.) Baggage Type

4.) Provide the ability to search the report for any text in any field.

5.) Print and display the report on demand

c. **Sort Correlation Table:** Printout of the entire Flight Record database.

1.) Present:

SORT CORRELATION TABLE

								TIME / DATE
AIRLINE	FLIGHT#	FINAL DESTINATION	CLOSE-OUT	DEPARTURE	MU	DEFAULT	PIER	DAYS
**	326	JFK	9:05	9:20	MU 2	MU 1		2,3,4
**	430	EWR	11:50	12:05	MU 4	MU 1		1,3,5,7
**	1232	ATL	17:00	17:15	MU 3	MU 1		1,2,3,4,5,6,7

TIME *DATE*

2.) This report shall be sortable by:

a.) Ascending/descending flight numbers

b.) Ascending/descending destinations

c.) Ascending/descending close-out time

d.) Ascending/descending departure time

e.) Ascending/descending make-up units

3.) Provide the ability to search the report for any text in any field.

4.) Print and display the report on demand.

5.) Provide Level 3, 4 and 5 protection for use of these functions:

a.) Disregard a single flight or all flight close-out times

b.) Disregard a single flight or all flight departure times

Note: Any flight(s) disregarded will be noted in this report.

d. **Immediate Equipment Malfunction and Correction Report**: Automatic printout upon detection of each equipment malfunction and each subsequent correction.

1.) Present: (upon detection of equipment)

IMMEDIATE EQUIPMENT MALFUNCTION REPORT

Time *Date*

DEVICE	MALFUNCTION DESCRIPTION	TIMESET
##-HSVPD	Diverter Jam	08:45

2.) Present: (upon correction of malfunction)

IMMEDIATE EQUIPMENT CORRECTION REPORT

Time *Date*

DEVICE	CORRECTION DESCRIPTION	TIMESET	TIME CLEAR	DIFFERENCE
##-HSVPD	jam cleared	08:45	08:50	00:05

3.) This report is required for the following equipment failures:

a.) I/O Fault
b.) DCH Failure
c.) Motor Failure
d.) Photo eye Jam
e.) Tachometer Failure
f.) MCP or Field Device Failure
g.) Door Fault
h.) E-Stop
i.) Diverter Failure
j.) Over length
k.) Overheight
l.) Conveyor Full
m.) Missing bag
n.) Unexpected bag
o.) Laser Array Failure
p.) Unknown bag
q.) Motor Overload
r.) EDS Device Failure
s.) PLC failure
t.) Computer to computer communication lines not linked
u.) Host computer communication lines not linked

4.) Print and display upon detection and correction of the malfunction.

e. **Equipment Operational Summary**: Printout, by subsystem, of diverter, photocell, and sorter statistics and summary of individual device malfunctions printed in Equipment Malfunction and Correction Report.

1.) Present:

EQUIPMENT OPERATIONAL SUMMARY

SYSTEM OPERATION ELAPSED TIME *TIME* *DATE*

Diverter I.D.	CYCLES	JAMS	FAILED AT HOME	OVERLENGTH	MU FULL	E-STOP	X-OVER FULL
##-HSVPD	136	1	8	1	2	4	0
## - HSVPD	44	0	1	0	1	2	1
## - HSVPD	223	3	1	1	1	3	0

TRACKING

PHOTOCELL	MISSING BAGS	UNKNOWN BAGS	JAMS
PE/ED1-1	5	1	0
PE/ED1-2	2	0	0
PE/ED1-4	4	2	1

JAM PHOTOCELL	JAMS
PE/TC2-1	5
PE/TC2-2	2
PE/TC2-4	4

DIVERTER	EXTENDED	HOME
DVT –01	4	5
DVT-02	2	1

2.) Print and display the report on demand.

f. **Computer and PLC Status Report**: Print out of which computer is on-line/offline and the computer status as well as which PLC is online/offline and the PLC status

1.) Present:

COMPUTER AND PLC STATUS REPORT

TIME *DATE*

COMPUTER	ONLINE/OFFLINE	STATUS
Workstation A	Online	Running
Workstation B	Offline	Standby

SORT CONTROLLER	ONLINE/OFFLINE	STATUS
CC1	Online	Running
CC2	Offline	Standby

PLC BANK	ONLINE/OFFLINE	STATUS
PLC-1A	Online	Running
PLC-1B	Offline	Running

UPS STATUS	UPS CHARGE PERCENTAGE	STATUS	RUN TIME REMAINING (If Battery Powered)
Line Power (or UPS Power)	100%	Good	2:00

INDIVIDUAL PLC STATUS REPORT

REPORT TYPE:	Online/Offline PLC
PLC NAME:	PLC-001A
SOFTWARE TYPE:	XXX
SOFTWARE REVISION:	XXX

PLC STATUS REGISTERS:

Key position:	Run/program/remote
Status:	Running/Online/Offline/Fault/Available

LED STATUS:

Processor:	Ok
Force:	Off
Communication:	Ok
Battery Power:	Ok

MEMORY SIZE:	xxx,xxx
MEMORY USED:	xxx,xxx
MEMORY COMPILED:	xxx,xxx
RUNG COUNT:	xxx,xxx
SCAN TIME:	xx ms

FAULT ERROR CODE:

Processor Error	0
Network Error	0

2.) This report will be dynamically retrieved from the PLC Data tables.

a.) Print and display the report on demand.

g. **Equipment Malfunction Summary**: Printout, by subsystem, of a summary of the Equipment malfunction and Correction Reports.

1.) Present:

EQUIPMENT MALFUNCTION SUMMARY

TIME DATE

EQUIPMENT	OCCURRENCES	FAULT DURATION
I/O Fault	0	00:00

DCH Failure	0	00:00
Motor Failure	0	00:00
Photoeye Jam	12	00:22
Tachometer Failure	3	00:10
MCP/Field Device Failure	0	00:00
Door Fault	0	00:00
E-Stop	5	01:10
Diverter Failure	1	00:04
Overlength	0	00:00
Overheight	0	00:00
Conveyor Full	3	00:33
Missing bag jam	3	00:11
Laser Array Failure	0	00:00
Unknown bag	25	-
Motor Overload	0	00:00
PLC failure	0	00:00
EDS Device Failure	4	45:00
EDS Device Communications Failure	1	05:00
Computer to computer communication lines not linked	0	00:00
Host computer communication lines not linked	0	00:00

2.) Print and display the report on demand.

h. **MEC Report**: Printout of individual manual encoding stations statistics.

1.) Present

MEC REPORT

TIME *DATE*

ME STATION

	ME1
DISPATCHED BY:	
FLIGHT	5
SCANNING	87
DESTINATION	2
MAKE-UP	3

BSM	2
PROBLEM STATION	3
OTHER CARRIERS	2
LATE BSMS	12
TOTAL BAGS	**126**

2.) Print and display the report on demand.

3.) BSM data is if the bag is read at the laser array and has no BSM but when read at ME the bag has a BSM (Late BSM).

i. **Load Balancing Report**: Printout of individual subsystem loading for the operational period. Time interval for current throughput figures is selectable from 1 minute to 24 hours.

1.) Present

LOAD BALANCING REPORT

REPORT TIME INTERVAL SELECTED *TIME* *DATE*

TYPE	SUBSYSTEM	TOTAL BAGS	CURRENT INTERVAL LOAD
MAKE-UP	MU 1	56	6
	MU 2	78	11

	EDS	Number of Bags	Number Clear	Number Suspect	Percentage Clear
EDS MATRIX	EDS1	210	180	30	86%
	EDS2	240	205	35	85%
EDS DEVICES	ED1	56	47	9	84%
	ED2	42	36	6	86%
	ED3	81	63	18	78%

2.) Print and display the report on demand.

3.) Load balancing report will report for at a minimum the following conveyors:

a.) Ticket Counters

b.) Manual encoding stations

c.) Mainlines in the sort matrix

d.) EDS Devices in the EDS Matrix

j. **Runout Report**: Printout of default make-up unit statistics for each subsystem. Time interval for current throughput figures is selectable from 1 minute to 24 hours

1.) Present:

RUNOUT REPORT

REPORT TIME INTERVAL SELECTED *TIME* *DATE*

RUNOUT	TIME	BSM#	LOST TRACKING	FAILED TO PUSH	UNKNOWN
MU1	07:00	4001512137	PE/ML1-02		
	07:26	4001512138		SPU-02 E-Stop	
MU2	10:23	4001512140	PE/ML1-06		
	10:26	4001512144		SPL-06 MU Full	

2.) Print and display the report on demand.

k. **Automatic Tag Reader (ATR)**: Printout of all laser array head statistics.

1.) Present:

ATR REPORT

ATR NUMBER: ML1 *TIME* *DATE*

	HEAD1	HEAD2	HEAD3	HEAD4	HEAD5	HEAD6	HEAD7	HEAD8
BAGS READ:	19	119	110	142	199	20	10	11
% READ of TOTAL	15%	35%	45%	45%	35%	15%	30%	30%

OVERALL STATISTICS

BAGS SEEN:	675
BAGS READ:	630
NO READS:	45
VALID TAGS:	625
CONFLICT TAGS:	3
NO MATCHING BSM:	2
READ RATE:	**93%**

2.) For each ATR array, include a Laser Diagnostics Reports shall at a minimum include the following reports and graphs. These reports shall be selectable to hourly and daily data. The reports shall show the performance of the overall Laser Array as well as the performance of each laser head. These reports will display selectable hourly information for at least the past seven (7) days:

a.) Scan Angle: This report will display where the tags are located in respect to the scan line.

b.) Unit Lengths: This report will display the lengths in inches of the product being scanned.

c.) Unit Separation: This report shall display accumulative quantity separation inches of the product being scanned.

d.) Label Position: This report will display the position of the labels in inches with respect to the leading edge of product being scanned.

e.) Label Types: The report will display the quantity of IATA 10 digit codes and 4 digit codes in respect to total quantity.

f.) Label Percent: This report will display the percentage of the labels being 10 digits and 4 digits in respect to total labels read. This report will ID the number of bags with multi codes.

3.) Print and display the report on demand.

l. **EDS Report**: Print out of which EDS machine (by EDS Serial Number and EDS Conveyor ID) is on-line/offline and the machine status:

1.) Present:

EDS MACHINE STATUS REPORT *TIME / DATE*

EDS MACHINE	COMMUNICATION SIGNAL
EDS Machine – EDS1	RTR - High
EDS Machine – EDS2	RTR - Low

PLC BANK	ONLINE/OFFLINE	STATUS
PLC-1A	Online	Running
PLC-1B	Offline	Running

COMMUNICATION INTERFACE MODULE	STATUS
MVI Module 1	Communicating
MVI Module 2	Not Communicating

INDIVIDUAL EDS DEVICE STATUS REPORT

EDS NAME: EDS Machine Serial Number– EDS1

SOFTWARE TYPE: XXX

SOFTWARE REVISION: XXX

EDS STATUS REGISTERS:

Run position: Normal/Test

Status: Running/Online/Offline/Fault/Available/E-Stop/Warm-Up

PLC Scan Time: xx ms (PLC xxx)

EDS AVAILABILITY AND COUNTS:

E-Stop	0 hours 12 minutes 38 seconds
Faults:	0 hours 46 minutes 12 seconds
RTR High:	8 hours 30 minutes 0 seconds
RTR Low:	5 hours 30 minutes 0 seconds
Jams:	3
Total Bags Screened:	717
Total Clear Bags:	589
Total Suspect Bags:	125
Total Fault Bags:	3
Total OOG Bags:	12
Total Added Bag Fault Bags:	1
Total In Tracking Bags:	714
Total Lost in Tracking Bags:	3
Percentage Lost in Tracking Bags:	0.4%
EDS Decision Timeouts:	0
EDS Flushes:	2
Average Level 2 Decision Time:	18.28 seconds
Average Bag Processing Time:	39.05 seconds
CAPPS Bags:	37
Alarmed CAPPS Bags:	22

2.) This report will be dynamically retrieved from the PLC Data tables and EDS interface.

a.) Print and display the report on demand.

b.) All EDS availability shall be cumulative for the selected time period.

c.) Jam and lost in tracking counts shall include only jams and bags lost in tracking that involve EDS conveyors.

m. **Day End Report**: Printout of through puts, laser stats, manual encoding stats and outputs. Automatically printed at the end of the operation period. Also provide a means to print report on demand or at selectable intervals.

1.) Present

DAY END REPORT

TIME ***DATE***

THROUGHPUT:

INPUT	BAGS
TC2	1000
TC3	1000
TC4	500
TOTAL	**2500**

ATR LASER STATS:

ARRAY	BAGS READ	LATE BAGS	BAGS SEEN	READ RATE%
ML1	95	2	100	95
TOTAL	**180**	**3**	**200**	**90%**

MANUAL ENCODE STATS:

STATION	BAGS
ME1	43
TOTAL	**43**

EDS DEVICE SECURITY SYSTEM STATS:

DEVICE	BAGS	BAGS CLEAR	BAGS SUSPECT	PERCENTAGE CLEAR
ED1/EDS Serial Number	150	130	20	86%
ED2/EDS Serial Number	323	300	23	93%
SB1 (Level 3)	20	20	0	100%
SB2 (Level 3)	23	21	1	96%

OUTPUTS:

MAKE-UP UNIT	BAGS
MU 1	25
MU 2	20
TOTAL	**45**

TRACKING:

LINE	NUMBER OF BAGS	NUMBER LOST TRACKING.	TRACKING PERCENTAGE (MIN 99%)
ML1	5180	25	**99.5%**

EDS1	4920	56	**98.8%**
EDS2	9125	80	**99.1%**

2.) Print and display the report on demand.

n. **Sort Area Assignment Report**: Printout of system operational summary. Automatically printed at the end of the operation period. Also provide a means to print report on demand or at selectable intervals.

1.) Present:

SORT AREA ASSIGNMENT REPORT

TIME *DATE*

PHYSICAL MU	ASSIGNED TO	
MU1	MU1	
MU2	MU2	
MU3	MU3	
MU4	MU4	<Reassigned>

2.) Print and display the report on demand.

o. **Flight Summary Report**: Printout of Flight Summary Report as reported by the scanner array.

1.) Present:

FLIGHT SUMMARY REPORT

TIME *DATE*

FLIGHT NUMBER	AIRLINE	NUMBER OF BAGS	BAG TYPE	BAGS ON TIME	BAGS LATE
0123	**	101	X	99	2
1941	**	158	O	145	13
2078	**	243	O	240	3
0760	**	125	O	124	1

2.) Automatically printed at the end of the operation period. Also provide a means to print report on demand or at selectable intervals.

1.)

p. **Individual Flight Summary Report** Printout of Individual Flight Summary Report as reported by the sort makeup.

1.) Present:

INDIVIDUAL FLIGHT SUMMARY REPORT

					TIME	*DATE*
FLIGHT #	AIRLINE	CLOSE OUT TIME	NUMBER OF BAGS SORTED	BAGS ON TIME	BAGS STILL IN SYSTEM	BAGS LATE
0123	xx	10:20	101	99	42	0

BAG DETAILS

BSM#	PAX NAME	TIME BSM RECEIVED	TIME READ ATR	TIME SORTED
4001512137	Smith, David	09:12:27	09:15:35	09:16:20
4001512138	Smith, David	09:13:02	09:20:45	09:21:10
4001512140	Johnson, Cathy	09:13:40	09:21:28	09:22:37

2.) Automatically printed at the end of the operation period. Also provide a means to print report on demand or at selectable intervals.

3.) This report shall be sortable by:

a.) Ascending/descending tag numbers

b.) Ascending/descending sort time

c.) Alphabetical passenger names

q. **BAG Tag Not Found Report**: Printout of all bag tags read with no destination shall be displayed in this report.

1.) Present:

BAG TAG NOT FOUND REPORT

	TAG NUMBER				*TIME*	*DATE*
CARRIER ID	NOT FOUND	TIME SEEN	LOCATION SEEN	PAX NAME	FLT #	
**	3006457841	09:15	XX Laser Array	Smith, John	UA123	
**	3001324972	10:26	XX Laser Array	Smith, Jane	DL345	
**	3007821198	11:24	XX Laser Array	Johnson, Janet	NW57	
**	3004687236	13:56	XX ME	Irvin, Michael	UA987	

2.) This report shall be sortable by:

a.) Ascending/descending tag numbers

b.) Ascending/descending flight numbers

c.) Alphabetical passenger names

d.) Provide the ability to search the report for any text in any field.

3.) Print and display the report on demand.

4.) All bags read by the scanners shall be verified for proper destination. In the event that a bag does not have a proper destination, record the bag tag in the above report.

r. **BSM Report**: Printout of all tag numbers during the operational period.

1.) Present:

BSM REPORT

TAG#	NAME	FLIGHT#	AIRLINE	TIME	READ	BAG TYPE	BSM REC'D	PRINT	LATE
4001512137	Smith, John	601	**	08:00	Array 1	outbound	7:34	7:33	x
4001512138	Johnson, Jane	842	**	10:08	Array 2	outbound	9:12	9:11	x
4001512139	Jones, Tom	1003	**	13:48	ME1	Origninating	11:57	11:56	x

2.) This report shall be sortable by:

a.) Ascending/descending tag numbers

b.) Ascending/descending flight numbers

c.) Alphabetical passenger names

3.) Provide the ability to search the report for any text in any field.

4.) Print and display the report on demand.

5.) Show every occurrence of a tag being read.

6.) Time indicates the time the bag tag was read.

7.) Print indicates time bag tag was printed.

8.) BSM REC'D indicates time the BSM was received at the BHS from the Host.

s. **Bag Data**: Consisting of the following items (Assuming this information is available to the BHS):

1.) BHS Tracking ID Number for each bag (Shared by BHS and EDS)

2.) Bag Type (OOG or in-spec)

3.) Screened by EDS Machine with machine Serial Number

4.) Time Stamped when entering into the EDS machine or time Stamped when OOG bags are identified

5.) Level 1 Screening Status

6.) Time Stamped at Level 1 Screening Decision

7.) Level 2 Screening Status

8.) Time Stamped at Level 2 Screening Decision. Note: Not all EDS machines have the capability to time stamp at both Level 1 and decisions – Confirm with EDS OEM.

9.) Time Stamped when delivered to CBRA Unload Conveyors

10.) Time Stamped when removed from CBRA Unload Conveyors

11.) CBRA ETD Screening Station Number (if available to the BHS)

12.) Time Stamped when Resolved by CBRA Screening Station (if available to the BHS)

t. **EDS Statistics**: Consisting of the following items (The following statistics shall be considered SSI and treated accordingly) (*Assuming this information is available to the BHS*):

1.) Number of Bags Alarmed by Specific EDS Machine

2.) Number of Bags Cleared by Specific EDS Machine

3.) EDS Machine Faults (if known)

4.) EDS Machine Hours of Operation

5.) Start Time of Operation

6.) Start Time of Fault

7.) End Time of Fault

8.) End Time of Operation

u. **Baggage Dimensioner Statistics**: Consisting of the following items:

1.) Total Number of Bags per array

2.) Total Number of OOG Bags per array

3.) Total number of standard items per array

4.) Total number of items not dimensioned per array

5.) Failures per array, detailing individual items that failed and duration of downtime

v. **OSR Statistics**: Consisting of the following items (The following statistics shall be considered SSI and treated accordingly) (*Assuming this information is available to the BHS*):

1.) Total Number of Bags through OSR

2.) Total Number of Bags through OSR by EDS Machine

3.) Total Number of Bags Cleared by OSR

4.) Average Time to Clear Bag by OSR

w. **CBRA Area Statistics**: Consisting of the following items (The following statistics shall be considered SSI and treated accordingly) (*Assuming this information is available to the BHS*):

1.) Total Number of Bags Received in CBRA

2.) Total Number of Bags Cleared by CBRA

3.) Total Number of Bags per CBRA ETD Screening Station

4.) Bag Time In/Out at each CBRA ETD Screening Station

5.) Number and Type of Alarmed Objects per bag

x. **Time in System Statistics**: Consisting of the following items (*Assuming this information is available to the BHS*):

1.) Minimum/Maximum Time Bag was in System (Measured from point positive bag tracking is established to security status identification on the exit conveyor of the L3 3DX 6600)

2.) Average Time Bag was in System

3.) Average Time Bag was in System by Screening Level

y. Security sensitive information such as the following items shall only be released to the TSA:

1.) Screening Alarm %

2.) Time to Decision

3.) EDS Alarm Rates

4.) OSR Alarm Rates

5.) ETD Alarm Rates

z. Provide ability to view all reports on screen as well as in printed format or file format (CSV).

Q. Baggage Control Room Equipment

1. Submit all Baggage Control Room tenant finishes required for supporting the BHS Control Room equipment. As a minimum, the submittal shall include:

   a. Proposed layout (pending the Owner or his representative approval)

   b. Phasing Layouts

   c. Final Layouts

   d. Required completion date

   e. Environmental requirements (including HVAC)

   f. Estimated combined heat output of computer equipment

   g. Power requirements (including UPS sources)

   h. Data transmission and communication drop locations (including number of telephone and fax/modem lines that are to be provided by the Owner)

   i. Clear heights

   j. Lighting and outlet requirements

   k. Fire protection requirements

   l. Architectural Requirements

   m. Coordinated scheduled equipment delivery and installation dates

2. Assume responsibility for providing readily available industrial equipment suitable for the purposes intended and functionally reliable within a Control Room environment.

3. Submit to the Owner or his representative for approval, quantities and manufacturer of proposed equipment. At a minimum, unless otherwise approved, the (each) Control Room shall contain the following:

   a. Workstation computers and related equipment (printers, monitors, keyboards, etc.) as described elsewhere loaded with application software for system monitoring and access system statistics.

   b. If the centralized architecture is utilized, redundant master PLC cabinets housing the scanning and tracking processors. The cabinets shall be on separate power supplies (feeds).

   c. Uninterrupted Power Supply(s) (UPS) shall be provided. Minimum protection time shall be two (2) hours.

   d. Provide all interfacing conduit and cabling between equipment.

   e. All equipment containing memory shall be backed up by an external source (e.g. tape drive, zip drive, read/write CD-ROM etc).

   f. The back up source shall have the ability to download all computer equipment with back up memory programs.

   g. Instructions shall be provided to aid operator in the download of memory back ups.

h. Communications System such as telephones, fax machines, intercoms, etc. (by the Owner).

R. Satellite Workstation

1. Provide a separate line item cost for one "satellite" desktop workstation and report printer in the TSA/EDS level 2 screening control room. The workstation shall provide the following functionality:

   a. The satellite MDS station for the TSA shall display all graphics, alarms, alarm text and any messages that are associated with the new outbound BHS subsystem.

   b. The satellite MDS controls functionality shall be identical to the new graphics and text displays, including the zoom-in capability.

   c. The satellite MDS workstation shall not be capable of any modification to the sort system, flight schedules, make-up assignments, HSVPD controls.

   d. The satellite MDS workstation shall provide read access to the daily alarm logs. This access shall also allow the user to save the alarm log data to a CSV (Comma Separated Variable) file, onto a CD/DVD and Hard Drive in the remote workstation.

   e. The method of connection between the new centralized MDS, which is located in the BHS control room, and the satellite MDS workstation, shall be such that the remote MDS station will be operational at all times the BHS MDS is operational.

   f. The satellite MDs workstation shall be password protected, similar to the new (centralized) MDS and require login to perform any functions other than view the display (i.e., anything to do with the alarm logs).

S. Security

1. A secure computer control environment shall be provided for the BHS. To achieve this, the network operating system shall provide multiple levels of password access appropriate for the level and authorization of staff, workmen or operators working on the BHS.

2. Different passwords are used for different access combinations by:

   a. Personnel group: Handling agents, apron/baggage supervisors, maintenance staff, control room operators, the Owner's staff, maintenance contractors, manual encoding operators, TSA Managers, etc.

   b. Different operating modes: Operations, monitor, training/simulations configure, etc.

   c. Modes of access: From control room, backup sites and manual encoding consoles via dial-up modem lines.

3. Global commands that have a large impact on operations will require higher-level password e.g. invocation of fail-safe to BHS equipment.

4. Operator personnel shall monitor all security violations through system printer and alarms since operations is manned round the clock although group or operational staff may not have very high password levels. All security violations will be logged by the system. Security violations shall include the following as a minimum:

   a. Unsuccessful log-ins

   b. Expired password date

   c. Failure to log-off

   d. Attempting to gain access to a user level than logged on for

   e. Operator initiated event

5. Under Fail-safe conditions, BHS shall default to a pre-defined state (Normally ON). The Contractor shall provide details of how forced fail-safe mode is being invoked for the Owner or his representative's approval.

6. Test mode should be provided to allow tests to be carried out off-line on any software modifications

carried out before saving the modified program into the live systems.

7. All of the system workstations shall have identical functional capabilities. Selective access to the different functional capabilities shall be controlled through the use of log-on IDs and passwords.
8. The password system must have at least six (6) levels of security clearance, e.g.:
    a. Handling Agent
    b. Operator
    c. System Engineer
    d. System Manager
    e. System Administrator
    f. TSA Manager
9. These different levels of security clearance will differ in the access to the various system functions regarding system operation and configuration. Differentiation shall be at least performed for the following functions:
    a. Display modification
    b. Database modification
    c. Report modification
    d. System configuration
    e. Report display
    f. Command initiation
    g. Operator actions
    h. Access to operating system
    i. Application programs
    j. Etc.
10. Security shall be performed at the access level to a menu, configuration dialogue, command window, etc.
11. A user level will be assigned to every person who is given access to the system. The user shall be required to log-on to the system through the various interfaces. All log-on shall be recorded in the system event log. Unsuccessful log-ins shall raise an alarm. The system shall maintain a security database of the number of allowable unsuccessful log-ins and password expiry dates, which is maintained by the security officer. This feature shall allow identification of the operator responsible for all operations executed from the specific workstation or interface.
12. If, after eight ((8) configurable) hours an operator has not logged off, an alarm message shall be sent to that operator workstation until that operator is logged off. The intent of this action is to prevent log-on from extending across operator shift changes.
13. If, after fifteen ((15) configurable) minutes an operator has not logged off of the manual encoding console, the encoding console shall initiate an automatic log-off procedure. The intent of this action is to prevent log-on from extending across operator shift changes.
14. Any system event that is operator initiated shall be recorded with the ID of the operator and the workstation it was issued from.
15. Access to the security configuration shall only be allowed to the user with the highest level, e.g. system

administrator.

16. Level of access by vendor dial-in shall be to the Owner or his representative's approval.

T. Software Design Requirements

1. Incorporate software/hardware consistent with industry standards, and where required software/hardware that is compatible with the Owner's equipment. Schedule a series of coordination meetings with the Owner or his representative (on-site) prior to detailed design to ensure the connectivity/compatibility between the Owner's (and/or user Airlines') reservation system and the proposed software/hardware system. Assume responsibility for all connections between the BHS related computer/PLC systems and the Owner's (and/or user Airlines') Reservation System.

2. All software proprietary information shall be provided to the Owner upon Final Acceptance, but shall not release the BHS Contractor of responsibility for any technical defects (bugs) that occur with the software. In addition, submit to the Owner or his representative a staffing schedule (supervisors and software engineers) to accomplish the specified work.

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

4. For all "commercially available" software used in the BHS, the As-Built Deliverables shall include all of the documentation that is available from the supplier of such software. Copies of all programmer and user manuals and other similar material shall be provided to the Owner along with a complete and fully documented listing of all software programs.

5. All systems, file servers and workstations shall be equipped with continuously running virus detection software to prevent virus infection. The BHS Contractor shall submit details of the virus protection program (i.e. manufacturer, etc.) to the Owner or his representative for approval.

6. At a minimum, adhere to the following software architecture and provide all associated hardware required to accomplish intended functions of the BHS:

a. Human Machine Interface (HMI)

1.) Shall provide a user-friendly interface.

2.) Shall be of the multi-tasking operating system type that can control multiple programs at once.

3.) Shall incorporate object linking and embedding (OLE) technology, or similar.

4.) Shall have the ability of running a software program that will automatically monitor the "wellness" of all installed software on the BHS workstation computers. Provide the capability of automatically initiating a self-test routine from any/all of the installed computers.

b. Networking/Communication

1.) Shall be compatible with the data communication highway(s) (DCH) protocols.

2.) Shall provide fast interfacing between all communication/control tiers.

c. Database/Sortation Controller

1.) Shall provide the handshake between the system bar code tag types, and output destination.

2.) Shall provide the means to route bags to correct output destination(s) in all modes of operation.

3.) Utility

4.) Shall aid in the linking of various applications (programming).

5.) Shall generate, edit and provide tangible maintenance diagnostic and management information system reports.

U. Software Confidentiality

1. The BHS Contractor shall not disclose, or use in future work, any proprietary operation information of the Owner facility, or any information considered a trade secret by the Owner, which was obtained during the course of the project work.

2. Except as otherwise required by law, the Owner will not publicly disclose trade secrets or proprietary software information obtained from the BHS Contractor in the performance of the BHS Contractor's obligations pursuant to this Contract. To the extent it is necessary to provide BHS Contractor's trade secrets or proprietary software information in order to operate or maintain the BHS, the Owner, by contract, prohibit the Owner's operation and maintenance contractor from publicly or privately disclosing the BHS Contractor's trade secrets or proprietary software information.

3. Any information that the BHS Contractor believes is a trade secret or proprietary software information shall be specifically identified and marked as such. Blanket type identification shall not be permitted.

4. In the event the Owner receives a request for the BHS Contractor's specifically identified trade secrets or proprietary software information, the Owner will notify the BHS Contractor and the BHS Contractor will be required to fully defend, in all forums, the Owner refusal to produce such information. Otherwise, the Owner will make such information available.

5. All software version upgrades, bug fixes, etc. for proprietary software shall be provided during the one year warranty period.

V. Source Code

1. All software shall be delivered with well-commented source code in addition to the executable version. Software shall be delivered in both hard copy and machine-readable formats on a media acceptable to the Owner. The BHS Contractor may propose a non-disclosure agreement.

2. The Owner shall have permission to use the software as necessary to support operations at Portland International Jetport, Portland, Maine once obtained from the BHS Contractor.

3. A backup copy of the configured system software shall be provided on CD-ROM media. All original distribution software shall be delivered with an installable backup. While CD-ROM is the preferred media, tape or diskette is acceptable if required by the specific software.

- END OF PART II -

PART III - EXECUTION SPECIFICATIONS

3.01 PREPARATION

A. General

1. Verify conditions in the field prior to start of work. If unanticipated mechanical, electrical, or other elements that conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit written report to the Owner in accurate detail. Pending receipt of directive from the Owner, rearrange work schedule as necessary to continue overall job progress without undue delay.

2. Cover and protect systems and equipment from damage and soiling during installation, demolition, removal. Erect and maintain dust-proof partitions and closures to prevent spread of dust or fumes to occupied portions of the building.

3. Obtain and pay for all airport security badges, permits, inspection fees, and certificates relative to all phases of the BHS construction.

4. Provide supports or bracing to prevent movement, settling, or collapse in which an area is to be removed and adjacent system is to remain. If safety of system appears to be endangered, cease operations and notify the Owner immediately. Take precautions to support endangered work until determination is made for continuing operations.

5. Locate, identify, stub off and disconnect electrical system services that are not indicated to remain. Provide bypass connections to maintain continuity of electrical service to remaining system. Obtain permission and provide advance notice to the Owner if shutdown of electrical service is necessary during changeover.

3.02 WORKMANSHIP

A. General

1. Perform installations, demolition, and removal work as shown within the specified BHS right-of-ways, with due care, including support, bracing, etc. Be responsible for damage, which may be caused by such work.

2. Perform work in accordance with applicable technical sections of the specifications. Where cutting and new work involve the exterior building envelope, consult the Owner to ascertain if existing guarantees, warranties or bonds are in force and execute the work so as not to invalidate such agreements.

3. Execute the work in a careful and orderly manner, with the least possible disturbance to the public and to the occupants of the building(s).

4. Materials installed by the BHS Contractor, whether furnished by him or not, shall be installed in a neat and workmanlike manner. Particular attention shall be paid to manufacturers instructions as to installation procedures.

5. Protect the employment and places of employment of each of his employees engaged in the construction work by complying with the appropriate standards as prescribed by OSHA.

6. Take necessary precautions to keep noise producing operations (such as impact hammering, Carborundum sawing, compressed air machinery and the like) to a minimum. Select equipment, which is of a quieter nature than others and enclose areas of operation with acoustical screens and partitions or other means necessary to accomplish reduction of noise.

7. Equip motorized equipment with mufflers or other types of sound control and blanket equipment with acoustical materials.

8. Locate installation and demolition equipment safely so that no part thereof shall endanger normal airport operations, including runways, terminals, terminal buildings, approach ways, and power utility, lighting and communication lines.

9. Promptly remove debris to avoid interference with system operations.

10. Cut out embedded anchorage and attachment items as required to properly provide for patching and repair of the

respective finishes.

11. Ensure that the standard of work and materials throughout the Project shall be of first-class quality and workmanship in every respect, the Owner will not accept workmanship, which for any reason, is otherwise.

12. Ensure that all equipment, components and materials are free from defects.

3.03 FABRICATION & INSTALLATION SPECIAL CONSIDERATIONS

A. General

1. The BHS Contractors attention is directed to the fact that the equipment is to be designed to meet the requirements of handling airline baggage. This entails consideration and care to be used particularly in fabrication of all components to ensure that projections, welds, sharp corners and transfer points that may cause possible damage to various types of bundles, handbags, suitcases, and trunks are eliminated. Ensure that bottom glides on cases, strings, tags, straps, bag handles, destination tags, etc. are guarded against damage on side guards, transfer points, and all surfaces which baggage may contact on the conveyor system.

2. Coordinate all on-going site work and with concurrent airport/airline operations.

3. Take into effect any long lead procurement items and take the necessary actions required to complete any installation in the ceiling space.

3.04 DELIVERY, STORAGE, HANDLING AND ON-SITE RESPONSIBILITIES

A. Delivery, Storage, Handling

1. Assume responsibility for the receiving, unloading, storage, protection, security and distribution of all material delivered to the site associated with this Contract.

2. The BHS Contractor as necessary for its work, shall provide flagmen and erect proper barricades and other safeguards, post danger signs and other warnings as warranted by hazards and existing conditions.

3. Assume responsibility for receiving, storing, handling, setting and connecting all equipment required for the BHS installation.

4. At all times provide and maintain adequate protection against weather so as to preserve his work, materials, equipment, apparatus and fixtures free from injury, pilferage or damage.

5. Furnish to the Owner, on demand, Bills of Lading for all equipment being shipped to the work site. Identify on each Bill of Lading each component and assembly involved, the equipment items to which they belong, the date and time of pick-up and the expected date and time of delivery to site. The shipping of such material shall involve proper identification of items, proper packing and proper means for unloading them at the work site.

B. On-Site responsibilities

1. General

a. Erect all temporary barriers and barricades to separate work areas from areas of public access, if applicable.

b. Assume the responsibility for providing exhaust fans (e.g. HEPA filter) to limit fumes/odors from welding, metal cutting etc., if the work being carried out is in an occupied/operational area.

c. Coordinate with any interfacing, on-going site work.

d. Provide adequate portable office facilities, communication, equipment and locker room for field force.

e. The BHS Contractor shall pay all costs of rental, installation, use and removal of accommodation and communication equipment.

f. Furnish shop drawings for any substitutions of equipment specified in this specification or shown on the drawings. During the progress of the job, revised drawings may be issued. Ensure all work is performed based on the latest drawings issued.

g. Clean and maintain work spaces, travel routes, and any other areas of work effected by his trade including but not limited to:

1.) Assume the responsibility for the removal on a daily basis of all erection rubbish and discarded materials.

2.) The burning of waste material is prohibited. The BHS Contractor shall remove and dispose of scrap and waste material in accordance with applicable laws, codes, regulation ordinances and permits.

3.) Be responsible for all fines received for failure to maintain or perform cleaning, and all costs due to damages directly caused by this Contractors work.

4.) The BHS Contractor shall use their hoisting material for rubbish removal.

h. Be cognizant that the equipment and lay down areas for the work may/will require relocation as directed by the Construction Manager or the Owner.

i. Be responsible for any employee parking and any site transportation that may be required to/from the construction site.

j. Be responsible for any escort service required for the transportation of materials and employees on the ATO side of the facilities.

k. Enforce the Owner's instructions, laws, and regulations regarding signs, advertisements, fires and the presence of liquor and firearms by any person at the job site.

l. Furnish the services of a competent field superintendent during erection, wiring, testing and correction of any discrepancies occurring during the Final Acceptance period.

m. Smoking shall only be allowed in areas as designated by the Owner.

2. Mechanical Work

a. Provide and install all supports, anchors and any other special considerations or requirements not provided for in this Specification but necessary to facilitate the complete mechanical installation and safe operation of all equipment and components.

b. Provide electrical connections for heavy-duty machinery, such as welding machines, battery chargers, etc. as required for the installation of the BHS.

c. As construction proceeds, assume the responsibility for any additional site surveys, which may be necessary.

d. Document in writing any mechanical, electrical or piping conflicts that may impact conveyor installation and submit to the Owner or his representative immediately following the site inspection and prior to the installation.

3. Electrical Work

a. Supply the necessary conduit, wiring and other electrical components to complete the electrical installation from power drop points (PDPs), to distribute to the equipment and be responsible for all electrical interconnections within the equipment and system.

b. Assume responsibility for the furnishing of all labor, materials, equipment and service necessary for and reasonably incidental to proper completion of all electrical work including electronic controls as required for the proper operation of the system as detailed in these specifications. Provide within the design standardization of components, function and maintenance procedures.

c. Drawings and specifications are to be considered as supplementing each other. Work specified but not shown, or shown but not specified, shall be performed or furnished as though mentioned in both specifications and drawings.

d. Provide and install as required, at no additional cost to the Owner, minor items, accessories or devices reasonably inferable, as necessary, to complete the electrical installation.

e. The BHS Contractor shall refer all conflicts between the requirements of these specifications and drawings or between either and applicable codes to the Owner or his representative for clarification before proceeding with the affected portion of the installation.

f. Obtain and pay for all permits, inspection fees, and certificates relative to the electrical work. Deliver all

certificates and letters of approval to the Owner upon completion of the work.

g. Locate all electrical equipment as shown on drawings. However, actual field conditions shall be checked to determine exact locations and avoid interference with other trades. The Owner or his representative must approve all deviations from the Contract Drawings.

h. The BHS Contractor at no additional cost shall do any reasonable location adjustment of electrical equipment requested by the Owner prior to installation.

i. At no expense to the Owner correct work improperly installed due to lack of construction verification.

j. Install materials and components in a neat and proficient manner. Particular attention shall be paid to manufacturer's instructions as to installation procedures.

3.05 INSTALLATION

A. General

1. Installation of the BHS shall be in strict compliance with the Construction Drawings, to be prepared in compliance with this Specification document and Contract Drawing Package. These drawings shall show in detail the location of each conveyor and the relationships between adjoining conveyors, conveyors and slides or chutes and any other transfer, which might affect baggage movement.

2. Assume responsibility for all interfaces between the BHS and the Facility. The system arrangement and layout shall ensure equipment alignment and clearance when installed in the Facility.

3. Provide all equipment required to complete the total system. Furnish all tools and necessary equipment for the performance of the installation tasks and exhibit sufficient planning to ensure their availability at the job site as required by the workflow. The Owner will not furnish tools, forklifts or erection equipment.

4. Staff the project to ensure timely completion. The BHS Contractor shall accelerate construction as required if schedule milestones are not met.

5. Provide all supports, anchors and any other items necessary to facilitate the complete mechanical installation and safe operation of all equipment and components.

6. Where equipment is to be installed in an operating facility provide a construction schedule to the Owner or his representative for approval that will minimize interference with normal operations.

B. Tolerances

1. Maintain the following tolerances for BHS equipment installation:

a. Maintain dimensions to exterior building walls or building columns within 1/4".

b. Install all conveyors level from side to side, within 1/8" across the width of the conveyor. In the event that the floor/ceiling is sloped, install the conveyors parallel to the floor in the direction of belt travel.

c. In plan and in elevation, install conveyors straight to within 1/4" of a taut line stretched at the belt elevation over the length of each intermediate section of conveyor.

d. Plumb supports vertical within 1/8" per 3 feet.

e. Maintain side clearances to building elements including walls and columns a minimum of 6" unless otherwise specified.

f. Shimming between adjacent intermediate sections of conveyors is permissible but do not exceed 1/4" of total shim stock at any one location.

g. As the building area becomes available, install all header steel (even if header steel is ahead of conveyor fabrication/delivery), to preserve conveyor right-of-ways. Preserve conveyor right-of-ways in all cases as soon as practicable.

h. The maximum allowable lateral offset in the conveyor slider bed shall be 1/8" in 40 feet of length.

C. Side Guards

1. Install side guards so that adjoining guards do not project into the flow of baggage. Clean any field cut edges and welds of burrs, and slag and grind smooth. Filler material at joints or seams is not permissible.
2. Notch the formed edge of the side guards around any vertical hanger or leg.
3. All side guard joints are to provide a snag-free surface. Side guards shall provide a continuous, uninterrupted surface the entire length and height of the joints. Lapped or out-of-line joints will not be accepted. Welding of joints is not permitted.
4. Extreme care is to be used in the design and installation of the side guards at the point of intersection with the conveyor fire/security doors. This interface point must not act as a snag/catch point for baggage or baggage tags.
5. Conveyor side guards must be flared on the downstream side of the intersection with the conveyor fire/security doors. Additionally, special detail must be provided with the conveyor bed section at this point. Its width must be extended to close the void between the bedside rails and the flared side guards.
6. Adjacent side guard joints are to be of the bolted butt coupled joint type at power turns and conveyor sections. Coupling of adjacent side guards or head/tail pulley supports to power turns shall be in alignment with the effective belt width of the turn to prevent interference with baggage movement.
7. Note that the side guards of power turns must not be welded to adjacent straight conveyor side guards.
8. Mounting of any mechanical or electrical equipment on the outside radius side guard of power turns is not accepted since it restricts maintenance access to the outer perimeter chain or guide bearings of the power turn belt.

D. Belt Splicing/Lacing

1. Belting material and the related lacing hardware must be trimmed in a 1" “V” notch fashion. Additionally, the nylon jacket of the lacing connecting pin (cable) must be enlarged with heat to prevent any lateral movement of the connecting pin (cable).
2. If “dutchmans" are used, the length of the "dutchman" must be at least equal to or greater than the circumference of the conveyor drive pulley.
3. All belt splices, shall be cut square, to ensure proper tracking.
4. Install each lacing with a single lacing pin (cable) extending the full width of the belt.
5. Assemble the lacing so that the centerlines of the matching belts are in line within 1/8".
6. The actual length of belting installed on each unit is to be included on system drawings and in the spare parts list.
7. All rough top belting to be ground smooth within 1" of the cut end to allow proper seating of the belt lacing

E. Belting

1. Check all pulleys and rollers for squareness to the centerline of the conveyor. Adjust when necessary.
2. Free conveyor beds of all foreign material and broom clean before pulling the belt.
3. Minimize number of belt lacings on each conveyor. Do not make belt segments shorter than 4'. Maximum acceptable number of lacings per conveyor belt segment is two (2).
4. Both sides of the pulley shaft elevations at the bearings shall be set within 1/32" of one another.

F. Belt Tracking

1. Ensure all belts track within 1 inch of center on any drive, tail pulley or intermediate point.
2. Run each conveyor for a minimum of 4 hours with no load and 4 hours with a baggage load as encountered in actual service before acceptance testing.

G. Floor Supports

1. All conveyors shall be adequately sway braced in order to ensure that there is no lateral or longitudinal displacement.

2. All support structure must be designed and installed so that maintenance access to the conveyor components, gap pans and access to walkway(s), work areas and drive aisles are not blocked.

H. Overhead Supports

1. The BHS Contractor is responsible for the design and structural integrity of all bolts, hangers, support structures etc, and is to provide all necessary materials required for installation.

2. All conveyors shall be adequately sway braced in order to ensure that there is no lateral or longitudinal displacement. Sway brace placement and attachment must be coordinated with the radiant flooring within the ceiling.

3. Locate conveyor supports at intermediate sections splices at 10 feet maximum to provide a rigid and rugged installation. Hanger rods shall be a minimum diameter of ¾ inch.

4. Installation and layout of header steel and all support structure shall not pose interference to maintenance and operation access.

5. The BHS Contractor shall repair/replace both new and existing fireproofing materials removed to allow the installation of BHS equipment header steel, supports structures etc.

6. Adequate vibration isolators shall be used to ensure that there is no noticeable vibration transmitted to the building. For installation of vibration isolators, adhere to the following criteria:

a. Where compression-type vibration isolators are installed below the sill, the threaded rod shall have a lock washer, a single flat washer, and a single nut above the sill while utilizing a single flat washer with two jam nuts, installed in a jam configuration, below the vibration isolator. In this instance, the diameter of the flat washer must be equal to or greater than that of the contacting surface of the isolator.

b. Where compression-type vibration isolators are installed above the overhead support structure, the threaded rod shall have a single flat washer (the diameter of which being equal to or greater than that of the contacting surface of the isolator) and one eccentric locking nut above the vibration isolator. Below the support structure the threaded rod shall have a lock washer, a single flat washer, and a single nut.

c. Where spring-type vibration isolators are used, the threaded rod shall have an eccentric locking nut, a single flat washer, and a resilient washer in contact with the spring mechanism.

7. Provide means of height adjustment on all hanger rods. Once the proper heights are established, lock the adjustments by means of lock nuts, etc.

I. Anchoring

1. Firmly anchor all equipment and structures to the floor or building structure where permitted, subject to review and approval, by the Owner or his representative. Align, level and finish grout, as required.

2. Anchor floor supports to the floor with a minimum of two (2) stud expansion anchors having a minimum size of 1/2" diameter by 2-3/4" long, unless otherwise noted on the specification drawings.

3. Weld floor supports, which rest on a steel mezzanine or intermediate structure.

4. Anchor impact protection with a minimum of four 3/4" diameter adhesive anchors, each having a minimum tensile strength of 3000 psi, concrete of 20,000 pounds and a minimum shear strength of 18,000 pounds, unless otherwise noted on the specification drawings.

J. Lubrication

1. Fill all reducers to the proper oil level using oil recommended by the manufacturer.

2. Install breathers at the highest opening.

3. Clean roller chains of dirt or debris and manually lubricate per manufacturer's recommendations.

4. Replace all lubrication fluids if testing or checkout period exceeds manufacturer's suggested start-up change-out interval.

5. Apply grease per manufacturer's specifications to all grease fittings (unless they are sealed for life type bearings)

prior to initial start-up of the equipment.

K. Motor Installation

1. Wire each motor on all components to a separate disconnect switch which shall be mounted within sight of the motor but not more than 3 feet from the motor.

2. Provide a means of disconnecting power, including the capability of being locked in the “Off” position etc., that meet or exceed the requirements of NEC Article 430 (or applicable local code), to any clutch or brake (if separately or group powered) mounted as part of drive unit so as to minimize the potential of electrical shock during any servicing or maintenance operations.

L. Jacking Bolt Installation

1. Install all jacking bolts in conjunction with pulley and motor bearing housings based on the following criteria:

a. When mounted in a threaded bracket, engage the bearing with the cup of the jacking bolt and lock the jacking bolt in position with a jam nut on the inside of the bracket (i.e., between the bearing housing and the bracket) to ensure the proper locking configuration.

b. When mounted in a non-threaded bracket, engage the bearing with the cup of the jacking bolt, position a jam nut on the inside of the bracket, and position a single flat washer, lock washer, and finished or semi-finished nut on the outside of the bracket (i.e., between the jacking bolt head and the bracket) to achieve the proper locking configuration.

2. Use of socket male/female adapters in conjunction with the jacking bolt is unacceptable.

3. Allow for minimum adjustability of the jacking bolt on either side of the mounting bracket equal to the maximum amount of adjustability provided for the associated bearing by the mounting slots.

M. Sheave/Sprocket Alignment

1. Align shafts, sprockets and sheaves using a steel straight edge. The use of a string for this purpose is not acceptable. Demonstrate during Acceptance Test that corresponding surfaces of mating sprockets/sheaves are in line within 1/32" in 24". Misalignment shall be determined by placing the straight edge against the face of one sprocket/sheave and measuring the gap it makes with the opposite sprocket/sheave. The operation shall then be reversed so that a total misalignment can be determined.

N. Fasteners

1. Protect all fasteners (nuts, bolts, screws, setscrews, etc.) against accidental loosening by the use of lock nuts, lock washers, jam nuts, or other suitable means, and against corrosion by plating or the use of corrosion resistant materials such as zinc plating or stainless steel materials.

O. Shaft Mounted Components

1. Mount all shaft mounted components using keys, splines, or equivalent, with positive retention devices.

P. Painting and Finishing

1. Equipment Finish

a. Stainless Steel

1.) Cover all metal components and surfaces of conveyors in public view with Type 304 stainless steel with No. 4 brush finish.

2.) The BHS Contractor shall also be responsible for the design; fabrication and installation of stainless steel trim frames around conveyor wall penetrations in public areas. The trim frames will be constructed of 12 gauge, 4" x 4" stainless steel angle. The BHS Contractor shall coordinate trim design/details with the Architect, the Owner or his representative.

3.) All stainless steel trim elements and related connections are to be smooth and flush without openings or projections on which bag tags, straps etc., may catch.

4.) All flat head screws used to attach the stainless steel shrouding, such as the horizontal portions

attached to the conveyor bed, are to be completely countersunk so that no portion of the screw head is above the adjacent surfaces. Such flat head screws are to be of the Phillips Head type. Grinding or filing of the screw heads to accomplish the above is not acceptable.

5.) Field welding of any stainless steel trim element is not acceptable. Additionally, no blemishes of the stainless steel trim elements shall be accepted. This includes those blemishes that are caused by poor manufacturing practices as well as those caused in the field plus those caused by field attempts to remove any blemish.

b. Protect all metal surfaces from corrosion using one or more of the following methods:

1.) Electro-galvanize or use stainless steel for slides and chutes unless otherwise specified on the contract drawings.

2.) Electro-galvanize or hot-dip galvanize conveyor side guards if exposed to outdoor environment, and paint on the outside only if used in interior areas.

3.) Use cold rolled or hot rolled low carbon steel primed and painted on both surfaces in all interior areas.

4.) As an alternative to items .2) and .3) above, the BHS Contractor can offer Powder Coating as an alternative due to superior quality and resistance to the elements.

5.) Use as received pre-painted housings from component supplier, such as motors, gearboxes and bearing housings.

6.) Paint conveyor slider bed components only on the outside exposed surfaces. Do not paint the surface in contact with the belting.

7.) Finish paint electrical enclosures normally purchased primed prior to assembly and delivery to the construction site.

8.) Protect all unpainted surfaces (shafts, slider bed, side guards) with a suitable rust inhibitor during shipping and installation.

9.) Prime and finish paint all catwalks, stairways, ladders, maintenance platforms and support steel.

10.) Apply an industrial quality primer and enamel to all to-be-painted surfaces in accordance with the manufacturer's directions. All paint shall be of the same make, type and color.

c. Prepare surface to be painted in accordance with paint manufacturer's requirements and as described below. If there is a discrepancy between the two, the manufacturer's requirements will take precedence. Suitable precaution shall be taken to ensure cleanliness during the period between cleaning and other finishing processes.

1.) Preparation of Surface

a.) Prior to the application of any finish, clean all surfaces to be free of dirt, grease, oil, flux, flash metal, spatter metal, sand, rust, scale, or oxides, and all other debris that might interfere with the effective application of the finish. Clean surfaces immediately before the finishing operation. Take suitable precaution to ensure cleanliness during the period (which shall be of minimum duration) between cleaning and other finishing processes. For galvanized surfaces, adhere to the following:

b.) Clean: Prepare surfaces so prime coat bonds well and adheres permanently.

c.) Rust-Inhibitive Wash: Use a compatible chemical solution such as phosphoric metal etches. Thoroughly remove solution with water and allow drying.

2.) General Application: Apply primer and enamel to provide a surface of high quality appearance free from runs, sags, cracks, flaking, peeling, blushing, or other defects which may affect drying characteristics, durability, and appearance of the painted surfaces. Apply primer and enamel by brushing, spraying, or dipping.

3.) Basic Application: Finish surfaces with not less than one coat of primer and one coat of enamel. Apply the primer and one coat of enamel at the factory and the touch up of enamel, if required, shall be

applied at the installation site, after erection, by brushing. When primer or enamel applied to the equipment prior to erection has been burned, chipped, or otherwise removed during erection, or where new unfinished metal is installed, finish the exposed surfaces with not less than one coat of primer and a finish coat of enamel, of the same color and type as originally painted, after sanding the surface to be painted down to the bare metal. After installation, clean and touch up all scuffed or otherwise marred surfaces, as above.

4.) Masking: Do not obscure equipment nameplates, identification plates, or other identifying markings when painting the equipment. Whenever possible, apply the plates and markings after painting. In all cases where they cannot be applied after painting, mask or otherwise protect them to retain their legibility. After painting, thoroughly and effectively remove all masking and protective coatings.

2. Conveyor Identification

a. Permanently and indelibly mark all conveyor equipment such as conveyors (both powered and slave driven), merge conveyors, diverters, sort devices, make up units, power turn conveyors, tapered pulleys, etc., with its respective (discrete) identification as defined on the contract drawings. All conveyor segments and other equipment such as diverters, vertical merges/sorters and the like shall be identified as specified elsewhere in this document by carefully and neatly painting with black paint the equipment identification characters utilizing a stencil, nominally 4" in height, in a conspicuous location (on both sides of a conveyor adjacent to the conveyor drive in the case of a conveyor). The only acceptable identification markings on any conveyor equipment, is to be of the specified conveyor identification numbers for this project. Any other form of identification or markings on the conveyor equipment is not acceptable and must be removed.

b. Identify conveyors in public areas by means of engraved plaques (riveted or bolted) with 2" high black lettering on a stainless steel background.

c. Conveyor identification shall be consecutive with no missing numbers in a sequence. In the event of any additions or deletions prior to each system installation, renumber the conveyors to adhere to this requirement.

d. Completely remove or print over any identification on reused equipment or any temporary markings associated on new conveyors for manufacture, shipping or installation.

e. Where temporary markings or labels on the conveyors or other equipment are required for installation, use a medium which is readily removable with water or a readily available commercial solvent, such that they may be removed without requiring any refinishing of the surface on which they appear. After installing, remove any temporary markings.

Q. Maintenance Ladder Drop Zone Striping

1. Provide painted caution area on bagroom floor at all swing down ladder drop zones that are exposed to vehicular traffic and are associated with the BHS.

2. Paint for reflective pavement markings shall conform to the requirements for safety yellow reflectorized, fast drying traffic zone.

R. Safety Signage

1. The BHS Contractor shall be responsible for the furnishing and installing of safety signage throughout the BHS as described within these Contract Documents and any associated addendums. The safety signage shall be located in all area’s and locations where there is exposure to hazards for maintenance/operational personnel and the public. Refer to OSHA, ANSI, NEC, National Safety Council, local, federal and state codes for recommended location, size, shape, design and verbiage required for safety signage, examples of some of the types of signs are included in the contract drawings, these examples are not to be construed as the only signs required. The verbiage of the sign shall be appropriate for the particular location/hazard.

2. The safety signs shall be clearly visible and firmly affixed. The following is a list of locations where safety signage should be placed as a minimum, this list is not to be construed as being complete since it is only provided as a guide:

a. All potential pinch points

b. Rotating parts

c. Chain and V belt guards

d. On all conveyors that are under the control of auto start

e. Outside of electrical cabinets and disconnects boxes

f. On all catwalks including step up/step down locations

g. At load and unload (smake-up devices) areas

h. At manual encode areas

i. At EDS devices

j. Adjacent to HSVPDs

k. Adjacent to Vertical Sort conveyors

l. Adjacent to tip chutes

m. Areas of low overhead clearance

n. Fire/Security doors

o. Around areas of false ceilings

p. Etc.

3. Safety chains and prominently displayed placards/signs shall be placed at the bottom of ladders and stairs to indicate restricted area for “authorized and trained personnel only”.

4. Placards/signs indicating locations of all E-stop control stations and lanyards shall be clearly visible.

S. Welding

1. Nationally certified welders shall perform all welding, and all welding shall be in strict compliance with local and national codes. The BHS Contractor shall provide to the Owner or his representative upon request, copies of certificates verifying that the welder(s) are nationally certified.

2. Only compressed natural gas (CNG) and electric welders shall be used.

3. Connecting welding equipment to any MCP power supply shall not be acceptable.

4. Before approving any cutting or welding operation, a fire safety supervisor or appointee shall inspect the work area and confirm that the following indicated precautions have been taken in order to prevent fires:

a. Ten pound ABC Dry Chemical Fire Extinguisher to be kept on site.

b. No flammable liquids permitted within 50 feet of work.

c. Floors swept clean of combustibles.

d. All wall and floor openings covered.

e. Covers suspended beneath work to collect sparks.

f. Opaque screens placed between work and spectators.

g. Fire watch is required to observe all work and shall remain on site for a minimum of 30 minutes after completion of work.

h. The Owner is to be notified prior to beginning work.

T. Maintenance Access

1. Where walls immediately adjacent to conveyor equipment affect maintenance access, advise the Owner or his representative of the location and size of the wall opening that needs to be developed to permit access to drive components, bearings, and other equipment that would normally be inaccessible because of the wall.

3.06 SPECIAL CONTROL REQUIREMENTS

A. Control Stations

1. Mount controls, consisting of push buttons, selector switches, indicator lights, etc., in Control Stations. All controls shall be grouped to minimize the number of operating points throughout the system. In the application of a single control for a specific function, push-button stations may be employed.
2. Locate control stations as specified. Position control stations so as not to impede access to the equipment for servicing.
3. Mount all Control Stations located in public areas flush to the equipment and equip with stainless steel cover plates.
4. Locate Control Stations so as to be clear of normal vehicular and personnel traffic lanes. Install guards to prevent inadvertent actuation where this cannot be accomplished.
5. Control Stations shall contain the appropriate control elements such as push buttons, selector switches, and those indicator lights, which will augment operations.
6. Control Station functions shall be identified in English using elementary concise terms supplemented by graphic symbols. All identification plates shall be mechanically affixed to the console face.
7. Control Stations shall conform to the environmental requirements specified herein.
8. Emergency Stop push buttons, disrupting electrical control power, shall be employed where an emergency may require immediate shut down. Where more than one emergency stop push-button is used in any circuit or subsystem, only the indicator lamp in the activated E-Stop push-button shall be energized. Actuation of any emergency stop shall be announced on the respective status monitoring system.
9. Indicator lights, especially outside the facility, shall not be affected by extraneous light, and shall be clearly visible in all lighting conditions.
10. Control elements such as switches, push buttons, handles, etc., shall be selected for ease of operation in an industrial "bag room" environment.
11. Control elements such as switches, push buttons, indicator lights, bulbs, etc., shall be easily replaceable and reasonably protected from physical damage.
12. Freestanding control stations and manual encode consoles shall be mounted on extremely rugged and braced pedestals with large firmly anchored base plates. The design shall account for extraneous loading and generally abusive conditions.
13. Independently anchored impact protection shall be provided wherever control panels, control consoles or control stations are exposed to work area traffic.

B. Photocell Functions

1. As a minimum, provide photocells to perform the following functions:
    a. Cascade Stop
    b. Jam Detection
    c. Over-Height Detection
    d. Over-Length Detection
    e. Length Measurement
    f. Baggage Tracking
    g. Missing Bag Jam
    h. Merge And Priority Control
    i. Auto Start

j. Auto Stop

k. Indexing Control (Accumulation)

l. HSVPD Timing

m. Failsafe

2. Combine photocell functions wherever possible provided proper operation of each circuit is maintained.

3. Cascade Stop

a. Locate a head end sensor photocell within 12" of the discharge ends of all straight conveyors and 6"on power turns and queue conveyors (or an appropriate distance from the discharge end to ensure that the piece of stopped baggage does not transition/stop on the downstream conveyor) so that the center of the photocell beam is approximately 2.5" above top of the conveyor belt to provide the signal for operation of cascade stop circuits.

b. Should a downstream conveyor stop as a result of a jam condition or mechanical/electrical failure, the conveyor immediately upstream of the stopped conveyor shall continue to run until the head end photocell is blocked. At that moment, the conveyor shall stop. The preceding upstream conveyor will run until its head end photocell is blocked. This cascade stop function will continue through the upstream conveyors until the jam/failure is cleared or the first conveyor in the subsystem has stopped.

c. The cascade stop photocell shall also be utilized for jam detection functions, but no control station shall be installed in conjunction with this photocell. Upon the detection of a jam at this photocell, initiate the following steps:

1.) Stop the conveyor with the cascade stop photocell and the one immediately downstream.

2.) Provide a jam indication signal at the MDS, MCP Touch Screen Terminal and a visual warning signal in the field (within the vicinity of the jam location).

3.) Illuminate the jam indicator light in the nearest jam reset/restart control station.

d. Cascade controls logic shall include programming to initiate the Ticket Counter Ready Pushbutton “Green light” to flash when the respective ticket counter conveyor subsystem has cascaded back to the load belt. This will notify the ticket counter agent that a jam/fault has occurred in the subsystem.

4. Jam Detection

a. Locate a head end sensor photocell to provide the signal for operation of jam detection circuits within approximately 12" of the discharge ends of all straight conveyors and 6"on power turns and queue conveyors (or an appropriate distance from the discharge end to ensure that the piece of stopped baggage does not transition/stop on the downstream conveyor). The center of the photocell beam is to be approximately 2.5" above top of the conveyor belt.

b. As a minimum, provide jam detection photocells and a jam indicator with a jam/restart/emergency stop control station in areas that have a relatively high frequency of jams. This shall include the discharge ends of all conveyors feeding onto power turns, at the bottom of inclines and decline conveyors, at all merges for both the primary and secondary lines, opposite all diverters and at any other location where experience indicates a potential jam point.

c. As soon as the photocell detects a jam (blocked for longer than an adjustable (0 to 10 seconds in the PLC), predetermined (nominally set to 6 seconds) length of time), initiate the following steps:

1.) Stop the conveyor with the jam detection photocell and the one immediately downstream, unless the photocell is mounted on a conveyor that feeds onto a power turn. In this case the conveyor with the jam detection photocell, the power turn and the conveyor immediately downstream of the power turn are to be stopped.

2.) Provide jam indication signal at the MDS and MCP Touch Screen Terminal.

3.) Illuminate the jam indicator light in the control station.

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

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

f. Conveyors that cascade stop as a result of a jam are to be "latched stopped" through PLC logic until the jam reset push button has been activated.

5. Over-Height Detection

   a. Provide over-height detection photocells at every baggage input to the system to detect bags that are too high to clear the lowest downstream obstruction for all possible routes. This photocell shall be set at 36" above the top of the conveyor belt unless otherwise stated and shall be variable.

   b. As soon as the photocell is interrupted, stop the conveyor.

   c. Provide jam indication signal at the MDS and the MCP Touch Screen Terminal.

   d. Provide an oversize indicator lamp in the control station; this lamp may be the same unit as that for over-length detection. Illuminate the oversize indicator lamp in the control station if an over-height bag is detected.

   e. Program the over-height circuit to require the following sequence to reset:

      1.) Actuate associated E-stop

      2.) Clear the photocell by removing or re-positioning the over-height bag, the oversize indicator lamp shall extinguish

      3.) Press the start push-button.

      4.) Clear the fault on the MDS and the MCP Touch Screen Terminal.

6. Over-Length Detection

   a. Provide over-length detection photocells at every baggage input in the system to detect bags that are too long.

   b. Program the over-length measurement circuit to stop the conveyor if a preset bag length (adjustable in the PLC) is exceeded.

   c. Provide jam indication signal at the MDS and the MCP Touch Screen Terminal.

   d. Provide an oversize indicator lamp in the control station. This lamp may be the same unit as that for over-height detection. Illuminate the oversize indicator lamp in the control station if a preset bag length (adjustable) is exceeded.

   e. Program the over-length circuit to require the following sequence to reset:

      1.) Actuate associated E-Stop

      2.) Clear the photocell by removing the over-length bag, the oversize indicator lamp shall extinguish

      3.) Press the start push-button. This push-button may be the same unit as that for over height detection.

      4.) Clear the fault on the MDS and the MCP Touch Screen Terminal.

7. Bag Tracking

   a. After bags have been scanned by BMA or ATR or manually encoded, their position shall be tracked by bag tracking photocells.

   b. The tracking photocell shall be typically located at the head end of tracked conveyors.

   c. All bag tracking photocells shall also be programmed to update the position of the bags and shall have diverter arming capability to cause bags to be diverted.

8. Missing Bag Jam

    a. A missing bag jam is defined as a jam that occurs when three (3) consecutive bags are sensed at a conveyor head end photocell and not detected at the next downstream photocell within a predetermined period.

    b. All tracked conveyor subsystems shall incorporate missing bag jam detection logic.

    c. The BHS contractor shall provide a means at the MDS to be able to override the missing bag jam logic. This shall be allowable within sortation subsystems only in order to prevent a gridlock type of situation in case of a failure.

9. Merge and Priority Control

    a. 45° Merges

        1.) Merge windows shall be dynamic in that the control system establishes a window only upon indication that a bag has arrived at either the merge or through line induction photocell (i.e., a fixed window control system will not be acceptable). Merge windows shall be variable and shall be established on the basis of bags per minute (BPM) throughput requirements per subsystem with associated window spacing. Bag length shall be measured by the control photocells to adjust the merge window length as required.

        2.) Photocells, timers and appropriate control stations shall be located on the conveyor equipment in 45° merge situations with functionality as follows. For all intents and purposes for this project, the conveyor line onto which bags are to be merged shall be referred to as the primary line, while the conveyor line from which bags are merged from shall be referred to as the secondary line:

            a.) A photocell shall be located at the discharge end of the secondary line merge conveyor. This photocell shall have the functions of jam detection, head end sensing and priority control. The jam detection function of this photocell shall detect a jam at the merge point resulting from bags being transferred from the secondary line onto the primary line. When this occurs, both belts involved shall be stopped until the jam is cleared (along with other appropriate conveyors upstream that will cascade stop as necessary).

            b.) All 45-degree merge conveyors are to be programmed in a run on demand mode and use energy management timers to stop. As a bag is transported towards the merge conveyor an auto- start photocell, located on the upstream conveyor, once blocked will actuate the start-up of the merge conveyor. If after 20 seconds (adjustable in the PLC) the auto-start photocell doesn't detect any baggage then the merge conveyor shall stop.

            c.) Merge window logic in the PLC is used to monitor and track the flow of bags on the primary conveyor line upstream of the merge. The merge window logic shall use a photocell and timer to measure bag length in order to determine the required merge window for proper transfer onto the primary line. The merge window logic is used to track the position of bags and the space between the bags on the primary line. The head end photocell on the conveyor immediately upstream of the merge conveyor on the secondary line shall be used to measure the length of bags as they move onto the 45- degree merge. The PLC utilizes this length to calculate the bag window size required on the primary line to merge a bag into. If the required bag window is determined to be available on the primary line then the bag is not stopped and is merged onto the primary line. If the bag window is determined to be unavailable then the bag is stopped and held on the merge conveyor until the appropriate size window is detected on the primary line.

            d.) The merging function shall be provided in two modes. Primary priority and reverse priority. In primary priority mode (to be considered normal mode of operation) bags on the primary conveyor line shall have priority over bags on the secondary conveyor line. The secondary line will have to wait for openings between bags on the primary line to be able to merge into. Priority control shall monitor the time in which the photocell on the primary line is being blocked, indicating that the appropriate merge window is being searched for.

            e.) Reverse priority mode shall be actuated in two different cases. First, if the 45-degree merge conveyor is stopped with bags in queue upstream (to a point which will be determined in design review meetings based upon subsystem length, BPM requirements, etc.) then the secondary line is

considered to be full and the reverse priority function shall be actuated for the period of time it takes to empty the secondary line of bags from the point in which the reverse priority was actuated. Second, if a bag is on the 45-degree merge waiting for a window and an opening is not detected for 60 seconds (adjustable in the PLC) then reverse priority shall also be enabled. The primary line conveyor onto which bags are being merged shall be stopped, and all merge control functionality of the secondary line shall be disengaged to allow for continuous and uninterrupted baggage flow from the secondary onto the primary line for 60 seconds (adjustable in the PLC), thus purging the secondary line of bags. Upon completion the merging function will revert back to primary priority mode.

f.) In the event that there are multiple merges onto the mainline each merge should receive equal priority in order to prevent any one of the merges from not being able to discharge bags onto the mainline.

10. Auto Start

    a. Provide Auto Start photocells upstream of sections of transport conveyors not specifically controlled by START/STOP switches. The same photocell may control both Auto Start and Auto Stop circuits.

    b. Program Auto Start circuits to start a string of conveyors whenever an Auto Start photocell is interrupted.

    c. Before any conveyors may be started, audible start-up warning alarms shall be actuated, audible throughout the area to be affected by the starting of the conveyors. Activation of the alarms shall be through the PLCs. The horn shall sound and after a period of between 5 and 25 seconds (adjustable in the PLC) the conveyor subsystem shall start.

    d. Each conveyor in the subsystem shall be sequentially started from output to input point with an appropriate delay between each motor starter actuation as to ensure electrical power surges are minimized. The next sequence of conveyors controlled by Auto Start functionality shall start in a similar manner, triggered by baggage at a predetermined location within the line.

11. Auto Stop (Time-Out)

    a. Provide Auto Stop photocells upstream of sections of transport conveyors not specifically controlled by START/STOP switches. The same photocell may control both Auto Start and Auto Stop circuits.

    b. Program Auto Stop circuits to stop a string of conveyors if an Auto Stop photocell does not sense a bag for an adjustable time period (adjustable in the PLC).

    c. If a conveyor stops for any reason, reset the auto stop timer and hold until the conveyor restarts.

12. Indexing Control (Accumulation)

    a. Provide a photocell at the discharge end of each conveyor feeding an indexing conveyor.

    b. Program the indexing conveyor to run when the photocell is blocked and to stop when it is clear.

    c. Include a time delay so that the conveyor can be programmed to continue for a preset interval after a bag clears the photocell and is completely on the indexing conveyor.

13. HSVPD Timing

    a. Provide a photocell at an appropriate distance upstream of each diverter with the center of the photocell beam at a height of 2.5" above the top of the conveyor belt for HSVPD timing/arming. The function of this photocell can also be combined with baggage tracking (not with jam, cascade, etc. functions)

    b. Program the photocell function to ensure accurate HSVPD -bag contact; given bag size, belt speed, and HSVPD cycling speed.

14. Fail Safe

    a. Provide a redundant photocell arrangement an appropriate distance downstream of the suspect bag HSVPD with the center of the photocell beam at a height of 2.5" above the top of the conveyor belt for failsafe monitoring. The function of this photocell can also be combined with baggage tracking (not with jam or cascade functions).

b. Program the photocell as described in Additional EDS Controls Functions below.

c. BHS Contractor shall coordinate the fault requirements and resets with the local TSA operational requirements.

C. Motor Overloads

1. Size the motor overload heaters not to exceed 115% of the full load amps as indicated on motor nameplate.

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

3. Following rectification of the cause of the overload and resetting of the overload protection device in the motor control panel or motor control center as applicable, the system may be restarted by actuation of the "start" button, at which stage, the "motor overload" indicator shall be extinguished and normal control shall resume.

4. "Motor overload" fault conditions shall be reported both visually and audibly on the MCP system Touch Screen Terminal and MDS.

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

D. Jam Indication/Restart

1. Provide an Illuminated Amber Jam Light (in a common enclosure with an Emergency Stop push-button and green re-start pushbutton) adjacent to all jam detection photocells as follows: As a minimum, provide jam detection photocells and a jam indicator with a jam/restart/emergency stop control station in areas that have a relatively high frequency of jams. This shall include the discharge ends of all conveyors feeding onto power turns, at the bottom of incline and decline conveyors, at all merges for both the primary and secondary lines, opposite all diverters, and at any other location where experience indicates a potential jam point.

2. Illuminate the Jam Lamp when the jam detection photocell senses a jam condition.

3. Restart the conveyor and extinguish the lamp only after the following sequence:

a. Actuate (push in) Emergency Stop push-button (E-Stop indicator lamp goes on)

b. Clear the jam

c. The jam light shall “flash” (indicating the jam photocell has been cleared and the conveyor is ready for restart).

d. Reset (pull out) emergency stop push-button (E-Stop indicator lamp extinguishes)

e. Depress green “re-start” push-button (conveyors restart after warning alarm sequence)

4. Paint the control station enclosure with "Safety" yellow paint and label with the conveyor Item Designations of the conveyors being controlled in 1/2" high block letters. Jam detection reset control stations shall be placarded with the conveyor designations, which are being controlled.

5. In most cases the control stations shall be located adjacent to the conveyors under control and shall be accessible only to the personnel clearing the jam to avoid a subsystem being re-started in an unsafe condition (e.g. personnel on conveyor). Note that all such control stations shall be located on the catwalk side of conveyors so equipped with catwalks.

E. Start-Up Warning

1. Provide amber rotating beacons and audible horn alarms as start-up warnings in areas as specified.

2. Activate the beacon and the horn for an adjustable period of time prior to the start-up of the conveyor system.

3. Appropriate audible start-up warning alarms shall be provided at public areas such as ticket counter and baggage input points.

F. Alarm Silence

1. Provide an ALARM SILENCE momentary contact push-button on the door of the MCP which, when depressed, shall silence the audible alarm. The design of the control circuitry shall be such that multiple faults shall always sound the associated fault warning alarm; i.e., if a jam condition has caused the alarm to have been sounded and the alarm has been silenced by the act fault but has not yet been corrected, a second fault occurring after the alarm has been silenced shall again cause the fault warning alarm to sound.

2. Do not extinguish the illuminated fault indicator until the fault has been corrected.

G. Emergency Stop Push-Buttons

1. Locate Push buttons as required to ensure that operating and maintenance personnel can easily and quickly reach an Emergency Stop Push-Button from anywhere in the system. In addition, ensure that Emergency Stop Push-buttons are installed at the following locations:

   a. Around the perimeter of all make-up.

   b. At each end of load/unload conveyors.

   c. Along lengths of conveyors, whether running at floor level or overhead mounted on conveyor support legs or building columns a maximum of 50' apart.

   d. In each jam indication enclosure.

2. Wire all Emergency Stop push buttons for a single subsystem in series with the coils of one or more emergency stop relays. Size the normally open contacts of the relays in series with the power source of the PLC output module(s) controlling the conveyors in the subsystem. The PLC shall not be required to remove power from the associated conveyors for an emergency stop condition.

3. Upon actuation of an Emergency Stop push-button, stop the associated conveyors in the subsystem, illuminate the lamp in the head of the push-button in a steady burning mode, and illuminate the red emergency stop fault light at the MCP.

4. Restart the conveyors and extinguish the indicator lamp and MCP fault light only after the following sequence:

   a. Reset (pull out) emergency stop push-button (indicator lamp and MCP fault light extinguish)

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

5. When a jam has been detected and an Emergency Stop push-button in the jam indication enclosure is activated, follow the same sequence of stopping the conveyors and illuminating the light in the head of the push-button, but do not activate the fault warning circuits at the MCP.

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

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

8. "E-Stop" conditions shall be reported both visually and audibly on the MCP system Touch Screen Terminal, MDS.

H. Security/Fire Door

1. Provide a photocell to detect bags under the security/fire door.

2. The door is to be equipped with either a limit, photocell or proximity switch mounted in such a manner so that the "fully open" position of the door is sensed. If the door is sensed by the limit or proximity switch not be in the fully open position, the associated conveyor shall be stopped if running or shall not be permitted to start if the conveyor is not already running. Note that this limit or proximity switch is in addition to those limit or proximity switches provided with the door operator if the door is powered.

3. The door is also to be equipped with a limit, photocell or proximity switch mounted in such a manner so that the "fully closed" position of the door is sensed. If the door is sensed by the limit or proximity switch not be in the

fully closed position, annunciation shall be sent to the system fault monitoring system for rectification of the problem. Note that this limit switch is in addition to those limit or proximity switches provided with the door operator if the door is powered.

4. The BHS Contractor shall interface and test the door interface with the building fire/security system for door open/closed status.

5. Bag belt can only be started with the swipe of an active badge. Door Control panel will enable 'Start' button and monitor status of rollup door. Door Control panel will receive a 'Belt Running' signal from Bag Belt Motor Control panel that will shunt alarm point at Door Control panel. These connections will be made in a demark box between Door Control Panel and Bag Belt Motor Control panel

6. Program the security/fire door to operate as follows:

    a. Normal Start/Stop

        1.) Start

            a.) Swipe an active badge at card reader for bag belt

            b.) Approved card read will enable 'Start' button for bag belt.

            c.) Depress 'Start' button and belt will begin to start and rollup door will open.

            d.) Bag belt will run continuous with detection of bags.

            e.) No detection of bags after five minutes, belt will stop and rollup door will close

            f.) If door remains open beyond five minutes without detection of bags, a door held alarm will be generated and A/V will sound

            g.) In the event the bag belt is running and an 'Emergency Stop' button is depressed, bag belt will stop and rollup door will remain open.

            h.) Any opening of rollup door without an approved card read will generate a door alarm

        2.) Stop: Run the feeding conveyor for one minute, stop the conveyor and lower the security/fire door. PLC to provide Building Security System with "Door Closed" status. If a bag is detected under the door via the door clear photocell or the door pressure switch, continue to run the conveyors until the photocell is clear and reattempt to close the door. The door should continue attempting to close, however an alarm should be displayed on the fault monitoring system that the door has failed to close after the third attempt.

    b. Upon fire detection and/or receipt of signal from fire alarm system:

        1.) Close the dry contact

        2.) If no bag is detected under the door by either the clear photocell or the door pressure switch, stop all conveyors and close the door.

        3.) If a bag is detected under the door by either the door clear photocell or the door pressure switch, run the conveyors until the photocell is clear and immediately stop the upstream and downstream conveyors to allow the door to close. If the door is unable to close upon detection of a fire signal or system stop signal an alarm shall be displayed on the fault monitoring system that the door has failed to close.

    c. Emergency Power: Remove if Fire/Security doors are not supplied with emergency power

        1.) The fire doors and respective upstream and downstream conveyors shall be supplied with both normal and emergency power supply. Reference "ELECTRICAL & CONTROLS SPECIAL CONSIDERATIONS" paragraph related to "emergency power" for additional requirements.

    d. A fire door control station shall be installed adjacent to each fire door for maintenance personnel use only (not accessible from the public side) which shall contain the following:

        1.) Maintenance/Auto Switch

2.) Emergency Stop

3.) Start Pushbutton

4.) Door Open Pushbutton

5.) Door Closed Pushbutton

e. When the Maintenance/Auto is in the Maintenance position, the door open and door-closed switches are active. Related conveyor systems are not active when in the maintenance mode. Activation of the ticket counter security card swipe is not required when in the maintenance mode.

f. All powered security/fire doors must be equipped with a manual release mechanism to permit the disengagement of the door drive unit so that the door can be either raised or lowered.

I. Fault Warning Alarm

1. Provide an audible/visual alarm on the MCP controlling the system.

2. Activate the alarm and one of the following indicator lights whenever any fault has caused a section of conveyor to stop or prevent it from starting:

Condition	Color
Jam	Amber
Motor Overload	Blue
Emergency Stop	Red

J. High speed vertical paddle diverter

1. Provide photocells at strategic upstream locations to synchronize HSVPD operation with bag position.

2. Provide a sensor at the "home" position of the HSVPD to stop the sort conveyor if the HSVPD does not return to the home position within a preset time after it has started its cycle. Report the fault condition to the MDS and the MCP Touch Screen Terminal. The sensor is to be of the shaft encoder type with proximity detector controlled by a Warner Electronic Controller (or approved equivalent) so that the “at home” paddle position shall always be the same.

3. Provide each HSVPD with one disconnect switch to control both the clutch/brake and motor.

4. Provide a photocell on the receiving conveyor spur to which the HSVPD discharges to report to the control system that a bag has successfully transferred and that no jam has occurred. If a jam is detected, attempt a second divert to “divert” through the jam, if jam is still detected inhibit further diverter operation and report the fault condition to the MDS and the MCP Touch Screen Terminal.

5. Each HSVPD feeding a conveyor spur shall have a four device control station installed adjacent to the photocell or on the housing of the HSVPD for maintenance personnel operation of the HSVPD:

a. One device of the control station shall be a green momentary contact Reset/Start push-button switch to allow for reset of the associated subsystem conveyors and energizing of the HSVPD motor following a jam condition and subsequent clearing of the photocell at the charge end of the associated receiving chute, opposite the HSVPD.

b. One device of the control station shall be an Illuminated Amber Jam Indicator Lamp to signal a jam condition of the photocell at the charge end of the associated receiving chute, opposite the HSVPD.

c. One device of the control station shall be Maintained Contact Illuminated Red Mushroom Head Emergency Stop type switch to stop the associated subsystem conveyors and energizing of the HSVPD motor.

d. One device of the control station shall be Auto/Cycle momentary switch. This will allow for the manual cycling of the HSVPD for testing purposes

K. Interlocks

1. Provide Failsafe interlocks and limits in the system to ensure safe operation. Assume responsibility for the

integration of all interlocks and limits that may be necessitated by the characteristics of the elements selected for combination into a total system. Interlocks and limits shall be included for the protection of personnel, equipment and baggage, and in the performance of the operational functions specified for the subsystem and elements comprising the system.

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

3. Provide warning signals, which are activated automatically upon start-up, where appropriate. Flashing lights shall be visible from all points in the vicinity of the equipment concerned. Alarms shall be audible within the equipment vicinity and each alarm in the system must be distinctive from any sound within the hearing range, and shall not be unduly annoying to working personnel and shall comply with all applicable codes and regulations. Although not specifically mentioned in the control subsystem descriptions all automatic start-up functions shall be preceded with appropriate audible and visual indicators unless otherwise specified.

4. Inhibit further equipment action upon sensor failure should personnel safety be in doubt. Inform the involved equipment operator or maintenance personnel of such failure through the MCP Touch Screen Terminal and the MDS. Sensors shall be selected and positioned such that false signals from debris, ambient light, personnel movement, etc. do not cause activation.

5. Assume the responsibility to coordinate the facility fire zones with the Architect and to add a dry contact to the subsystems controls, so that if a fire is detected the system will perform the necessary shutdown. This feature shall be provided to the BHS control system, regardless if the system includes a fire door or not.

L. E-Stop Lanyards (ESL)

1. Provide e-stop control lanyards in non-public operational areas as detailed on the contract drawings including along the length of the suspect and clear bag subsystems within the CBRA.

2. Activation of the e-stop control shall cause the related conveyor to stop for as long as the control is activated.

3. The e-stop lanyard cable shall be color coded – Red

M. Swing Down Ladder Advisory/Warning Beacon (if required)

1. Furnish a failsafe interlock with associated swing down ladder to provide:

a. An Amber rotating beacon as a swing down ladder warning in the vicinity of each swing down ladder, which will be visible to tug and cart drivers entering the immediate area of the respective ladder.

b. Activation of the beacon shall occur as the swing down ladder is traveling from the full up position to the full down position and be maintained while in the down position.

c. Deactivation of the beacon will occur when the swing down ladder is in the full up position.

N. Vertical Sorter Conveyors

1. The VSU shall be comprised of three self-contained conveyors and shall be controlled by the respective subsystems PLC and local control station, as described below.

2. Provide photocells at strategic upstream locations to synchronize the VSU operation with bag position.

3. Provide the necessary number of proximity sensors for the control of the unit and to confirm the position of the switch conveyor. If the VSU switch conveyor does not reach the appropriate position within a preset time after it has started its cycle, report the fault condition to the MDS. The sensor is to be of the shaft encoder type with proximity detector controlled by a Warner Electronic Controller (or approved equivalent) so that the switch conveyor position shall always be the same.

4. The Vertical Sorter Conveyors shall be able to operate in automatic and manual mode, which shall be determined through the local selector switch that will be installed on the VSU control station. When the selector switch is set in the Automatic mode (i.e., normal mode of operation), the PLC control logic shall issue the switch conveyor commands based on the assigned destination of the baggage. When the selector switch is set in the Maintenance

mode, for maintenance and trouble-shooting purposes, the PLC controls shall be disabled and the control of the VSU shall be controlled through the local hardwired UP – DOWN pushbuttons; in this regard, the VSU belts shall be controlled by the FORWARD or REVERSE pushbuttons.

5. Provide a photocell on the receiving conveyor spur to which the VSU discharges to report to the control system that a bag has successfully transferred and that no jam has occurred. If a jam is detected, inhibit further operation of the unit and report the fault condition to the MDS.

6. Each VSU feeding a downstream conveyor shall have an eight (8) device control station installed adjacent to or on the housing of the VSU for maintenance personnel's use to troubleshoot faults and for purging purposes of the VSU:

   a. One device of the Control Station shall be a two-position selector switch for use by maintenance personnel only. Turning the Auto/Maintenance switch to the Maintenance position stops the conveyors and enables the VSU manual controls for maneuvering the conveyors to the up or down position. Returning the selector switch to the Automatic position enables the normal operation of the VSU.

   b. Two pushbutton control devices on the control station shall be provided for the Manual UP – DOWN Control of the switch conveyor. Pushing and holding in place the UP or DOWN pushbutton shall activate the VSU in the relative direction. The unit shall automatically stop when reaching the raised or lowered proximity switch, which shall confirm the position of the switch conveyor. Releasing the UP or DOWN pushbutton shall stop the movement of the switch conveyor.

   c. A second set of pushbutton control devices shall be provided on the control station for the FORWARD and REVERSE control of the VSU belts, which the unit is under the control of the maintenance mode.

   d. One device of the control station shall be a green momentary contact Reset/Re-Start push-button switch to allow for reset of the VSU, with its associated subsystem conveyors, and energizing of the VSU motor following a jam or fault condition and subsequent clearing of this condition, at any juncture of the VSU, via the related Jam Reset procedures. Pressing this pushbutton while the conveyors are Timed-out will not start the subsystem.

   e. One device of the control station shall be an Illuminated Amber Jam/Fault Indicator Lamp to signal jam conditions and raising-lowering-positioning faults at any juncture point of the VSU unit. When a fault is detected the manual controls listed above may be used to clear baggage from the unit. Aligning the VSU unit to a raised or lowered limit and pressing the Reset/Restart pushbutton clears the fault condition.

   f. One device of the control station shall be Maintained Contact Illuminated Red Mushroom Head Emergency Stop type switch to stop the associated subsystem conveyors and energizing of the VSU motor.

3.07 ELECTRICAL & CONTROLS SPECIAL CONSIDERATIONS

A. Power Source

1. The electrical equipment and PLC control systems supplied by the BHS Contractor shall be compatible with, and operate reliably and effectively with, the normal electrical supply typically available at airport locations. The equipment shall not be unduly sensitive to fluctuations in supply voltage which may typically vary by plus or minus ten percent (10%) of nominal values.

2. The BHS Contractor shall provide necessary electrical supply filters, conditioners, and regulators for all equipment, which cannot meet the specifications stipulated.

B. Emergency Power

1. Normal and emergency power shall be provided to all fire doors and their immediate upstream and downstream conveyors with all associated controls in order to provide a positive means for preventing obstructions (i.e. baggage) from interfering with the operation of the fire doors in accordance with the fire door mode of operation upon detection of heat, smoke, or fire elsewhere in the specification.

2. Normal and emergency power shall be provided to the oversize conveyor subsystem and the associated clear bag slide and fire/security shutters.

3. The remaining conveyors and related equipment of the respective subsystem are to be controlled and power by

normal building power supply.

4. To accomplish emergency power supply, the following shall be provided:
    a. Emergency electrical power feed to a junction box with 20' of cable coiled inside near the PDP location (by others).
    b. Wiring from the junction box to a disconnect and to a distribution panel (by BHS Contractor).
    c. Wiring from the distribution panel to the appropriate MCP(s) housing the subsystem components responsible for the fire door/associated conveyor operation (by BHS Contractor).
5. Functional Intent
    a. The fire doors and their immediate upstream and downstream conveyors with all associated controls are to be normally powered by normal building power. In the event of loss of building power, the power-switching device shall detect this loss and apply the emergency power to the fire doors and their associated upstream and downstream conveyors and controls to assure the fire door pathway is clear prior to stoppage of conveyors and closure of the doors.
    b. The BHS Contractor shall supply the power-switching device and associated controls.

C. Outbound System input conveyor "Manual Start" Sequence
1. Each Outbound BHS subsystem shall be enabled by means of suitable computer dialogue at the computer keyboard with password protection.
2. Each check-in subsystem shall be initiated to start via a local "Subsystem Start" Security Card Swipe Device. Activation of the security card swipe shall supply power to the respective control station, located at the associated conveyor segment area. Actuation of the Subsystem's Illuminated Start push-button will energize the respective Visual/Audible warning alarms along the conveyor line, both in the public space and air side, for 10 seconds (adjustable) - e.g., check-in area input conveyor respective sub-system ceiling conveyor right-of-way platforms and the work aisle(s) of the make-up devices. The Fire/security doors shall open while the "Run" 10 second alarm sounds and flashes. After the 10 (ten) second "Run" alarm period and when the Fire/Security doors are fully opened, the check-in collection conveyor(s) shall start. The downstream transport conveyors and make up devices shall start via an auto-start function. The downstream transport conveyors shall all start sequentially from the output to the input with an appropriate delay between each motor starter actuation to ensure electrical power surges are minimized. The start-up warning signal at the flat plate make-up device shall sound only if the device(s) are not already running.

D. System Ready Indication
1. A green indicator light, labeled SYSTEM READY and located on the door of each MCP shall serve to indicate that the devices under its control are ready to operate upon receipt of a START signal, from the BHS control system and local card swipe device. To accomplish this, the light shall illuminate under the following conditions, per the respective subsystem:
    a. Power is applied to the MCP.
    b. The local conveyor motor and Fire/Security door disconnect switches are in the "ON" position.
    c. All Emergency Stop pushbuttons are reset.
    d. No Motor overloads are tripped.
    e. No Jam conditions are indicated
    f. No oversize conditions are indicated.
    g. All HSVPDs, diverters, vertical sorters are in the HOME position.
    h. No faults are indicated on the MDS, Touch Screen Terminal or MCP.

E. Make-up Control Stations
1. Make Up Device

a. Provide Four "Start" Pushbutton control stations (two on the each side of the flat plate make-up device) for Manual Start-up operation of the make-up device; In case the flat plate make-up device times-out before all baggage has been sorted, activation of any start button on the flat plate make-up device shall cause the device to run for an additional twenty (20) minutes (adjustable) without the feed conveyors operating.

3.08 BHS DETAILED CONTROL DESCRIPTIONS/REQUIREMENTS

A. General Design Requirements

1. The following subsystem control descriptions apply the referenced components and circuits to the operational aspect of the system and specify the actual elements under their control.

2. By means of suitable computer dialogue at the computer keyboard in the Computer/Control Room, (or by "Mouse" manipulation and using pull-down menus) it shall be possible to make changes to baggage flow in response to a variety of conditions such as:

   a. Jams

   b. Equipment Failure

   c. Conveyor full condition

3. In each case an operator, having access to the proper passwords, as an example, will be able to:

   a. Activate a HSVPD and set it to operate either continuously or in an alternating sequence.

   b. Shut down a HSVPD or conveyor.

   c. Set up alternative flow paths, for instance, to bypass a defective section of conveyor, or similar.

   d. Set up default make up devices, for example, should a make up device fail in the outbound bagroom; assign another make up device within the bagroom to allow transfer of baggage.

4. Reference the Contract Drawings for conveyor equipment power distribution and subsystem indication. Location for each of the new MCPs is referenced on the BHS Partial Plan and Control Plan Drawings. Power distribution point (PDP) locations for the new MCPs are at the immediate area of the respective MCP as shown on the BHS Partial Plans.

5. The Control Functions associated with the, outbound sort and screening systems and each of the ticket counter check-in, etc. are described in the following paragraphs. Apply the generic subsystem/conveyor line functional description to the detail design of each electrical subsystem of similar type.

6. Prepare software for the control system reflecting the sequence of operation for each subsystem as described in the following paragraphs. The paragraphs describe the particular subsystem specific controls that will be required in addition to those standard controls (i.e., Jam Detection, Jam Reset, Cascade Stop, Oversize Detection, Merge Control, Auto Start, Auto-Stop, Emergency Stop, etc.) that will be required for each subsystem (described elsewhere in this document).

7. Although Fire doors are not required as part of this project, the BHS Contractor shall assume the responsibility to provide a dry contact to the subsystem controls so that in the event a fire is detected the conveyor system will shut down.

8. Each Control Station located on the Airside (Ticket Counter Control Stations, Oversize Conveyor Control Station, etc.) shall have the ability to interface and connect to a security card swipe (provided by others).

B. Ticket Counter Subsystems

1. General

   a. The outbound ticket counter system consist of the following subsystems:

      1.) TC2 through TC4

   b. All fault annunciation and status reporting for the outbound ticket counter conveyor subsystems shall be displayed both graphically and in text on the workstation MDS system or Touch Screen Terminal.

c. The following describes the TC2 ticket counter line sequence of operation all other ticket counter conveyor lines will operate in a similar manner.

1.) Provide security/fire doors and draft curtains.

2.) The Check-in Ticket Counter and Outbound Transport Line portion of the subsystem transports originating outbound baggage from the ticketing area to the EDS matrices.

2. Control Equipment Components

a. A minimum of two control stations shall be provided for Start/Stop control of each ticket counter conveyor lines. One station shall be located on the wall, adjacent to the charge end of the TC2-01 conveyor, the second on the wall, adjacent to the discharge end of TC2-02. The location of these control stations shall be coordinated with the Owner or his representative.

1.) The control station located at the charge end of TC2-01 shall include the following operators/control devices:

a.) Lighted " Start" Pushbutton

b.) "System Stop" Pushbutton

c.) Lighted Push-Pull (Lockable) E-Stop

d.) Sonalert Warning Device

2.) The station at the discharge end of the TC2-02 conveyor shall include the following operators/control devices:

a.) Lighted "Start" Pushbutton

b.) "System Stop" Pushbutton

c.) Lighted Push-Pull (Lockable) E-Stop

d.) Oversize Reset Illuminated Push Button Light.

e.) Sonalert Warning Device

f.) Security Card Swipe interface

b. Ticket Counter Conveyor Start Sequence:

1.) The conveyor line's local "Subsystem Start" shall be enabled via the "System Start" function, from the Master Control Room's BHS Workstation cabinet. This function shall allow the local "Subsystem Start" security card swipe to supply power to the respective TC2 line Start/Stop control stations (BHS Contractor to coordinate the card swipe interface and requiremetns with Card Swipe Contractor).

a.) Automatic System Cascade Start:

(1.) The conveyor segments downstream of TC2-02 shall start via an "Auto Start" sequence. Provide auto start photocells upstream of sections of outbound transport conveyors, not specifically controlled by the "Start/Stop" control station. Program the auto start circuit to start conveyor segments in zones throughout the BHS (if not already running) whenever the auto start photocell(s) is (are) interrupted. Each downstream TC2 zone shall start sequentially from the output to the input with an appropriate delay between each motor starter actuation to ensure electrical power surges are minimized. This process shall be similarly implemented throughout the BHS.

b.) Automatic System Cascade Stop:

(1.) The conveyor segments downstream of the last load belt (TC2-02) shall stop via an "Auto Stop" sequence. Provide auto stop photocells upstream of sections of outbound transport conveyors, not specifically controlled by the "Start/Stop" control station. Program the auto stop circuit to stop conveyor segments downstream of TC2-02 whenever the auto stop photocell does not sense a bag for 5 to 30 minutes (adjustable). The same photocell may

control both "Auto Start" and "Auto Stop" functions.

c.) Manual Stop:

(1.) Depressing the "Stop" pushbutton on any of the Ticket Counter Control Stations shall stop all load conveyors upstream of the fire/security door and close the fire/security door (if the Door Clear Photocells are not blocked); conveyors shall run for a predetermined period to clear all bags on the conveyor segments, prior to the stoppage of the conveyor segments and closure of the door.

d.) Start-up alarms and fault alarms shall be located as required, along the outbound line and make-up device area. Start-up and Fault Warning Alarm(s) location and function shall be consistent with the specified requirements indicated elsewhere in this document.

e.) Jam Reset and Emergency stop control station(s) location and function shall be consistent with the specified requirements indicated elsewhere in this document. All Jam Reset and Emergency stop stations associated with the TC2 line's outbound transport conveyors in the departures floor level ceiling space shall be located adjacent to each conveyor drive on the maintenance platform side, so that they are accessible by maintenance personnel.

f.) The Ticket Counter conveyors shall be activated by the security card swipe. This action shall supply power to the pushbutton control stations located at the Ticket Counter area. Pressing a “Start” pushbutton on any ticket counter control station shall energize the TC2 Start-up alarm(s) in the check-in area, along the outbound transport line and the bagroom for 10 seconds (adjustable). The start-up alarms in the bagroom area shall sound only if the make up sort system is not already running. The Fire/Security door shall open while the "Run" 10-second start-up alarm sounds and flashes. After the 10 second "Run" alarm period and when the Fire/Security door is fully opened, the ticket counter check-in conveyors TC2-01 through TC2-02 shall start along with the next zone in TC2.

3. Other Control Functions:

a. Control Functions associated with the conveyor line's Fire/Security Door operation, Cascade Stop, Jam Detection/Restart, Oversize Detection/restart, Emergency Stop/Reset, Motor Control Panels, Motor Overload conditions and respective Alarm Silence function(s) shall be compliant with the specified requirements described elsewhere in this document.

b. Flash the Ticket Counter Start Pushbutton “Green light” when the respective ticket counter conveyor subsystem has cascaded back to the load belt. This will notify the ticket counter agent that a jam/fault has occurred in the subsystem

c. Merge Control functions associated with any of the ticket counter conveyor lines' 45 degree merge and mainline conveyors shall be compliant with the specified requirements described elsewhere in this document.

C. Mainline Sortation Subsystem

1. General

a. The Sort Line will contain an ATR for linking outbound originating bags to their designated flat plate make up device. By means of high-speed diverters on the Main Sort Line, bags shall be diverted from the ML1 line to a MF line for access to one of the four (4) sort outputs (flat plate make-up devices). For bags lost in tracking or misreads at the ATR the ML1 line continues to the ME1 line for Manual Encoding.

b. Bags arriving from the referenced input areas shall have bag tags attached, which shall contain machine-readable bag tags. The Main Sort Line shall accept the bags from the outbound transport line and pass them through the Automatic Tag Reader. The information from the scanner will be sent to the PLC/Control System where it will be matched to a particular record in a flight table to determine its device destination.

c. The make-up device (MU1 through MU4) and associated conveyors shall start through the ATR/control system when a bag is destined for that make up device, if not already running.

d. Manual Encoding Line: Bags that are not successfully read shall be transported to the manual encoding line

(ME1). At the manual encoding line, the bag shall advance on a series of queue conveyors until positioned at the manned station. The bag shall then be encoded, using a scan gun or by key encoding, and then released. Once released from the manual encoding area bags shall be merged onto the ML1 via the 45 degree merge conveyors, the bag shall be tracked from the manned position to its sort output/destination.

e. Each make-up carousel shall be equipped with a stack lamp indicator consisting of a minimum of three stacked lights. The first light shall indicate if there is a bag awaiting at the manual encoding area. The second light shall indicate if there is a bag awaiting removal at the oversize clear bag conveyor and the third light shall indicate if there is a bag at the 'dump' carousel which either lost tracking or required manual encoding.

2. Control Functions

a. There will be no manual start/stop controls for the conveyors in this subsystem other than local device controls, as specified. All conveyors will operate by means of auto-start/stop circuits.

b. Start-up Sequence

1.) The normal start-up operations of the Main Sort Line of conveyors is governed by an auto-start circuit and is controlled by separate photocells; located on each input line (i.e., TC2, TC3, TC4). The photocells shall be located far enough upstream of each input line, to allow the sort line conveyors to come up to speed before baggage arrives. When a bag is detected at the input line's photocell(s), the sort line conveyors - associated with that input - shall start (if not already running) sequentially beginning with the first sort line conveyor segment relative to the input line. Activation of the start push button will also start the respective mainline if not already running.

2.) An amber warning beacon shall be positioned at/near the manual encoding station and the flat plate make-up devices. These beacons shall be activated at the start-up of the ML1 line. Additional Start-up Alarms and Fault alarms shall be located, as required, along the sort line's right-of-way (e.g., maintenance platform areas).

3.) The manual encoding panel and conveyors in the ME1 subsystem shall energize through the ATR/control system that a bag is destined for the conveyor ME1-01.

c. Shut-down Sequence:

1.) The ML1 conveyors of this subsystem shall shut-down through an auto-stop circuit which will time-out and immediately stop all conveyors if, after a 15 minute period (adjustable), no bags have been detected by the auto-start circuits and all baggage have cleared the train of conveyors.

2.) Conveyors ME1-01 through ME1-xx shall shut-down when a bag has not been detected at the ATR/control system destined to manual encoding (ME1-01) for a pre-determined time (adjustable from 5 to 10 minutes) the conveyors will shut-down, but will remain energized.

d. Merge Priority

1.) The ML1 line shall have priority over the ME1 subsystem's 45° merge conveyor until baggage is cascaded back to a certain point (to be determined and agreed upon during the design review meetings). This prioritization shall be

D. EDS Security Screening System

1. General

a. The BHS Contractor shall submit as per Part 1 of this specification submittal process, to the Owner or his representative for review and approval, the control sequence of operation and functionality of the In-Line EDS Security System.

b. The type of EDS device to be provided and integrated into the Baggage Handling System for this project is the L3 3DX 6600.

c. The BHS Contractor shall be responsible for obtaining the latest L3 3DX 6600 Integration Guide, L3 3DX 6600 Site Planning and Design Guide and L3 3DX 6600 BHS Interface.

d. The control sequence of operation and functionality of the EDS system shall abide by the current TSA protocols. It shall be the BHS Contractors responsibility to obtain the latest TSA protocol.

e. The following description for the EDS Security Screening System and related sequence of operation is provided as an example; Detail control functionality shall be coordinated with the TSA or their representative and the Owner or his representative through the shop drawing submittal process. The BHS Contractor shall submit a detailed In-Line EDS Security System Control Sequence of Operation for review and approval by the Owner or his representative and the TSA or their representative. The control sequence of operation and functionality of the EDS system shall abide by the current TSA protocols. Assume the responsibility to obtain the latest TSA protocols for the security screening of originating baggage.

f. The BHS Contractor shall be responsible to coordinate with all relative on-site disciplines/contractors for all required interfaces to the BHS. Assume the responsibility to also coordinate and work closely with the TSA's EDS provider and the Owner's Security Representative for all CBIS integration testing, including providing the necessary support and participation for the required system acceptance demonstrations relating to the TSA's mandated certification testing, such as the Pre-TRR, TRR and ISAT, as specified in Part 1 of this specification.

g. Prior to the TSA's mandated certification tests (i.e., Pre-TRR, TRR and ISAT), a SAT will be performed on each EDS machine, independent of the BHS. The BHS Contractor shall provide the necessary support during the SAT on each EDS machine, which shall include but not be limited to the installation of power and controls to the related conveyor segments to allow for full operation of the EDS.

h. It should be noted that all documentation that is associated with the operation/functionality of the CBIS, including SAT, Pre-TRR, TRR and ISAT are Security Sensitive Information (SSI) and will have to be managed/controlled as such, in accordance with 49 CFR 15 and 1520. All Security Testing shall be done in conjunction and coordination with DOA SST (Security and Systems Technology Unit).

i. The BHS Contractor shall assist the TSA in performing the mandated Independent Verification and Validation (IV&V) for both the Outbound in-line EDS systems. The BHS Contractor shall be responsible for obtaining the latest copy of the TSA IV&V test procedure (from the TSA or IV&V Contractor) to ensure their completed EDS systems meet all the protocols and requirements contained within, prior to the TSA IV&V(s). The BHS Contractor shall carry out a "dry test run" of the IV&V prior to the TSA testing.

j. The In-Line integrated EDS configuration for this project will consist of three (3) Screening Level Classifications which are as follows:

   1.) Level 1 – EDS screening in the "Automatic" mode:

      a.) All originating checked bags and bags designated CAPPS shall be routed to an Explosive Detection System (EDS) device for security screening. The EDS device software (by others) will automatically scan each bag. The EDS will provide a status for the bag "clear" or 'unclear' based on the assessment of the images and notify the BHS via the EDS/BHS interface. "Clear" Level 1 bags will be routed to the sortation system using the most direct route.

   2.) Level 2 – Remote Operator Screening.

      a.) Baggage that receives a "Unclear" status from the level 1 device will have the suspect image delivered via the security interface network to the EDS security monitoring area (level 2). The images shall be received and displayed on monitors in the EDS control room. An operator will view the image in the display for a configurable time duration utilizing Threat Resolution Tools (TRT) to determine if the bag is "Clear" or "Unclear". If the allocated time period expires (to be determined by local TSA staff), and no decision has been rendered, the image and relevant bag will be given an "Unclear" Level 2 status and routed to level 3 for review and appropriate handling. "Clear" Level 2 bags will be routed to the sortation system.

   3.) Level 3 – Explosive Trace Detection (ETD) operation.

      a.) Bags with a "Unclear" Level 2 status will be transported to the manual reconciliation room for further inspections and appropriate handling (ETD). Cleared level 3 bags would be re-introduced into the system via the clear bag (CB) subsystem(s). "Failed" level 3 bags shall be handled per the local EOD protocol.

4.) The BHS Contractor should note that the terminology of “Unclear” and “Unknown” as utilized throughout this document are general terms and in actuality is dependant on the type of EDS supplied. The different terminology for Unclear and Unknown is as follows:

a.) “Unknown/Fault” EDS bags are bags that were caught in the EDS machine when a machine fault occurred and were subsequently discharged as the result of a machine restart/reboot cycle.

b.) L3 Communications utilizes Search for “unclear” bags and “Unknown” for unknown bags

k. This description of operation is intended to define the unique overall functional requirements of the BHS control system that are related to the operation of the EDS subsystems regardless of the type of EDS device installed. As set forth elsewhere in these specifications, the definitive architecture, detailed design and any/all coordination required for the control system design in its entirety, including (but not limited to) the BHS-EDS interface requirements, shall be the responsibility of the BHS contractor. It shall be the BHS Contractors responsibility to tailor his system to meet the requirements of the EDS systems to ensure the functionality is provided as described herein. The operation described below shall be the primary operation for the system to be provided as a part of the scope of work specified herein.

l. The BHS contractor shall, as a part of this work, provide and coordinate with the EDS equipment manufacturer as required to coordinate the details of the necessary interface(s) between the BHS and EDS systems in order to accomplish the intended operation described herein. The BHS contractor shall, in all cases, be responsible for any wiring, communication bridges etc. between the BHS and EDS equipment systems that are required for these interfaces (hardware and software).

m. Through the required interfaces with the EDS equipment systems, the BHS shall receive an “active” or “inactive” (i.e., out of service, etc.) status for each of the EDS equipment devices which shall, on a real-time basis, be recognized by the BHS so as to determine whether bags should be sorted to the device and update the MDS displayed status for associated BHS conveyors and EDS equipment in the BHS control room. Provided that the associated devices are “active”, the baggage shall then be diverted via diverter, to one of the lines feeding an in-line EDS equipment screening device. As soon as a machine becomes inactive, the diverter feeding that line shall immediately cease sending bags to that device. Should bags be queued upstream of the device after it has become inactive, an appropriate alarm shall be raised at the MDS indicating this situation.

n. Each of the EDS lines shall contain a number of queuing conveyors upstream of the EDS equipment device (minimum of three), which shall provide separation of the bags and buffer the input flow to the individual machines and allow for a balanced distribution of the bags among the available equipment. When all active level 1 EDS equipment devices, or all those operating in the needed mode of operation (see explanation below), and their associated queuing conveyors are full, baggage shall be allowed to cascade upstream. The BHS shall maintain tracking and status of bags at all times while both in the EDS matrix and until scanned/updated by an ATR scanner.

o. The EDS security screening subsystems (matrix) shall be configured so that any number of the EDS devices can operate in either a fully-automated mode (machine decision) or in a “manual” mode of operation that will allow review of the scanned image by an operator (located in a remote screening room). The mode of operation will be software selectable through the EDS workstations. Through required interfaces with the EDS screening devices/systems, the subsystem shall receive and immediately recognize this mode of operation (on a real-time basis) and route baggage appropriately (as described in paragraphs below). Note that “manual” mode shall actually refer to the several variations that are or may be available on the EDS devices (hold all bags, hold on alarm, etc.).

p. The BHS contractor shall make provisions to accommodate a Level 2 operation in the controls system. Level 2 shall refer to the process whereby the images/information acquired by the Level 1 EDS equipment are presented to remote operators for manual review and subsequent resolution. In the absence of a Level 2 decision, the BHS control system shall automatically default un-cleared, fault, (decision pending) if required at the level 3 decision point bags to the level 3 manual ETD process. The system shall therefore allow for a minimum of 3 screening decision levels within the process, although only two may be utilized. The database of baggage IDs maintained by the BHS control system shall have a minimum of 3 security fields to record the screening process at each level as applicable. The BHS control system shall recognize decisions from various screening levels provided by the screening system and shall record these decisions in the database in

the appropriate fields.

q. If a "decision pending" status (referred to as Level 2 in these documents) was given at hand-over (for Level 1 equipment only), the corresponding EDS equipment shall then send an additional (i.e., Level 2) bag-specific decision message (clear, un-cleared or unknown/fault) to the BHS when a decision is available. A decision time-out default time shall be established during controls development, and shall be no longer than the time between the output of the level 1 device and the level 2 -diversion points (initially this will be 45 seconds and shall be a variable setting)). Bags are then sorted to one of the diversion points to either Level 3 ETD or the sortation system (only if "clear").

r. As baggage is transported through the system in all of the processes described above, it shall be continually tracked for position by the BHS. The only allowable exceptions to this shall be while inside the EDS equipment devices themselves where the EDS equipment shall track the bag. Particular attention should be paid to the "handoff" points between the BHS and EDS to ensure positive tracking of baggage.

s. If the Level 1 decision is "fault", then the corresponding bag shall be routed to CBRA. If a bag loses tracking while within the CBIS the bag shall also be routed to CBRA.

t. In the paragraphs below it should be noted that "decision point" refers to the point at which a bag will either be routed into the BHS for final sortation or routed to the next security screening subsystem for further processing.

u. The BHS Contractor shall provide bag-centering functionality prior to every EDS device (whose belt width is smaller than a standard conveyor (i.e. as a minimum, fixed diverters attached to the conveyor side guards to force the bag to the center of the conveyor)). Refer to Part II of this specification for the minimum requirements for a Directional Input Device (DID). The BHS Contractor shall provide to the Owner and Engineer the type of centering to be proposed for review and approval.

v. To prevent "Out of Gauge" items (refer to EDS specification for maximum bag sizes) being introduced into the level 1 EDS device the BHS Contractor shall provide a means to monitor for "out of gauge" items utilizing either a BMA or photocell arrangement. "Out of gauge" items result in both increased downtime due to EDS device reset/restarts time and bags that were being processed by the device at the time being ejected during the reset and given a Fault decision which results in those bags to be re-circulated through the system back to Level 1. The "out of gauge" monitoring should take place prior to the divert into the EDS devices(s) line. "Out of gauge" items shall be transported directly to level 3.

2. EDS Subsystems

a. Reference the BHS Control Plan drawings for the layout and definition of the EDS security screening equipment, associated with the security screening subsystems. All originating checked bags shall be routed to the EDS machines located in the bagroom. The following subsystems comprise the EDS security system matrix:

1.) ED1 through ED3 (level 1)

3. Controls Functions

a. The following paragraphs describe the particular subsystem specific controls that will be required in addition to other controls (i.e., Bag Tracking, Jam Detection, Jam Reset, Cascade Stop, Oversize Detection, Merge Control, Auto Start, Auto-Stop, Emergency Stop, etc.) that will be required for each EDS subsystem (described elsewhere in this document).

b. Upon bag arrival, at the conveyor directly interfacing any of the EDS devices, the BHS shall, through the BHS-EDS interface(s), "hand over" the bag to the EDS equipment device by sending (or receiving) a bag ID number. The BHS system shall provide the EDS system with an ID for each bag and track that baggage item with the unique ID until the closest encoding point (be it an ATR or manual encode position) and update the ID with the real baggage ID at that encoding point. The bag ID shall be easily recognizable as an EDS bag ID (e.g. start with 1 for ED1, 2 for ED2 etc.). The BHS Contractor shall coordinate with the EDS supplier for all BHS/EDS handshake protocol. Upon receipt of a signal from the EDS equipment, the BHS shall then advance the bag into the EDS equipment device. The bag shall be scanned and, depending on mode of operation, the bag shall be passed back to the BHS. The EDS equipment shall pass the bag back to the BHS by sending an appropriate message that includes status (e.g., clear, unclear, unknown/fault, decision

pending, etc.) and also echoes the bag ID number upon arrival at the exit conveyor, note: not all machines will pass the bag status back at the same time that the bag is passed back from the machine, it may happen at a downstream point and the BHS control system should be set up to allow for this. Upon receipt of the corresponding bag status/hand-over message the BHS shall send a message back to the EDS equipment acknowledging receipt of that status and route the baggage as described below.

c. When a "clear" bag decision is received from any EDS equipment for a known bag, the BHS shall relay the decision through the interfaces described elsewhere in these specifications and route the cleared bag to the corresponding main line for onward transport to the appropriate make-up.

4. The following describes the EDS security subsystem operation;

a. Level 1 Screening

1.) All baggage will enter the conveyor line that feeds the Level 1 Screening equipment. Level 1 screening equipment shall consist of EDS equipment located at ED2 through ED4 (matrix 1 – east matrix), ED6 through ED8 (matrix 2 – west matrix) to be provided by others and integrated under this contract by the BHS Contractor.

2.) Bags entering the EDS device will have a unique bag security identification ID assigned, the BHS shall pass this ID number to the EDS via the EDS/BHS interface for tracking purposes and status updates (the BHS Contractor shall coordinate with the EDS supplier for all BHS/EDS handshake protocol).

3.) The EDS device software (by others) will automatically scan each bag. The EDS will provide a status for the bag "clear" or 'unclear' based on the assessment of the images and notify the BHS via the EDS/BHS interface.

a.) All bags will be tracked in dynamic PLC RAM via a memory model of the bag ID number, from the entry to the EDS equipment (Tracking of Bags should start at the first point of ID (e.g. at an BMA, EDS device, etc.) and tracking actually ends at the entrance to the EDS or the handoff point to the EDS since the EDS takes over. Tracking starts again at the handoff point from the EDS to the BHS). The memory model will be updated in real-time to reflect the position of the bag on every conveyor.

b.) Bags that receive a "Clear" status will be diverted to the sortation area, after having their ID status updated, be it an ATR or manual encode position

c.) Bags that receive an "Unclear" status will be processed as described in the Level 2 Screening procedure.

d.) Bags that receive an "Unknown/Fault" status will be re-routed back to Level 1 for re-screening.

b. Level 2 Screening

1.) Baggage that receives an 'Unclear' status will have the suspect image delivered via the security interface network to the EDS security monitoring area (level 2). The images shall be received and displayed on monitors in the EDS control room.

2.) An operator will view the image in the display for configurable time duration. If the allocated time period expires, and no decision has been rendered, the image and relevant bag will be given an 'Unclear' Level 2 status.

3.) A Level 2 operator will press the 'Clear' button for resolved alarms.

a.) These bags will be assigned a 'Clear' Level 2 status.

b.) The information will be transmitted to the BHS via the EDS/BHS interface.

c.) The BHS will update the information referenced to the Bag Security ID and continue to track the bag and route the bag to the main sortation line for sortation to the output destination.

d.) If the BHS receives a level 2 "clear" status after the bag has been diverted to the level 3 area, such message shall be ignored (however, appropriate logs of this event shall be kept and provided in reports)

4.) An operator will press the “Unclear” button for images that cannot be resolved in this process.

a.) These bags will be assigned an “Unclear” Level 2 status.

b.) The information will be transmitted to the BHS via the EDS/BHS interface.

c.) The BHS will update the information referenced to the Bag Security ID and continue to track the bag through the Level 3 diversion point.

5.) Bags that receive an “Unknown/Fault” status will be re-routed back to Level 1 for re-screening.

c. Level 3 Screening

1.) Bags with an “Unclear” Level 2 status will be transported on the SB line to the reconciliation room for further inspections and appropriate handling.

2.) “Cleared” Level 3 bags would be re-introduced into the system via the SB/CB subsystem.

3.) Failed level 3 bags would be handled per the local EOD protocol.

5. Fail Safe - Clear Bag (CB) Diversion

a. The Control system shall provide for fail-safe controls at the diverters to the CB subsystems to ensure that all bags that are supposed to be diverted to the sortation system are actually diverted. Failsafe photocells shall be employed on the mainline immediately downstream of the diverters/vertical sorters. When a bag is supposed to be diverted to this line, the receiving conveyor shall verify that the bag is received and the photocell immediately downstream of the diverter on the mainline shall verify that no bag is detected in the window where this bag was or no unknown bag is found prior to another successfully tracked bag passing this photocell. If the bag is not verified to be received on the SB conveyor or a bag is seen on the mainline that should have been diverted, stop the mainline, raise an alarm at the MDS identifying a failed to divert bag at the SB subsystems and include the bag ID in the alarm (to assist staff in finding the bag that failed to divert). Require reset of this condition to restart that mainline (use the appropriate local start pushbutton to actually restart the subsystem). The baggage failsafe detection shall be activated by less than 0.5% of the total bag volume as measured by the number of individual bags causing the failsafe fault.

6. EDS Efficiency Requirements

a. Less than one percent of all bags processed shall jam throughout the system (i.e., from the normal daily point[s] of induction through the EDS, through Resolution [if Non-Clear], and to the point[s] where bags are returned to the outbound system). This is measured by counting the total number of jammed bags and not by counting jam events. This count includes BHS systems feeding EDS screening systems.

b. For systems that do not have conveyors to reintroduce bags from the Resolution area for screening through an EDS, the error rate as defined below may be no more than one percent of the total bag volume processed.

c. The error rate formula is:

1.) Error Rate = [(Total Bags at Resolution) minus (Valid EDS Out-of-Gauge Bags) minus (Valid Non-Clear Bags with Tracking IDs)] divided by Total Bags Inducted.

a.) Valid Non-Clear Bags include Suspect and EDS Unknown/Faulted bags.

b.) Valid Out-of-Gauge Bags include bags whose length, width, or height is outside the processing dimensions published for the specific EDS, or outside the dimensions published in the BHS Specifications.

d. For each Suspect bag that arrives in the Reconciliation/ETD area, exactly one digital or printed image should be available to allow TSA to conduct a directed search. A provision shall be made for by the BHS to generate reports that can be made available to TSA, showing which bags were “Lost in Tracking” to aid TSA in resolving abandoned images and bag counts in ETD.

e. For those systems using On-Screen Resolution (OSR) protocols (versus machine decisions only) the system must allow 45 seconds of travel time between the exit of the EDS and the final diversion point to the Reconciliation/ETD area.

7. EDS Start Sequence

    a. The following start sequence describes security screening for the TC2 outbound mainline:

        1.) The level 1 EDS unit(s) shall be activated from the Security Screening Control Room, independently of the baggage system, at the beginning of the day to allow for sufficient warm-up time. As a minimum, the associated EDS conveyor lines must be running for the EDS device to start up or as required by the EDS machine. Also refer to the EDS "TEST" mode of operation outlined in the following paragraphs.

8. EDS Stop Sequence

    a. The level 1 EDS device (s) shall be shut down from the Security Screening Control Room, independently of the baggage system, at the close of the day.

    b. The level 1 and level 3 EDS conveyor lines shall have an auto-stop function. Photocells located at the discharge end of the first and last conveyors on the TC2, TC3, TC4 subsystems (and the adjacent conveyor sections that make up the EDS conveyor lines) shall be on a 20-minute timer (adjustable). If both photocells of one subsystem remain unblocked for 20 minutes while the conveyors are running, conveyors in the mainline subsystem and individual conveyor feed lines shall shut down. If an Emergency Stop push button is activated or a jam occurs at any point during operation, the timers shall reset to zero.

9. Added Bag Functionality

    a. The BHS shall be capable of detecting when a bag has been added between the EDS machine and the Clear Bag diversion points as long as that bag is added anywhere other than on top of, underneath, or directly beside another bag. If the bag is added in front of, between, behind or directly against the leading or trailing edge of another bag than the system shall detect this addition.

    b. If the addition occurs downstream of the EDS and only the added bag itself is affected, the system shall treat the bag as "Lost in Tracking" and the BHS shall ensure that the bag is sent to Explosive Trace Detection screening.

    c. If the addition occurs downstream of the EDS and the added bag infringes on the tracking of another bag, then both bags shall be declared "Lost in Tracking" and the BHS shall ensure that the bag is sent to Explosive Trace Detection screening.

    d. The BHS shall measure the bag as it exits the EDS machine and as the bag approaches the Clear Bag diversion points to determine if there has been an "Added Bag" fault.

10. E-Stop Functionality

    a. Activation of any screening machine E-stop will stop the associated ED subsystem conveyors and device.

    b. Activation of an ED conveyor subsystem E-stop will not E-stop the EDS machine

11. EDS IQ Test Mode Control Stations

    a. A control station shall be installed at the discharge end of each exit conveyor. The location of these control stations shall be coordinated with the Owner and TSA. The control station shall contain the following operators/control devices:

Description	Label
"Green" flush-head Pushbutton	Reset/Restart
Lighted Push-Pull (Lockable)	Emergency Stop
Normal/Test Keyswitch	Normal/Test

        1.) In the NORMAL mode the BHS shall operate as already outlined in this document. The key shall be removable only in the NORMAL mode.

        2.) In the TEST mode (primarily used by the TSA or EDS Contractor for testing/calibration of the EDS device), all bags input for testing shall stop upon reaching the head end photocell of the EDS device exit interface conveyor and shall require removal and subsequent actuation of the start pushbutton on the control station to re-start the exit conveyor.

3.) While in the TEST mode, bags shall not be diverted to the respective EDS device that is being tested.

b. An INSERT BAG control station shall be included at the last BHS conveyor prior to the EDS device's and shall operate as follows:

1.) Operations staff shall wait for an available window and place the INSERT BAG key-switch to manual mode (left hand position).

2.) This shall stop the last BHS conveyor prior to the EDS device's entrance conveyor.

3.) Operations staff shall place the bag on the conveyor and press the re-start pushbutton; the bag shall then be automatically transported into the EDS device. Upon completion of the Insert Mode operation, the INSERT BAG key switch shall be positioned to the right hand (normal) to place the system back to the normal mode of operation (automated)

c. Coordinate with the EDS Contractor the necessary EDS/BHS interface, and provide the required BHS controls and exit interface conveyor BHS control station requirements for the EDS TEST mode of operation.

12. Sleep Modes

a. After five (5) minutes of inactivity, the X-Ray (PSX and CT) shut down.

b. After twenty (20) minutes of inactivity, the gantry stops.

13. Sleep Mode Recovery

a. A "wake up" signal from the BHS shall be sent to the all CTs upon initial start of that particular load conveyor (i.e. TC start pushbutton activated).

b. The EDS machines shall receive a "wake up" signal from the BHS when a bag is present on the ED line at the hand over point to the Screening Machine.

c. After a bag arrives at the EDS machine:

1.) The first event is a Calibration (regardless of how long the X-Ray were off), before the first bag is actually scanned (although this first bag is loaded into the loading module during this calibration).

2.) If the gantry was in standby, it takes about 50 seconds to get it to rotate at 120 RPM.

14. Decision Point Control Station

a. A control station shall be installed at the discharge end of each L3 3DX 6600 exit conveyor and at each "decision point" divert. The location of these control stations shall be coordinated with the Engineer, TSA and Owner. The control station shall contain the following operators/control devices:

1.) Lighted "Start" Pushbutton

2.) Lighted Push-Pull (lockable) "E-Stop"

3.) "Clear" Illuminated White Light

4.) "Suspect" Illuminated Red Light

5.) "Fault" Illuminated Amber Light

b. The BHS Contractor shall also provide at each exit conveyor and at each "decision point" divert a stacked light module with amber (fault); red (suspect) and white (clear) lenses using LED bulbs. The light will activate in parallel with the lights on the control station described above. The stacked module shall be mounted on a post at least 30 inches above the side guard so as to provide an additional visual indication of a bags status as it passes the diversion point(s).

15. Other Controls Functions

a. In the event that a minimum of one – (1) device is not active in a Level 1 matrix while the baggage subsystem is running, the bags shall remain on the mainline TC2 and bypass the unavailable Level 1 EDS machine.

b. The BHS Contractor shall present as part of the functional specification submission a detailed matrix clearly identifying all the possible security screening failure scenarios and the fallback action to be initiated (manually by the control room operator or automatic by the BHS Computer system).

16. Maintenance Platforms

a. The BHS Contractor shall be responsible for the design, provision and installation of maintenance platforms and access stairs required to allow easy access to all three – (3) outbound L3 3DX 6600 devices by TSA agents who are responsible to both test the EDS devices and clear bag jams within the devices. The BHS Contractor as part of the submittal processes shall provide to the Engineer, TSA and Owner the design of the platform and access ladders for review and approval.

b. BHS Contractor is responsible for coordinating access provisions for TSA operators so as to minimize obstructions. Locations of control stations and electrical boxes are to be coordinated to support unrestricted access by TSA staff to the input/output EDS interface positions. The provisions of the conveyor supports; drive configurations, personnel guarding and side guards shall allow for maximum TSA operator accessibility.

17. EDS Reporting

a. The BHS reporting system shall provide for report generation of the security subsystem activities. In addition to the reports identified elsewhere in these specifications which will need to reflect EDS activity, it shall be the BHS contractors responsibility to provide a daily log of all bags processed at the EDS devices with appropriate filtering provisions to allow for sort by bag ID specifics, EDS device, decision rendered and lost tracking etc.

b. As a fault finding diagnostics tool, the BHS operator shall have (via a pull down screen at the MDS workstation) the ability to monitor the status of all EDS/BHS handshake/interface signals (per device) in real time. The BHS Contractor shall provide to BNP and the Owner a sample of the diagnostic status screen.

c. The BHS Contractor shall monitor the following EDS/BHS operations and generate fault messages both graphically and in text at the MDS and stop directing bags to the faulted ED line until the issue has been resolved:

1.) Multiple baggage IDs lost at the EDS

2.) Loss of communications between the EDS and BHS

3.) Multiple bags in a row with an “unknown” or “no” status (these are unknown/no bags not generated as a result of an EDS fault reset)

4.) Loss of bag tracking through the EDS line

18. SB1 ETD Subsystems

a. This subsystem consists of a number of conveyor segments for transport of baggage to the Level 3 ETD screening area. If baggage requires additional screening in the CBRA they shall be transported to the Threat Resolution Room. Mis-tracked baggage on this subsystem shall be transported to the Threat Resolution Room for screening. Baggage tracking shall be provided on this line.

b. Controls Equipment Components

1.) Note that the control functions described below are for the CBRA runout conveyors associated to SB1 line and are provided as an example; detailed control functionality shall be coordinated with the Owner or their representative and the TSA through the shop drawing submittal process. Seven (7) unload stations shall be provided on the operator’s side of the CBRA runout conveyors for removal of bags in the Threat Resolution Room to one of the seven CBRA Screening Station unload conveyors. The location of the control stations, LCD displays, hand held scanners, bag tag printers and related stanchions/supports shall be coordinated with the Jetport or their representative and the TSA.

a.) The SB1 runout control stations stations shall control the operation of the SB1 subsystem runout conveyors and shall include the following operators/control devices

(1.) CS/SB1-xx/GPB: GREEN momentary contact push-button switch: Actuation of the subsystem's 'Reset/Restart' pushbutton shall reset faults associated to this runout conveyor and restart the SB1 subsystem after the fault is reset.

(2.) CS/SB1-xx/BPB: Flush-head BLACK momentary contact push-button switch. The controls for the "Print Tag" pushbutton shall send a request to print a bag tag at the associated bag tag printer to this station for a bag that arrived at the discharge end photocell of conveyor without a bag tag.

(3.) CS/SB1-xx/EPB: Illuminated RED maintained contact mushroom-head emergency stop push-button switch: Upon activation of the pushbutton, the respective indicator light shall flash until the fault is cleared/reset; the control system shall stop the subsystem conveyor segments and sound the associated subsystem warning alarms.

(4.) CS/SB1-xx/LTB: Flush-head BLUE Illuminated momentary contact push-button switch. The controls for the "Remove" Illuminated pushbutton will stop any further advancement of the bag. The agent shall then scan the bag tag, using the associated hand held bar code scanner. This indicator light shall signify, by a steady burning indication, an acknowledgement that the bar code has been positively scanned by the scan gun. The pushbutton shall be reset and the indicator light shall extinguish by actuating the "Bag Advance" pushbutton.

(5.) CS/SB1-xx/BPB: Flush-head BLACK momentary contact push-button switch. The controls for the "Request Bag" pushbutton shall advance baggage to the discharge end photocell of conveyor.

2.) Seven (7) LCD displays shall be provided on the operator's side of the runout conveyors for displaying the bag tracking I.D. in the Threat Resolution Room. The location of the LCD displays shall be coordinated with the Owner or his representative and the TSA.

a.) These SB LCD displays shall indicate the discrete tracking I.D. of that bag upon activation of the discharge end photocell of conveyor SB1-xx, the reason why the bag is there (i.e., Clear, Suspect, Fault, Unknown, , No/Pending Decision or Out of Gauge), the bag identification number, the EDS machine the bag was screened (if applicable) upon reaching the unload point of each conveyor as well as whether the bag can be removed from runout conveyor. The LCD display units shall be constructed from 14 gauge steel (NEMA 12 enclosure) and provided with ¼" thick acrylic lenses. Additionally, these units shall be capable of displaying a minimum of four lines of alpha-numeric text, and provide real time process data with high-brightness that will be visible up to 100 feet. Integrate the Tracking I.D. display update with the "Bag Advance" pushbutton activation of the ETD Suspect Bag Line Control Station.

3.) Provide the necessary control stations with their respective control devices and functions for the SB1 conveyor line to accommodate the requirements relating to the Jam Reset Control Function and Emergency Stop Control/Reset.

c. Controls Functions

1.) Initial Settings - the system ready indication for the initial conditions of the subsystem(s) shall be as described above in this Specification Section, under System Ready Indication.

2.) Automatic System Cascade Start

a.) The SB1 conveyor segments shall start via an "Auto Start" sequence. The normal start-up operation of the SB1 conveyor line(s) shall start (if not already running) through the BHS control system when a bag is destined for the SB1 subsystem. The control system design shall ensure that the start-up signal for these conveyor segments permit the conveyors to come up to speed before baggage arrives. When a bag is detected that it is destined for the SB2 subsystem, the related conveyor line shall start (if not already running) sequentially from the input to the output with an appropriate delay between each motor starter actuation to ensure electrical power surges are minimized.

b.) Amber warning beacon(s) shall be positioned at/near the SB1 runout conveyors, in the Threat Resolution Room. The beacon(s) shall be activated at the start-up of the line. Additional Start-up Alarms and Fault alarms shall be located, as required, along the SB1 line's right-of-way (e.g., maintenance platform areas).

c.) The Threat Resolution Room runout conveyors shall energize when the SB1 line is activated and shall operate like a runout. These conveyor segments shall operate, once activated by the appropriate controls, until the bag reaches the head end photocell at the discharge end of each unload conveyor.

3.) Automatic System Cascade Stop

a.) The SB1 conveyors shall shut-down when a bag has not been detected by the control system for a pre-determined time (adjustable from 5 to 10 minutes), the conveyors shall shut-down, but will remain energized.

b.) The complete SB1 subsystem, including the related runout conveyors, shall have the capability to shutdown via an "Auto-Stop" sequence, as specified elsewhere in this document. Provide photocells upstream of each conveyor segment and program the auto-stop circuit to stop the SB1 conveyor segments whenever the auto stop photocell does not sense a bag for a 5 to 30 minute period (adjustable). The same photocells may control both "Auto-Start" and Auto-Stop" functions. The "Timed Out" condition shall be reported to the Control Room via the BHS Graphical/Text Display(s).

4.) All bags transported along the SB1 line shall be tracked and have their positions continuously updated in order to ensure that they will be diverted and properly identified at the SB1 runout conveyors in the CBRA. Pulse generators and, if necessary, additional photocells shall be provided to ensure proper tracking throughout the system.

5.) As noted above, the SB1 subsystem within the CBRA shall consist of a series of queue belts. Each ETD unload queue belt shall have a control station, hand held scan gun, bag tag printer and a visual display.

a.) A bag will arrive at the first conveyor in the SB1 CBRA and stop. A TSA agent will press the "Bag Advance" button on the control station to advance the bag to the queue associated with that control station the TSA agent utilized, for subsequent processing as described below. If the next bag arrives before the bag on has been advanced, then the bag will queue outside of the CBRA room. If all of the queues outside of the CBRA room are occupied then the bags will automatically advance within the CBRA to the next available queue.

b.) As stated above a TSA agent will press the "Bag Advance" button on the control station to advance the bag to the queue associated with that control station the TSA agent utilized. The "Suspect Bag", "Out of gauge", "Unknown", "No/Pending Decision", "Lost in Tracking" or "Clear" status, the bag's tracking ID, the EDS number the bag was screened (if available) will be indicated on the LCD display. Additionally, the LCD display will indicate 'SCAN BAG TAG' as a prompt to the TSA agent. The TSA agent shall then press the "Remove" button on the Control Station associated with the bag location (queue conveyor). This will stop any further advancement of that bag. The TSA agent shall then scan the bag tag, using the SB1 queue's associated hand held bar code scanner. If the hand scan is successful, the hand scan gun will beep and the control station "REMOVE" light will illuminate and the LCD display will indicate "READY TO REMOVE". The BHS system will automatically update the BHS database containing the dummy ID# with the bag tag information that the bag was removed for level 3 inspection, the ETD Screening Station Number and time stamp of when it was scanned. When the "REMOVE" light is illuminated and the LCD display indicates "READY TO REMOVE", it will be the indication to the TSA agent that it is OK to remove the bag from the queue associated with that control station.

c.) Ensure that the SB1 unload queue conveyor will not index until the bag tag has been successfully scanned and the photocell has been cleared (bag removed from the queue) i.e. the queue shall not index/move if the agent has to move the bag around to access the bag tag

for scanning and inadvertently moves the bag from in front of the photocell.

6.) For the ETD unload queue conveyors on the SB1 subsystem, the method to transfer the alarmed or No/Pending Decision image to the MUX Server Passive Threat Resolution Interface (PTRI), the TSA agent is going to use to view the suspect image, provide the following:

a.) The BHS LAN shall have an Ethernet connection for each PTRI, configured so that the connection replicates the data stream from a barcode reader. Provide all Ethernet cabling, hubs, serial cables, and Ethernet-Serial converters, hardware and software as required to implement the BHS/PTRI interface.

b.) The sequence of operation at the PTRI would be the following:

(1.) The PTRI displays replay bag dialog (by EDS Supplier)

(2.) The TSA agent scans the bag tag with the BHS hand-held scanner associated with that PTRI at the ETD Station, prior to removing the bag off the conveyor.

(3.) The BHS computer system matches the scanned bag tag number with Tracking ID #, through the BHS/EDS interface, and sends the Tracking ID# to PTRI at the ETD Station.

(4.) PTRI at the ETD Station reads the data stream and loads the image from MUX server (EDS Supplier).

(5.) When TSA agent is done with image (i.e. Clears the bag), return to first step.

c.) Coordinate the latest BHS PLC/MUX Server communication protocols and interface requirements (both hardware and software) to/from the MUX Server with EDS Supplier.

7.) For bags that arrive at the SB1 queues with an “Out of gauge/Unknown/Lost in Tracking” status, the TSA agent will still scan the bag tag with the hand scanner at the SB1/ SS1 queue (no image will be transmitted from the MUX Server). The BHS computer system, for reporting purposes, will update the bag tag information in the BHS database with the “Out of gauge/Unknown/Lost in Tracking” status and the bag will be inspected per the TSA protocol for the respective message.

8.) For bag tags that will not scan (no illumination of the “REMOVE” illuminated push button light or hand-held scanner beep) due to a problem bag condition (e.g., no bag tag or invalid tag), the BHS Contractor shall print a bag tag label from the local bag tag printer and attach the tag to the bag. This tag will start with 99 the last 8 digits will be incremental. The TSA agent will scan the bag tag and the BHS computer system will automatically update the BHS database containing the dummy ID# associated with the bag tag information that the bag was removed in the CBRA and time stamp of when it was scanned. The alarmed image shall be transferred to the PTRI Station after the TSA agent has scanned the printed tag at the PTRI station which will transmit the dummy bag ID# associated with the bag tag number to the respective PTRI station via the BHS Contractor supplied communication port and network. The BHS Contractor shall coordinate the BHS PLC/MUX Server communication protocol and connections to/from the MUX Server with EDS Supplier

9.) It may be possible to receive a level 2 “clear” status after the bag has been transported to the Threat Resolution Room. These bags will arrive at the SB1 queues and the “clear” status light will be indicated on the LCD Displays. Coordinate with EDS Supplier a means to test for this operation in the event it may be implemented at a later date.

10.) “Cleared” Level 3 bags would be re-introduced into the system via the CB5 subsystem. When the bag is re-scanned at the ATR, the bag tag information will again be updated with the time stamp of when it was scanned by the ATR. Provide as part of the required EDS reports the approximate dwell time of a bag in the Threat Resolution Room (time difference from when the bag was scanned at the Threat Resolution Room queue to the time scanned at the ATR).

11.) Submit to the Jetport or their representative a functional specification on the Threat Resolution Room operation for review, approval and coordination with the TSA.

E. Anti-Gridlock

1. In the event of a gridlock condition within the outbound sortation system the BHS Contractor shall develop and submit an anti-gridlock procedure/software for approval by the Owner or his representative that will accomplish automatically the following, as a minimum:
    a. Inhibit all outbound lines that feed into the sortation system.
    b. Purge the sortation system by using a “divert/push all” mode to a pre-assigned sort device for an adjustable period of time to eliminate the gridlock condition.

F. Sortation
1. All bags transported along the Main Sort Line (ML1) shall have their positions continually updated in order to ensure that they will be diverted to the proper destination. Pulse generators and, if necessary, additional photocells will be provided to ensure proper tracking throughout the system.
2. A photocell will be provided immediately upstream of the diverter to synchronize diverter operation with bag position. The controller will take into account the length of each bag being diverted to ensure that the diverter will contact the center of the bag.
3. A sensor shall be located at the home position of the diverter to confirm that it has completed its cycle in a reasonable time and that the diverter is clear of normal baggage flow. If the sensor signals a possible interference, it shall be considered a jam detection, which is specified elsewhere in this document.

G. Manual Encoding (ME1) Control Functions
1. General
    a. The Manual Encoding Consoles and associated Scan Guns shall comply with the design requirements specified elsewhere in this document.
    b. When the manual encode station “ON-OFF” key switch is in the “ON” position the manual encoding station scan gun and key pad functions shall be energized and the conveyor lines shall be switched to on-demand mode of operation. The conveyors shall start when a bag is given a manual encode destination as a result of a “no read” from the ATR.
    c. When the switch is in the “OFF” position the keypad functions shall be inoperable, the manual encode conveyors shall not be active, and the mainline shall not be able to discharge baggage to the manual encode charge conveyor. Bags requiring manual encoding while the station is in the “OFF” position shall be directed to the last makeup carousel (selectable) and the bag arrival shall be indicated on each of the stack lamps located at each makeup unit.
    d. The manual encoding position shall function in on-demand mode and then stop to wait for operator action. The RELEASE pushbutton must be actuated to advance bags to the downstream conveyors.
    e. Manual Encode conveyor auto shut-down will take place through a normal time-out control sequence, described elsewhere in his specification. The "Timed Out" condition shall be reported to the Control Room via the BHS Graphical/Text Display(s).
    f. If the Manual Encoding console is not logged in, but a bag has arrived at the MES area then an appropriate error message shall be displayed and the bag shall be indicated on each of the stack lamps located at each makeup carousel.
    g. If a bag has been in the manual encoding station for a predetermined amount of time (initially 2 minutes) while the station is logged in, then an error message shall be displayed and it shall be indicated on each of the makeup carousel stack lamps.
    h. It shall be possible to configure the system to automatically discharge manual encoding bags to any predetermined carousel.
2. Manual Encoding Operations
    a. Provide the manual encoding console with the means to allow the operator to select the type of bag or identify specific information on the tag being encoded (e.g., identification of bag by tag number, flight number and sort output). This feature shall enable the encoding position, and subsequently the control

system, to differentiate between numeric entries for "Tag Numbers" (10-digits), "Flight Numbers" (4-digits), and "Sort Output" numbers (2-digits). The capability to encode in various ways is necessary should a tag be damaged to a point where the bar code is smeared, torn or otherwise unintelligible and the only number present is the flight number. Should a bag enter manual encoding with only a two-digit pier tag or if it is more convenient for the operator (e.g., daily flight always processed at the same makeup), this feature (e.g., button or switch) shall be used to allow entry of this number.

b. An adjustable volume audible warning signal shall be incorporated in the manual encoding console to signal the operator when an invalid command has been requested (i.e., invalid entry, flight number duplication, or multiple destination flight).

c. Separate indicator light shall not be required to show that the encoding station is operational. Instead, the "ON" condition will be indicated by display in the numeric field of primary display (i.e., 0000 or flight number if encoded).

d. During encoding, baggage will automatically be stopped on the encoding station conveyor where it shall await encoding by the operator. A valid code consists of one, which is listed, in the particular day's flight schedule table. The computer shall accept the four-digit flight number only (unless in tag number or makeup number mode - see above) that in most cases (approximately more than 90% of the time) is sufficient to make the entry unique. In that small number of cases in which there are two or more identical flight numbers in the list (different airlines) on the same day, the secondary alpha displays on the encoding console shall display the alternative airline codes, and the audible warning signal shall sound, at which point the operator must check which airline is involved before releasing the bag (see below).

e. During the numeric encoding process, the numeric entries shall appear in the display at the right hand unit and index to the left, thus eliminating the need to enter leading zeros. For example, if the flight number is 0256 or 256 the following would appear on the display as the operator types in the flight number:

1.)	Blank Display:	0	0	0	0
2.)	Enter Number 2:	0	0	0	2
3.)	Enter Number 5:	0	0	2	5
4.)	Enter Number 6:	0	2	5	6

f. Should a bag arrive and its flight has been closed-out by the computer (typically 15 minutes prior to the scheduled flight departure), encoding of the flight number and actuating the release pushbutton will cause the bag to be routed to the late bag conveyor and cause a visual indicator and audio alarm to be actuated adjacent to the late bag conveyor (with parallel indications actuated in the system's control room). NOTE: In the case of an invalid code not caused by encoding operator error (i.e., flight number on baggage tag is not in current schedule) the operator shall be able to cause a visual indicator to be actuated adjacent to the manual encoding area with parallel indications (i.e., visual and audio) actuated in the system's control room. It shall also be possible to release the bag to a designated problem bag makeup where the problem can be resoled without delaying encoding operations.

g. During the encoding process, should the operator realize he has made an error (up to the point of depressing the RELEASE or REPEAT buttons); his depressing of the ESCAPE/CLEAR button shall cause the display to be zeroed at which point he may begin the encoding process again. Actuation of ESCAPE/CLEAR button will only cancel the current sequence of operation.

h. Baggage shall only be released from the encoding station following actuation of the primary "RELEASE" push-button on the keyboard and provided that the following conditions apply:

1.) Flight, tag, or sort device number input is unique

2.) Flight has a single destination only

3.) All classes of services for the flight have been allocated to the same sort device

i. Following actuation of the "RELEASE" push-button and if the flight number has been recognized as valid (above conditions are all satisfied), the airline prefix and the flight destination will be displayed (i.e., prefix in primary display and destination in secondary alpha display) and the computer will energize the manual

encoding queue conveyor and control the processing of the bag through the sortation transport subsystem to the appropriate sort output. At the encoding console, the flight number will be retained in the display as the next bag arrives. If the bag is tagged for the same flight, the operator shall depress the "REPEAT" button. If it is not tagged for the same flight, the operator's entry of the first digit will cause the display to re-zero then display the digit just entered.

j. In the case of flight number duplication for multiple airlines, the bag shall not be released. Provide a visual and audio means to inform the operator of the duplication, to determine and choose alternate airline codes (e.g., via alpha displays and pushbuttons) and actuate the bag with the correct destination. At the same time, the selected flight prefix will be displayed in the primary display and retained until the next bag arrives (as in the normal release case).

k. In the case of a multi-destination flight, the airline prefix and all destinations will be displayed (i.e., prefix in primary display and destinations in secondary displays) and the audible warning shall sound. At this point the operator must check the required destination and then press the appropriate destination/release button to release the bag. The flight number, etc., will be retained as above, but a second bag with the same flight number and destination shall not be released by actuation of the "REPEAT" button. In this case, it would be necessary to use the appropriate destination/release button.

l. In the case of a flight in which different classes of service (F - First, J- Business, Y - Tourist) have been allocated to different sort devices, a similar procedure as described above shall occur. In this case, the audible warning will sound and the classes of service applicable to the flight will be displayed in the secondary displays. Actuation of the appropriate destination/release button shall cause the bag to be released and directed to the selected sort output.

m. In the event that more than 5 secondary parameters are required for a given flight (e.g., 6 or more destinations, etc.), provide a means (e.g., push-button) that will cause these selections to be displayed.

n. It shall be possible to isolate the encoding position locally by use of the "ON-OFF" switch. Selection of the "OFF" position shall inhibit the mainline discharging to the chute feeding the encoding station conveyors, but will permit encoding and release of bags already diverted.

H. Sortation Controller Operational Provisions

1. General

a. The following is a compilation of the many sort decisions and fallback routing decisions the BHS Computer/Control System shall encounter in day-to-day activity. Each one requires a different course of action; therefore ensure that the system as installed shall accommodate the desired response.

1.) Late Bag:

a.) The Sortation Controller shall be capable of recognizing a late bag by comparison of the scheduled (or updated) departure time to the actual time at moment of tag reading and directing the bag to MEC or the appropriate carousel.

2.) Standard Sortation:

a.) The ATR shall decode the bag tag and provide the information to the BHS Computer necessary for the controls to initiate the appropriate diverters to: divert baggage to the designated sort output (i.e., flat plate make-up device)

3.) Manual Encoding:

a.) No-reads (or unconfirmed mis-reads and bag tag conflicts (multiple tags) shall be classified as a no-read by the Control System and immediately direct baggage to the manual encoding area.

4.) Problem Bag Transport:

a.) Bags that have been diverted at the problem bag area or MEC (i.e., invalid tag, flight already departed, or where directed by Encoding Area personnel) will be handled by operations staff at the designated Problem/Late Bag Processing Area (it is assumed that any bags for already departed flights will be re-tagged for a later flight).\

I. Outbound Oddsize Subsystem

1. General

1.) The Outbound Oddsize system consists of a single subsystem originating on the east of TC2 and inclines into the ceiling before declining into the CBRA for baggage screening.

b. Oversize conveyor shall be clearly displayed on the MDS.

c. Start-up alarms and fault alarms shall be located as required, along the oversize lines and in the make-up area. Start-up and Fault Warning Alarm(s) location and function shall be consistent with the specified requirements indicated elsewhere in this document. The location of the alarms shall be coordinated with the Owner or his representative.

d. Auto-stop photocells shall be provided. After no bags have been detected for approximately 3-5 minutes (adjustable), the conveyors will stop and the fire/security door will shut.

e. Control functions associated with the conveyor line's Cascade Stop (forward and reverse directions), Jam Detection/Restart, Emergency Stop/Reset, Motor Control Panels, Motor Overload conditions and respective Alarm Silence function(s) shall be compliant with the specified requirements described elsewhere in this document.

f. Activated of the start pushbutton at oversize load conveyor with cause the downstream transport conveyors to all start sequentially from the output with an appropriate delay between each motor starter actuation to ensure electrical power surges are minimized.

g. The unload conveyors shall operate under inch and store controlled by the photocell at the discharge end of upstream conveyor.

h. A remove pushbutton shall be included at the discharge end of the oversize conveyor. Once a bag has reached the discharge photocell and stopped, the stop shall be latched until the remove pushbutton is pressed. An audible alarm (variable) shall indicate that an oversized bag is awaiting removal and shall only be silenced after the photocell is clear and the remove button has been depressed.

i. A photocell shall be located at the discharge end of each oddsize unload conveyor to indicate full lateral condition.

j. Over height photocell cells and a lighted reset push button shall be provided.

k. Ove length photocell and lighted reset push button shall be provided.

2. Control Panels

a. Two control panels shall control the operation of the start/stop of the oddsize conveyors. They shall be located and labeled as follows:

1.) CS/OS1-01 adjacent to OS1-01 load conveyor at the check in area

2.) CS/OS1-xx adjacent to OS1-xx unload conveyor at the CBRA

b. Control stations located at OS2-01 shall control the operation of the oddsize in the forward direction for transporting oddsize bags to the first level and shall consist of the following:

1.) Card Swipe Interface

2.) Illuminated Pushbutton Start

3.) Extended Head Pushbutton Stop

4.) Lighted Push Pull (Lockable) Emergency Stop

5.) Illuminated Pushbutton Overheight / Overlength

c. Control stations OS1-xx (the CBRA unload conveyor) shall control the operation of the oddsize and shall consist of the following:

1.) Illuminated Pushbutton Start

2.) Extended Head Pushbutton Stop

3.) Lighted Push Pull (Lockable) Emergency Stop

4.) Illuminated Pushbutton Bag Remove

5.) Illuminated Pushbutton Overheight / Overlength

6.) Card Swipe Interface

d. Control Functions

1.) Start Sequence (Forward Direction) OS1-01

(1.) Card Swipe activation (to be coordinated with Card Swipe Contractor)

b.) Press “Start”

(1.) Start up alarms will activate

(2.) Security doors will open (if previously closed)

(3.) Conveyor OS1 will sequentially start

2.) Stop Sequence at any control station

a.) Press “Stop” pushbutton

b.) Second Level OS1-01 conveyor will stop after 15 seconds

c.) Security door will close

d.) The remaining conveyors will sequentially auto stop after an additional 3 to 5 minutes (adjustable)

3.09 SPECIAL CONTROLS CONSIDERATIONS

A. Laptop Computers

1. Supply to the Owner two (2) laptop computers. The laptops are to be loaded with all applicable PLC manufacture software programs and the BHS system as-built ladder logic programs required to maintain the BHS system.

2. Provide to the Owner or his representative, the laptop manufactures literature for approval prior to the purchase of these items.

3.10 CONSTRUCTION PHASING SEQUENCE

A. General

1. The BHS installation is required to be completed in phases. The BHS scope of work will be in accordance with an overall project phasing sequence. Reference attached BHS phasing plans and overall program phasing plans (i.e., B00.60 and B01 series). The BHS contractor shall be required to coordinate all work with the Program Manager, other disciplines working in the immediate area of construction, airline flight schedules and hours of operation, so as not to impact the Terminal's normal functions and concurrent airline operations.

2. The BHS implementation staging is of vital importance to the success of the BHS installation of the new conveyor equipment and modifications to the existing subsystems. Installation of the new conveyor equipment and removal/modifications of the existing equipment will occur simultaneously with on-going airline operations. The new conveyor system and the modifications to the existing subsystems will increase the existing outbound operational capacity, as illustrated on the accompanying drawings, and it is therefore vital that the outbound baggage make-up area continue to process baggage throughout the implementation period without operational disruption or capacity reduction.

3. Schedule and coordinate the BHS Scope of Work (installation, removal, and interim connections), in accordance with the phasing sequence indicated by the project’s overall phasing plan and the phasing sequence described herein. Coordinate all work with the Owner/Program Manager, other disciplines working in the immediate area of construction, airline flight schedules and hours of operation, so as not to impact the Jetport's normal functions

and concurrent airline operations.

4. Short duration system shutdown (ex. overnight) will be permitted for the extension of the mainline (ML1) and makeup carousel (MU3). Shutdown of the system during changeover shall be scheduled during times of low impacted terminal operating demands. The contractor shall check and field-verify actual site conditions to determine and coordinate the schedule for any shutdown period. Notify the respective carrier 72 hours in advance and obtain approval before proceeding with the shutdown of the system(s).

5. As the majority of the new BHS work is within a new Terminal Expansion, the space will be available during all three shifts. BHS Contractor shall utilize all three shifts as required to meet the Project Schedule. The portions within the existing terminal will only be available during third shift operations, so as not to impact airline concurrent operations. Additionally, portions of work associated with the outbound sort system will be available to the BHS contractor only during the third shift, as dictated by the project's overall phasing plan.

6. Assume full responsibility to transfer all of the necessary construction material, conveyor equipment, tools, and components required for the implementation of the BHS to and from the designated Lay-Down areas during the work period. All Airline operational areas associated with the BHS work shall be left broom clean at the end of the Contractor's shift without any equipment, tools, or components left in the area. BHS construction material, equipment and tools/components will be permitted in the immediate area of construction only during the contractor's work period/shift.

7. Existing BHS equipment indicated for removal shall be removed, salvaged and turned over to the Owner. Storage of the salvaged components shall be coordinated with the construction manager and the Owner in compliance with the specified requirements of this section (Part III). Equipment shall be turned over to the Owner's Jetport Operations and transferred to the designated area within a 5-mile radius of the Jetport Property. BHS Contractor shall dispose of any equipment not desired by the Owner, in compliance with the specified requirements of this section (Part III).

8. Reference the overall program phasing plans and the following BHS Phasing plans (as also illustrated in the contract drawings). The BHS Contractor shall include as part of his proposal the best duration period, per phase, that will require completing the specified work.

    a. Phase 1

        1.) New building extension up to the face of the existing building will be constructed (not in BHS Contractor's Scope of Work)

        2.) Step 1 - Existing unused inbound conveyor portions are to be removed

        3.) Existing ticket counter conveyor and outbound make-up area to remain operational during the first phase of construction

        4.) Step 2 - Construct all conveyors within new building (ZONES 4 and 5) including:

            a.) All ED subsystems

            b.) All CB and SB subsystems

            c.) RI Re-Input subsystem

            d.) TC2, 3 and 4 subsystems

            e.) ME1 subsystem

            f.) MU1 and MU2 and associated feed conveyor subsystems

            g.) ML1 west of Gridline 1Z

            h.) Commission system and utilize this phase of BHS including all TSA required testing to ensure that the system is approved and operational from ticket counter input through the CBIS to the makeup.

    b. Phase 2

        1.) Step 1 - Demo existing Ticket Counter, Curbside and Outbound make-up conveyor including all

associated structural and electrical components.

2.) Step 2- Install the following conveyors in Zones 3 & 4 on Levels 1 & 2

a.) A majority of MU3, leaving the west end for drive aisle for operational BHS

b.) MU4

c.) Associated sections of ML1

3.) Step 3 -Install remainder of MU3

3.11 DEMOLITION/EQUIPMENT REMOVAL

A. Maintain Operations

1. Remove existing equipment indicated on the Contract Drawings as "To Be Removed". Maintain operation of unaffected baggage handling equipment through the implementation of temporary electrical connections or the addition of supports to replace connections or supports removed in the demolition process. No equipment shall be reused or refurbished for re-use.

2. If the removal of equipment creates unsecured access to a secured area, provide a guard on a 24-hour per day basis until installation of equipment returns the area to secured status.

B. Conduit Removal

1. Remove conduit including junction boxes and control/wiring devices rendered unused by the demolition process in its entirety to the motor control panel. Exception: abandon in place the imbedded portion only of any imbedded conduit after removing all conductors. Where a conduit passes through a floor or wall, cut the unused conduit flush with both surfaces of such floor or wall and abandon the section within the floor or wall if it cannot be removed without breaking masonry. Ensure that any area where material has been cut away is left in a clean and flush condition with no holes or protrusions showing. Where removal creates an indentation in concrete, chip away the surrounding concrete, cut the material (e.g., anchor bolts, conduit) below floor level and fill flush with cement.

C. Support Steel Removal

1. Remove support steel including header beams and attachments rendered unused by the demolition process in their entirety. Remove anchor bolts flush with floor, wall, or ceiling by burning or cutting.

3.12 DEMOLISHED MATERIALS TO BE DISPOSED

A. General

1. Remove and dispose of any materials or items demolished and not designated to become the property of the Owner.

B. Equipment Disposal

1. Remove from Jetport site all debris, rubbish and other materials resulting from demolition and alternation operations on a daily basis. Transport and legally dispose equipment off-site in legal landfills or scrap yards. Obtain written permission from the property owner on whose property the removed materials shall be placed, and submit a copy of the agreement to the Owner.

2. Burning of removed materials is not permitted on the project site.

3. Store materials, which cannot be removed daily in areas specified by the Owner.

4. Do not store or sell removed items on-site.

3.13 OPERATION AND MAINTENANCE TRAINING

A. General

1. Instruct and train the Owner operating and maintenance personnel at the work site. Conduct this training prior to Conditional Acceptance of each phase of the work and ensure competence in the operation and maintenance of the new equipment and the system/subsystems.

2. Training is to be provided by a professionally qualified instructor. Use of site supervisors, equipment or system designers, etc., as an instructor for the formal training will not be accepted unless approved by the Owner or his representative.
3. The BHS Contractor shall furnish all tools, equipment, materials and supplies, and perform all functions and services required to complete the training as specified. With the exception of safety and overview training, training shall be divided into separate categories for operations training and maintenance training further broken down to specific trades.
4. No actual operations training of a piece of equipment will be permitted until the equipment is properly installed and is operational.
5. A detailed outline of the proposed training to be conducted shall be submitted to the Owner or his representative for review and approval in accordance with the schedule of submissions prior to the testing of the system. The training program submittal shall include, at a minimum, the following information for review:
    a. Types and durations of training/classes.
    b. Name and professional credentials for each instructor/trainer.
    c. Max/min number of persons allowed per class.
    d. Any specialty type of requirements such as classroom/conference room space, VCR, TV, white board, etc. (to be coordinated with the Owner however the Owner is not responsible to supply the above mentioned space or materials)
    e. Copies of all training materials, to be used during training. All training binders/materials shall be submitted for review in the format in which they will be used during the on site training. It should be noted that the O&M manuals will not be allowed to be used for training purposes; however consolidated sections of the O&M manuals which have been tailored for classroom training are permitted.
6. Times and duration of the classes may involve irregular hours in order to provide training of the operational and maintenance personnel on different shifts.
7. All training sessions will be monitored and approved by the Engineer. Any session or portion thereof deemed unsatisfactory, based on evaluation of the training, shall be repeated by the BHS Contractor or the BHS Contractors representative at no additional cost to the Owner.
8. Assume responsibility for developing and maintaining a training attendance record for all operation and maintenance training sessions presented. The record is to note the following information in duplicate form. The original copy of the record is to be forwarded to the Owner with the second copy being retained by the BHS Contractor for his files. The recorded training information must include for each session:
    a. Date of training session
    b. Name of project
    c. Name of Instructor
    d. Subject of training
    e. Time of training session
    f. Signature and department of each attendee
9. Provide the Owner with two (2) copies of the video recording of one (1) complete operational and maintenance training class for this project. The video recording shall be provided to the Owner in a media acceptable to the Owner (DVD).

B. Operational Training

1. Provide formal instruction of the Owner operational personnel at the site who will be charged with operation of the BHS. Include a description and on-site demonstration of the electrical controls and their operation, modes of operation, the operating limitations of the equipment and the safety devices and their functions.
2. Provide a minimum of 20 hours of operational training per shift for this project, for a minimum of two (2) shifts.

C. Maintenance Training

1. Provide formal training of the Portland International Jetport Terminal Expansion BHS maintenance personnel with the objective of preparing the employees to perform the required preventive maintenance to minimize breakdown and to perform necessary repairs when work stoppages or breakdowns of the equipment occur. The training shall include, but not limited to the following:

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

    b. Special tools, techniques, or procedures required for either preventative or corrective maintenance of the equipment, or it's auxiliary or support components.

    c. Procedures to perform adjustments required for alignment, wear and calibration for all preventative and corrective maintenance, and an estimate of time required to perform such procedures.

    d. Assembly and disassembly procedures, including parts lists required for appropriate and corrective maintenance. Models, "exploded" views, and audiovisual materials shall be used for training. These materials shall be handed to the Engineer upon completion of training. Hands on field training shall be provided, subject to the approval of the Engineer.

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

3. On-site training shall be scheduled to commence immediately following classroom training and shall stress hands-on performance based application of the classroom training. Equipment shall be started and relevant systems and components shall be demonstrated.

4. Off-site training, primarily for the technical trades e.g. electricians, controls technicians; mechanics shall focus on specialized, technical training and shall be provided by the manufacturer at their factory or training facility. In the event the Engineer requests specialized factory training on a particular piece of equipment, the BHS Contractor shall make arrangements with the applicable manufacturer to provide such training.

5. Provide maintenance training for any specialized equipment used in the related system that is not of the BHS Contractor's design or manufacture. The qualified representatives will present such training, from the manufacturer of the specialized equipment.

6. Provide a minimum of 40 hours of maintenance training per shift for this project, for a minimum of two (2) shifts.

7. Examples of specialized equipment and other BHS maintenance related training include, but are not limited to those items listed below:

    a. Safety Procedures including Lock out/Tag-out

    b. Operation and Maintenance Manual use

    c. Warranty Procedures

    d. System Preventative Maintenance

    e. EDS/BHS System Interface and Troubleshooting

    f. Power Turns

    g. Flat Plate devices

    h. 45 Degree Merge conveyor

    i. HSVPDs

    j. Vertical Sorter conveyor

    k. Fire/Security Doors

l. Automatic Tag Readers (ATRs)

m. BMA Array

n. Programmable Logic Controller Systems including basic ladder programming techniques

o. Computer Systems Equipment

p. Interfaces to the Owner (or user Airlines') Networks

q. Problem Resolution Screens

r. System Reports

s. Paging System

t. MDS and MIS Systems with associated fault annunciation to the graphic/text displays.

D. Supplemental Training

1. Should the Owner require supplemental training beyond that specified above, provide at a time and at rates as mutually agreed upon between the Owner and the BHS Contractor.

- END OF PART III -

PART IV - QUALITY CONTROL SPECIFICATIONS

4.01 FIELD QUALITY CONTROL

A. Quality Control Manual

1. The BHS Contractor shall provide a Quality Control Manual acceptable to the Owner or his representative.

2. Indicate inspection lists and methods that will be utilized for quality control inspection and testing to confirm compliance with the specified requirements.

3. The Quality Control Manual shall assure that there is a system for final inspection and testing of completed products, construction and installation. Such testing shall provide a measure of the overall quality of the completed product and shall be performed so that it simulates product end use and function. Final inspection and testing shall provide for reporting to the Owner or his representative any difficulties, deficiencies, or questionable conditions. When modifications, repairs, or replacements are required after final inspection or testing, there shall be re-inspection and re-testing of any characteristics affected.

4. The Quality Control Manual shall provide instructions for handling, storage, preservation, packaging, and shipping to protect the quality of products and prevent damage, loss, deterioration, degradation, or substitution of products. It shall also require and monitor the use of procedures to prevent handling damage to articles. Products in storage shall be protected against deterioration and damage.

B. Quality Assurance

1. The BHS Contractor shall be responsible for all quality control of its Work, including work performed by any of its subcontractors. It shall be the BHS Contractor's responsibility to include in its own direct subcontracts those provisions which are necessary to assure that the quality of subcontracted work will be as good as that required of the BHS Contractor by the requirements herein.

2. The Owner or his representative shall have the right to audit and inspect the BHS Contractor's and its direct subcontractors' quality systems. Such audits may be conducted on a random or routine basis and may include an audit of the BHS Contractor's inspection and test records. The Owner or his representative shall have the right to witness any tests or inspections and shall have access to all test data including test procedures, test specifications, and test results. The Owner or his representative shall have the right to conduct independent tests or inspections at its own expense on any material or equipment to be used on the project. Should such the Owner or his representative directed independent test result in failure, the BHS Contractor shall reimburse the Owner's expense for the test. The objective of all audits, inspections, or tests conducted by the Owner or his representative is to ensure that all BHS Contractor-performed work is accomplished in compliance with the Contract Documents.

3. The Owner or his representative shall have the right to reject, and the BHS Contractor shall replace at the BHS Contractor's cost, any construction, production or installation, or portion thereof, which has not been accomplished or documented as accomplished in accordance with the accepted Quality Control Plan.

C. Quality Assurance Representative

1. Appoint a Quality Assurance Representative acceptable to the Owner or his representative who shall be responsible for the overall quality assurance implementation and monitoring of the general requirements.

2. The quality assurance representative shall be available on-site during the construction period at all times and be qualified to advise the Owner or his representative on the overall BHS scope of work (i.e., installation/removal procedures, provisioning, start-up and maintenance of the equipment).

D. Configuration Management Plan

1. The BHS Contractor shall be responsible for maintaining strict configuration control of all aspects of the design, construction, fabrication and installation of the BHS Systems. The BHS Contractor shall submit a Configuration Management Plan for the Owner or his representative review and approval. The BHS Contractor shall be responsible for carrying out all aspects of this Plan.

2. The BHS Contractor's responsibility as part of the Configuration Management Plan shall be to establish a system,

to identify, organize and track all documents developed as part of the BHS Contract Work throughout the duration of the project. The BHS Contractor shall serialize all correspondence and transmittals, and establish a logging system for incoming/outgoing correspondence showing action requirements and action taken. Drawings, specifications, subcontract documents, reports, estimates, studies, reviews, and computer files, etc., shall be tracked by a logging system.

3. Tracking logs for correspondence and documents shall be provided when requested by the Owner or his representative. The BHS Contractor shall establish a single source for transmitting and receiving documents and correspondence. Material from the BHS Contractors subcontractors shall be consolidated and submitted to the Owner or his representative by the BHS Contractor.

4. Logs for correspondence and document control shall be provided to the Owner or his representative on electronic media and in reproducible hard copy for use in the Owner's document control system.

5. Once configuration for an element of the BHS System is established (for example, at Design Reviews), the configuration of all such elements shall not be changed by the BHS Contractor without proper approval as provided for in the Configuration Management Plan. Once configuration changes are approved, formal Change Order Documentation shall be circulated in accordance with a distribution list (which shall include the Owner or his representative) developed for that purpose.

6. At conditional acceptance of the system (or completion of a phase) the BHS Contractor shall provide a software solution that automatically manages configuration and change management for all operating software applications to carry out the following functions as a minimum:

   a. Monitor critical computer services

   b. Log system events across concurrent processes

   c. Audit and log changes made to the running processes

   d. Verify, backup and recover programs and system files

   e. Secure access to editing and monitoring functions

   f. Provide file management for all system components

   g. Manage and secure product access

7. The audit function shall track every change made to the BHS system and its operating programs, including detecting who, where and when changes were made. The archive file management function shall manage all revisions carried out to the system, as files are modified, revisions shall also be stored and be accessible for future use.

E. Safety Program Manual

1. The BHS Contractor shall prepare a site-specific safety program manual acceptable to the Owner or his representative.

2. The BHS Contractor shall designate a Safety Manager/Coordinator acceptable to the Owner or his representative.

3. The Safety Program shall be implemented by the BHS Contractor to identify and resolve hazards. The Safety Program shall emphasize the prevention of accidents by resolving hazards in a systematic manner. The Safety Program Plan, as described below, will identify the responsibilities of all parties for implementing the Safety Program.

4. The Safety Program shall demonstrate compliance with all applicable safety rules and regulations. The levels of compliance shall meet the OSHA Standards, ANSI Standards, NFPA Standards, NEC Standards, and trade association standards and recommendations as applicable.

5. The safety program manual shall contain as a minimum the following:

   a. Have as its objective to provide for the safety of the passengers, employees, general public and equipment.

   b. Encompass all elements within the BHS Contractor-provided BHS Systems.

c. Include all interfaces with Facilities provided by others and identify all hazards within the Facilities that may result from the unique characteristics of the BHS System.

d. Identify the safety roles and responsibilities of all the BHS Contractors' organizational elements and require accountability of each.

e. Contain a hazard resolution process that includes the procedures necessary to identify and resolve hazards.

f. Indicate safety inspection lists and methods that shall be utilized by all personnel employed on this project.

g. A plan for furnishing and enforcing the use of individual protective equipment including hard hats, rain gear, protective footwear, protective clothing and gloves, eye protection, ear protection, respirators, safety belts, safety harnesses, safety lifelines and lanyards, and high visibility reflective safety vests.

h. A plan for providing first aid facilities, supplies, and trained personnel.

i. A plan for employee safety training to include employee safety orientation during the first week of work, weekly work crew safety meetings, periodic safety meetings for supervisory personnel, and special training prior to working with especially hazardous materials or operations.

j. Emergency plans for fire emergencies, severe weather, or flooding emergencies, seriously injured personnel, traffic accidents along the project site, and injuries of members of the public.

k. Pre-construction planning relative to safety and control of hazards including special tools, equipment, facilities, and individual protective gear.

l. A plan for periodic safety inspections, investigations of all accidents and injuries and submission of timely reports.

m. Submission of injury/accident/incident data for statistical analysis.

F. Project Management Team

1. The BHS Contractor shall submit to the Owner or his representative for review and approval, the following listing of key personnel with resumes and qualifications that will be working on the project:

a. Senior Project Manager

b. On-Site Field Supervisor(s)

c. Professional Engineer(s)

d. Safety Manager

e. Configuration Control/Schedule Manager(s)

f. Quality Control/Assurance Manager(s)

g. Project Manager(s) - Electrical and Control Systems Engineering

h. Project Manager(s) - Mechanical Engineering

i. Project Manager(s) - Computer Systems Engineering

j. Instructors/training personnel (in addition, provide instructors professional qualifications)

2. Include on-site and off-site participating personnel and the percent of anticipated participation on this project. The Owner or his representative reserves the right to approve or reject key personnel from the list.

3. The Project Manager and on-site Superintendent(s) shall not be changed without the Owner’s or his representative’s written approval.

4. The BHS Contractor, individuals or entities constituting the BHS Contractor and the officers or directors of the BHS Contractor or entities or key members of the Project Management Team shall have records of past performance sufficient to assure the Owner or his representative that they have the experience, competence and integrity to successfully complete a project of this magnitude.

G. Project Management Office

1. Within one week of the date of commencement initiate the Project Management Office, inform the Owner or his representative of the details of the office, and authorize the Project Manager and on-site Field Superintendent to act as representatives
2. The Project Manager shall be given full authority to make decisions and enter into binding agreements with the Owner for all aspects of the project.
3. The BHS Contractor shall provide to the Construction/Program Manager, the Owner or his representative a listing of all key project personnel with 24-hour contact details (cell phone number, pager number and e-mail addresses etc.).
4. The BHS Contractor shall be responsible to supply all office equipment (e.g. telephones, copiers, fax, computers, plotters, furniture etc.) required to establish their on-site project management office.

H. Workmanship

1. Ensure that all equipment is manufactured and installed in accordance with the best commercial practices consistent with the intended design and usage and is acceptable to the Owner or his representative.
2. Ensure that all materials and components are new and free from defects. Do not supply used equipment, whether refurbished or reconditioned, unless indicated in the specifications and drawings or without the express approval of the Owner or his representative.
3. The Owner or his representative shall reserve the right to inspect any conveyor component at the BHS Contractor's factory prior to shipment of said components. The BHS Contractor shall co-ordinate with the Owner or his representative, fabrication of any components that the Owner or his representative requests to inspect such that said components are fully assembled and available for inspection by the Owner or his representative at the previously arranged time of the factory visit.

I. Pre-Installation Meeting

1. Prior to the start of the installation; attend meetings on-site as required or requested by the Owner or his representative. The Owner or his representative will schedule the Pre-Installation meetings, for the purpose of coordinating the on-site installation with ongoing airport operations.
2. The BHS Contractor shall provide at the initial pre-installation meeting to the Owner or the Construction Manager the following:
    a. Safety Program Manual
    b. Drug Policy Manual
    c. Submittal Schedule
    d. Project Organization Chart to include all Sub Contractors
    e. Principle suppliers to include long lead items and planned procurement dates
    f. Insurance enrollment forms
    g. Quality Control Manual
    h. Configuration Management Plan
    i. Diversity Program
    j. Updated Master Schedule
    k. Plans for coordination and notification for utility work
    l. Plans for coordination with the work of other contractors and procedures for sharing access to the work site.
    m. Schedule of deliveries of major equipment

J. Pre-Demolition Meeting

1. Prior to the start of any demolition; attend meetings on-site as required or requested by the Owner or his

representative. The Owner or his representative shall schedule the Pre-Demolition meetings for the purpose of coordinating the on-site removal of the BHS equipment with ongoing airport operations.

K. Work Activities Bulletin

1. Submit a detailed work plan for IV&V (both BHS Contractor and TSA conducted), individual subsystem testing, sortation testing, every planned cutover, demolition, system outage etc. A BHS specific "Work Activities Bulletin" must be submitted by the BHS Contractor to the Owner or his representative for distribution to the impacted airlines, other impacted contractors (e.g. L3 3DX 6600, ATR manufacturer, BMA manufacturer, etc.) and the Owner a minimum of 7 days prior to the testing, demolition or cutover activity-taking place.
2. No work should be commenced unless the BHS Contractor has a signed "Work Activities Bulletin" in hand, and has distributed copies the User Airlines, the Owner or his representative.
3. The "Work Activities Bulletin" shall contain the following as a minimum:
    a. Contractor's internal deadlines for completion of pertinent facility interfaces by other disciplines (e.g. permanent system power, support structure etc).
    b. Date and time planned activity to take place from start to finish
    c. User Airlines that are impacted
    d. Details of all conveyors to be removed with duration
    e. Details of all conveyors to be installed with duration
    f. Electrical installation duration
    g. Contractors internal testing with duration
    h. Ticket counter/make up device requirements for loading/unloading of test bags. Coordination with the Owner or his representative and user airlines will/may be required
    i. Generation of airline 10-digit bag tags/BSMs required for testing. Coordination with the Owner or his representative and user airlines will/may be required
    j. Witnessed system testing with duration
    k. Full details of contingency plans
    l. Details of person(s) (with qualifications) overseeing the activity
    m. Details and number of personnel to be present who are qualified to troubleshoot all aspects of their respective equipment during the planned activity, for example:
        1.) Mechanics
        2.) Electricians
        3.) Controls Engineers
        4.) Computer programmers
    n. Other affected equipment manufacturers (e.g. L3 3DX 6600, ATR manufacturer, BMA manufacturer, etc). Confirmation that these manufacturers have been notified and will be in attendance if required.
4. Detailed description of activities required when completing overnight changeovers to ensure that disruption to baggage handling system is kept to a minimum. Include all preparatory work by other trades. Provide back up plan for recovery of operations if changeover work will not be completed in time.
5. Coordination and operational interface to ensure on-going airline and airport operation is not disrupted.
6. The BHS Contractor shall submit as part of the submittal process a sample of their proposed "Work Activities Bulletin" format for review and approval by the Owner or his representative.

L. Field Quality Control Services

1. Establish and maintain quality control for operations under this Section to ensure compliance with Contract Document requirements and maintain records of quality control for alteration and removal operations.
2. Submit quality control procedures for operations in conjunction with work under this Section for approval. Do not start work prior to receiving approval.
3. The procedures shall include a checklist of points to be observed.
4. The actual quality control observations and inspections shall be documented and a copy of the documentation maintained on file.
5. Any work found not to be in compliance with the Contract Documents, shall be promptly corrected in an approved manner, at no additional cost to the Owner.
6. If the facility is under construction or modification, cooperate with other contractors who may be working in the immediate area for coordination of right-of-way clearances and verify as-built conditions.
7. Where walls immediately adjacent to conveyor equipment affect maintenance access, advise the Owner or his representative of the location and size of the wall opening that needs to be developed to permit access to drive components, bearings, and other equipment that would normally be inaccessible because of the wall.
8. Ensure that the design and installation of all conveyor equipment provides maximum access for operational and maintenance personnel.

M. Approval to Proceed

1. Before starting any work affecting existing baggage handling equipment that shall temporarily discontinue or disrupt service to the existing system/operations, notify the Owner or his representative 72 hours in advance and obtain the Owner or his representative approval in writing before proceeding with this phase of the work.

N. Preparatory Inspection

1. To be conducted prior to commencing work:
    a. Check schedules, project conditions, protection, traffic arrangements, utilities services maintenance, and related preparatory work for conformance to submittals.
    b. Check to assure adequate protection against damage.
    c. Ensure that all workers are qualified.
    d. Review installation; demolition and disposal procedures to assure coordination of Contract Documents requirements with each person involved in performing the work.
    e. Verify as-built conditions and notify the Owner or his representative of conflicts.

O. Initial Inspection

1. To be conducted after a representative sample of the work is complete:
    a. Review the representative sample of the work against the specification and code requirements previously discussed at preparatory inspection.
    b. Check for workmanship.
    c. Check installation, removal and disposal of each item for conformance.
    d. Check for damage and ensure that damaged work is corrected, at no additional cost to the Owner.
    e. Submit documentation for review to the Owner or his representative detailing compliance of the above.

P. Follow-Up Inspection

1. Check completed work against results of initial inspection of representative sample of work against items mentioned in the preparatory inspection.
2. Verify that damaged work is corrected properly and approved by the Owner or his representative, at no additional cost to the Owner.

3. Submit documentation for review to the Owner or his representative detailing compliance of the above.

Q. Inspection Results

1. Certify inspection results: This certification shall state that the observations were performed by or under the direct supervision of the BHS Contractors Quality Assurance Representative and that the results are representative of the conditions being certified.

2. Work accomplished shall be considered satisfactory only when the records and inspections show that all variances have been corrected and that the work is in conformance with the Contract Documents.

3. Submit documentation for review to the Owner or his representative detailing compliance of the above.

4.02 TESTING AND ACCEPTANCE

A. Inspection and Testing Procedures

1. General

a. After installation of the BHS, the BHS Contractor shall demonstrate its operating capability. The BHS Contractor prior to the start of the Systems Acceptance Testing should have accomplished all “debugging” and internal testing. In addition, the BHS Contractor shall carry out a “dry test run” of Acceptance Tests prior to conducting such tests with the Owner or his representative to ensure that tests conducted with the Owner or his representative are successful. The BHS Contractor shall make available to the Owner on a daily basis any and all records of internal testing and debugging (with corrective action carried out) performed prior to Acceptance Testing.

b. The System shall be capable of handling the maximum and minimum specified sizes and weights without jamming, damage or toppling of the baggage.

c. The BHS Contractor shall provide all actual baggage and simulated weighted baggage required for testing. Actual baggage provided shall be representative of the many different types of baggage pieces encountered during live operations, including the maximum sizes and weights as defined in this specification. Simulated weighted baggage used shall be either weighted tubs or boxes. All baggage used for testing purposes shall be approved by the Owner or his representative prior to testing. The ratio of actual to simulated test baggage for this project shall be 50% of each. If necessary during the testing period, the BHS Contractor shall replace any simulated or actual test baggage that becomes damaged to the extent that it is no longer useable in order to maintain a minimum of test pieces at all times.

d. All tests shall be conducted with the above ratio of actual and simulated baggage except for load tests, which shall be acceptable to be performed with simulated baggage only.

e. Provide appropriate service personnel "on-site" during the testing period to service or adjust, as required, the System equipment as well as to open all control boxes, control station covers, drive assembly chain/V-belt guards, covers, etc. for the Owner inspection of the system equipment.

f. Provide all necessary test, measuring, and recording devices required to demonstrate the operational characteristics and performance of the equipment to the satisfaction of the Owner (clamp-on type ammeter, direct read FPM digital readout tachometer, etc.).

g. The BHS Contractor shall provide written notice (minimum 14 days) to the Owner prior to acceptance testing that they have completed all “dry test runs” of the acceptance tests and are ready for the witnessed testing. Ensure that the Owner or his representative witness all Acceptance Tests and shall indicate Acceptance by signing and dating the test data sheet. The Owner reserves the rights to back charge the BHS Contractor for the time and expenses of all who attended the Acceptance Testing on the Owner’s behalf should the requested acceptance test(s) be unsuccessful and require re-testing at a later date.

2. System Inspection and Test Plan Submittal

a. Prepare an Inspection and Test Plan for this Project based on the information provided below and submitted per the submittal schedule detailed Part 1 of this specification for review and approval by the Owner or his representative.

b. The BHS Contractor is to be aware that various subsystems may require testing independent of one another.

Therefore, the BHS Contractor must take into account the fact that a number of tests will have to be conducted at the various stages of installation.

c. The test plan shall be provided in both hard copies for field use during the testing process and a completed (based upon acceptance testing) electronic format agreed upon by the Owner or his representative.

d. The test plan shall include as a minimum the following:

1.) Description of each Test

2.) Pass/Fail Criteria

3.) Expected duration of the test

4.) Number of test bags required and where they are to be positioned for the start of the test

5.) If required, confirm all bag statistics on the MIS reports have been reset

6.) Number of airline 10-digit bag tags/BSMs required for testing. Coordination with the user airlines will/may be required

7.) List all test equipment required

8.) Number of personnel required for the test to include:

a.) Test Supervisor

b.) Mechanical

c.) Electrical

d.) Controls/computer engineer(s)

e.) Personnel required to load and remove bags

f.) BCR operator

9.) List other affected equipment manufacturers (e.g. L3 3DX 6600, ATR vendor etc.) that may be required for the test. Confirmation that these manufacturers have been notified and will be in attendance.

10.) Details of all reports to be printed after the test

11.) Pass/Fail and Notes/Comments sections.

12.) Section for witnessed sign off, to include as a minimum BHS Contractor, the Owner or his representative

e. The following is intended to be a guideline, and is not to be construed as all-inclusive:

1.) Mechanical Static Inspection: Provide a comprehensive, easy to read mechanical equipment inspection plan for every piece of mechanical equipment installed as part of the BHS. This inspection plan shall verify adherence to the Specification for the following items:

a.) Belt Conveyors: Gaps between adjacent head and tail pulleys, - Vertical clearance, - Angle of incline/decline, 4" conveyor I.D. - Gaps between adjacent bed sections, - Gaps between adjacent side guard sections, - Baggage snag points, - Sharp edges or shear burrs, - Condition of painted surfaces, - Tightness of all hardware, - Alignment of stainless steel trim and bed section filler plate, - Spacing of vertical braces for side guards/back guards, - Spacing of conveyor supports, - Sway bracing, - Trim securement screw type and countersinking, - Safety guarding/belly pans, - Anchoring/mounting of access ladders, - Installation of static merge deflector , - Installation of right angle transfer transition plate, - Belting material and splicing, - Belt lacing size and cable, - 1" V-notch in belting splice, - Belt path routing, - Belt wrap, - Belt tension, - Pulley diameter, - Pulley shaft diameter, - Vertical alignment of head and tail pulleys, - Lateral position of pulleys, - Return roller diameter, - Return roller spacing, - Bearing mounting lock washers, - Bearing jacking bolts, - Bearing grease zerk removal, - Bearing caps, - Motor and speed reducer mounting

lock washers, - Speed reducer drip pan, - Motor/speed reducer related sprocket/sheave and shaft alignment, - Motor/speed reducer related sprocket or sheave key tightness, - Motor/speed reducer related chain/V-belt tension, - Chain/V-belt safety guard, - Speed reducer leakage, - Speed reducer lubrication level, - Mounting of speed reducer torque arm, - Safety finger guards on end pulleys at staffed conveyors (ticket counter conveyors, sort makeups, manual encoding, etc.) -- 25% take-up pulley position, - Installation of strip door type draft curtain, - Installation of fire/security doors, - Removal of construction related debris, - Maintenance access, - Protective guard railing installation, - Vertical clearance for traffic aisles.

b.) High speed vertical paddle diverters: Gaps between adjacent bed sections, - 4" diverter I.D., - Gaps between adjacent side guard sections, - Baggage snag points, - Sharp edges or shear burrs, - Condition of painted surfaces, - Mounting and anchoring of diverter assembly, - Tightness of all hardware, - Bearing mounting lock washers, - Bearing grease zerk removal, - Motor and speed reducer mounting lock washers, - Speed reducer drip pan, - Motor/speed reducer related sheave/shaft alignment, - Motor/speed reducer related sheave key tightness, - Motor/speed reducer related chain/V-belts tension, - diverter safety guard, - Speed reducer oil leaks, - Speed reducer lubrication level, - Mounting of speed reducer torque arm, - Removal of construction debris, - Maintenance access, - Alignment of diverter blade/paddle, - Alignment and secureness of diverter blade/paddle pad, - diverter blade/paddle face sweeper.

c.) Scanner Arrays: Array I.D, - Vertical and lateral clearances, - Baggage snag points, - Sharp edges or shear burrs, - Condition of painted surfaces, - Proper anchoring of scanner array framework, - Scanner support/mounting hardware tightness and lock washers, - Maintenance access – Bottom heads blower motors support/mounting hardware tightness.

d.) Flat Plate Devices: Tray vertical clearance -- gaps between adjacent back guard sections -- gap between perimeter finger guard and top of pallet not in excess of 1/8" -- skirting above and below conveying surface -- sharp edges or shear burrs -- condition of painted surfaces -- tightness of all hardware trim -- securement screw type and countersinking -- baggage snag points -- drive assembly safety guarding -- speed reducer drip pan -- motor/speed reducer type and alignment -- motor-driven sprockets/sheaves alignment -- motor-driven chain/V-belt tension -- speed reducer leakage -- removal of construction debris -- maintenance access -- protective guard railing gap between adjacent plates not in excess of 1/16" -- plate-driving sprocket alignment -- plate-driving chain tightness

e.) Vertical Sorter: Gaps between adjacent bed sections -- 4" sorter I.D. -- gaps between adjacent side guard sections -- baggage snag points -- sharp edges or shear burrs – condition of painted surfaces -- mounting and anchoring of sorter assembly -- tightness of all hardware -- bearing mounting lock washers -- bearing grease zerk removal -- motor and speed reducer mounting lock washers -- speed reducer drip pan -- motor/speed reducer related sheave/shaft alignment -- motor/speed reducer related sheave key tightness -- motor/speed reducer related chain/V-belts tension -- sorter safety guard -- speed reducer leaks -- speed reducer lubrication level -- mounting of speed reducer torque arm -- removal of construction debris -- maintenance access

2.) Electrical Static Inspection: Provide a comprehensive, easy to read electrical equipment inspection plan. This inspection plan shall verify adherence to the Specification for the following items:

a.) Belt Conveyors: Control station I.D./function tags -- control station and disconnect switch accessibility/location -- illuminated push button switch protective guard ring -- tightness of all hardware -- photocell mounting -- tach mounting and coupling -- control circuit wiring size, type, color, and number tag -- power circuit wiring size, type, color, and number tag -- wire "whiskers" at terminal points -- wiring terminal point screw tightness -- splice point wire nuts within junction boxes -- conduit routing and mounting -- tightness of conduit/sealtite fittings -- junction box covers -- unused openings in junction boxes or control device boxes -- safety disconnect switch lockout capability -- lanyard cable supports and limit switch -- maintenance access -- record motor name plate data, size of motor overload heaters, and size of all fuses.

b.) Flat Plate Devices: Control station I.D./function tags -- control station and disconnect switch accessibility/location -- illuminated push button switch protective guard ring -- tightness of all

hardware -- photocell mounting -- control circuit wiring size, type, color, and number tag -- power circuit wiring size, type, color, and number tag -- wire "whiskers" at terminal points -- wiring terminal point screw tightness -- splice point wire nuts within junction boxes -- conduit routing and mounting -- tightness of conduit/sealtite fittings -- junction box covers -- unused openings in junction boxes or control device boxes -- safety disconnect switch lockout capability -- maintenance access -- record motor name plate data, size of motor overload heaters, and size of all fuses.

c.) High Speed Diverts: Control station I.D./function tags -- control station and disconnect switch accessibility/location -- illuminated push button switch protective guard ring -- tightness of all hardware -- photocell mounting -- tach mounting and coupling -- control circuit wiring size, type, color, and number tag -- power circuit wiring size, type, color, and number tag -- wire "whiskers" at terminal points -- wiring terminal point screw tightness -- splice point wire nuts within junction boxes -- conduit routing and mounting -- tightness of conduit/sealtite fittings -- junction box covers -- unused openings in junction boxes or control device boxes -- safety disconnect switch lockout capability -- lanyard cable supports and limit switch -- maintenance access -- record motor name plate data, size of motor overload heaters, and size of all fuses.

d.) Scanner Arrays: Scanner I.D. tags -- tightness of all hardware -- control circuit wiring size, type, color, and number tag -- tightness of scanner cable connections -- power circuit wiring size, type, color, and number tag -- wire "whiskers" at terminal points -- wiring terminal point screw tightness -- splice point wire nuts within junction boxes -- conduit routing and mounting -- tightness of conduit/sealtite fittings -- junction box covers --unused openings in junction boxes or control device boxes – bottom heads blower motors conduit routing and mounting -- maintenance access.

e.) Baggage Dimensioning Device: Device I.D. tags -- tightness of all hardware -- control circuit wiring size, type, color, and number tag -- tightness of cable connections -- power circuit wiring size, type, color, and number tag -- wire "whiskers" at terminal points -- wiring terminal point screw tightness -- splice point wire nuts within junction boxes -- conduit routing and mounting -- tightness of conduit/sealtite fittings -- junction box covers --unused openings in junction boxes or control device boxes – bottom heads blower motors conduit routing and mounting -- maintenance access.

f.) Motor Control Panels: I.D. information for MCP and all devices contained within -- control station I.D./function tags -- illuminated push button switch protective guard ring -- location of control devices -- tightness of all hardware -- control circuit wiring size, type, color, and number tag -- power circuit wiring size, type, color, and number tag -- wire "whiskers" at terminal points -- wiring terminal point screw tightness -- panduit wire raceway -- splices in panduit wire raceway -- panduit wire raceway covers -- conduit routing and mounting -- tightness of conduit fittings -- conduit bushings and chase nipples -- "air-space" around programmable logic controllers -- MCP door(s) mechanical safety interlock -- safety shield over line and load terminals of MCP main breaker -- orientation of status panel -- restraint clips for plug-in type power supply --installation of hour meter -- hour meter I.D. tag.

3.) Mechanical Testing: Provide a comprehensive, easy to read mechanical test plan. This test plan, at a minimum, shall verify the specified functionality of the following:

a.) Belt Conveyors: Conveyor speed -- belt tracking -- shaft run-out on pulleys -- excessive vibration -- operation of clutch/brake units -- lateral movement of speed reducer on shaft during start/stops -- abnormal noises -- torsion flexing of drive assembly during start/stop operation -- operation of controls

b.) Flat Plate Devices: Operation of "soft-start" device -- engagement of plate cam followers with drive assembly -- vertical or horizontal displacement of plates through drive assembly section -- excessive vibration -- abnormal noises -- binding of perimeter finger guards with top surfaces of plates -- operation of controls.

c.) High speed vertical paddle diverters: Operation of clutch units -- abnormal noises -- cycling speed -- paddle height above belt during cycle -- paddle extension across full width of conveyor belt --

operation of controls--capability of processing all types of baggage, including but not limited to, golf bags, etc.

d.) Vertical Sorter: Operation of clutch units - abnormal noises - -cycling speed - - operation of controls.

4.) Electrical Testing: Provide a comprehensive, easy to read electrical test plan that clearly identifies all installed control devices, the control device locations in the BHS, the function of the control device, all conveyors affected by the control device, and the expected field result with applicable system monitor message/display. The test plan shall be provided in both hard copy for field use during the testing process and a completed (based upon acceptance testing) electronic format agreed upon by the Owner or his representative.

a.) All Control Devices: Photocells -- limit switches -- status lights -- hour meter -- start-up alarms -- fault warning alarms -- fault warning alarms with multiple faults -- fault warning alarm silence buttons -- timer settings -- auto shut-down -- motor overloads -- motor disconnects – auto start – cascade operation – inch and feed operation – e stop function – run lanyard – overheight/over length function – jam function.

b.) Workstations: Graphical system status display – graphic fault warning and associated text display -- report generation (daily, weekly, monthly, annual and on demand) – accuracy of all reports -- redundancy operation between primary and back up workstations -- problem resolution text – modification to flight and tag tables – change makeup assignments – system re-route/re-configuration – monitor redundancy functions –access to all security levels – BSM retention control – ability to render individual equipment unavailable/available – statistics and counter reset capability –demonstrate statistical data back up functionality

c.) Scanner Arrays: Read capability of scanner array with all tag orientations -- generation of "no-read" error information -- generation of performance statistical information -- generation of fault warning alarm(s) and appropriate indications for multiplexing device failure -- generation of fault warning alarm(s) and appropriate indications for individual scanner output failure – verification of redundancy – operation of blower motors for bottom heads.

d.) Baggage Dimensioning Device: Baggage sizing capability of baggage dimensioning device with bags in all orientations -- generation of "unable to size" error information -- generation of performance statistical information -- generation of fault warning alarm(s) and appropriate indications for multiplexing device failure -- generation of fault warning alarm(s) and appropriate indications for individual dimensioner output failure – verification of redundancy.

e.) Cable Testing: Test all cables, including all fiber optic, Cat-5e and Cat-6 telecommunication cables, and all cables to be connected as part of an interface to another system (e.g. fire system, host computers, ACAMS, EDS devices, PanelView Terminals etc.).

f.) Interface Testing: Test all interfaces with other systems (e.g. fire system, security card readers, EDS devices etc.) Coordinate with other trades in support of this testing.

5.) Empirical Readings

a.) The Empirical Readings which are to be taken at the time of Conditional Acceptance Testing are to include the following:

(1.) Main Feeds: Fuse size per phase, actual amperage per phase.

(2.) Transformers: Fuse size per phase, actual amperage per phase.

(3.) Conveyor/Device Speeds: Actual “center-line” speed of conveyor/device.

(4.) Motors: Nameplate data, horsepower, listed motor current; fuse size per phase, actual amperage per phase, overload heater size or designation.

(5.) VFDs: record all VFD settings

6.) Load Testing: Provide a comprehensive, easy to read test plan listing the expected load rating for each

device, at a minimum, provide the following:

a.) Individual device identifications with the expected load rating for each device

b.) Amperage readings per phase under No Load conditions.

c.) Fuse Sizes (if applicable) and motor heater settings.

d.) Motor nameplate FLA for each device drive and HP.

e.) Amperage readings per phase under Full Load conditions.

f.) Pass/Fail and Notes/Comments sections.

All FLA readings taken during load testing shall be recorded and included in the Final O&M Manual for record.

7.) Rate Testing: Provide a comprehensive, easy to read test plan detailing the loads, system loading points, manpower required throughout the BHS for loading and re-circulating testing materials (if applicable), observational manpower required to monitor the system performance during the test, and clearly identify the system reports (by name) that will be used to demonstrate the system has achieved the specified processing rates.

a.) The following is in addition to any TSA required testing.

b.) The Rate Test shall require the demonstration of the ability to accurately process the specified items per minute for 30 consecutive minutes.

c.) It is the intent of the Specifications that the maximum processing rate is for average length bags of 33-inch length.

8.) Sortation Testing: Provide a comprehensive, easy to read test plan, which will demonstrate the sortation capability of the system. It must clearly identify all the testing requirements outlined above.

a.) At a minimum, the test shall verify the ability of the System to perform the following:

(1.) Communications between the sort computer and the ATR scanner array

(2.) Sortation through the ATR scanner array using valid 10 digit BSM tags

(3.) Sortation through the ATR scanner array using invalid 10 digit BSM tags

(4.) Sortation through the ATR scanner array using conflicting 10 digit BSM tags

(5.) Sortation through the ATR scanner array using valid 4 digit tags

(6.) Sortation through manual encoding using valid 10 digit BSM tags

(7.) Sortation through manual encoding using invalid 10 digit BSM tags

(8.) Sortation through manual encoding using valid 4 digit tags

(9.) Sortation through the ATR scanner array using fall back procedures

(10.) Sortation through manual encoding using fall back procedures

(11.) Functionality of Anti-Gridlock provisions

(12.) Communications between the PLC and the scanner array

(13.) PLC scan time verification test

(14.) All Operational and Maintenance Computer generated reports for accuracy and content

9.) Redundancy Testing: Provide a comprehensive, easy to read test plan, which will demonstrate the redundancy capability of the system:

a.) At a minimum, the test(s) shall verify the ability of the System to perform the following:

(1.) Redundancy Operation of the high level network

(2.) Redundancy Operation of the low level network

(3.) Redundancy Operation between primary and back up PLCs

(4.) Redundancy Operation between primary and back up sort computers

(5.) Redundancy Operation between primary and back up server computers

(6.) Redundancy Operation if an MDS monitor fails

(7.) Redundancy Operation of the ATR Scanner Array

(8.) Redundancy Operation of the Baggage Dimensioning device

(9.) UPS(s) Operation and redundancy

10.) EDS Matrix Testing: The BHS Contractor shall provide a comprehensive, easy to read test plan, which will demonstrate the EDS Matrix system.

a.) The BHS Contractor shall provide a comprehensive, easy to read test plan, which will demonstrate the EDS subsystem

b.) At a minimum, the test shall verify the ability of the EDS Matrix System to perform the following:

(1.) Transfer of bag ID information and screening status between the BHS and EDS device

(2.) Sortation through security screening Level 1 EDS matrix

(3.) Sortation through security screening Level 2

(4.) Sortation through security screening Level 3 ETD

(5.) Bag Flow/Sortation through screening level 1 as individual EDS devices are made inoperable/operable

(6.) Test integration for Secure Flight Selectee bag. Sortation system for Clear (level 1) and CBRA for Unclear Secure Flight Selectee level 1 bag. Ensure a Clear message assigned by level 2 (OSR) does not change assigned unclear Level 1 status and bag is diverted to the CBRA.

(7.) Redundancy Operation through all levels of EDS security screening system.

(8.) Level 2 decision timeout verification test

(9.) Tracking accuracy as specified within this specification

(10.) Routing of lost tracking/missing bags (as per the TSA protocol)

(11.) Functionality of the EDS Test and Insert modes

(12.) Operation of the decision point failsafe system. Correct functionality of control station (clear, suspect and unknown bag status indicator lights) located at the decision point.

(13.) Accuracy of EDS reports

(14.) EDS device Hold and Auto Modes of Operation with respect to the BHS system

(15.) Test bag insert after an EDS functionality

(16.) Test E-stop state between the EDS and BHS (all conveyor belts are stopped, no signal is sent to the EDS device gantry)

(17.) Test for a sustained maximum throughput rate for the complete EDS matrix

c.) The BHS Contractor shall assist the TSA in performing the mandated Site Acceptance Testing (SAT) and Independent Verification and Validation (IV&V). The BHS Contractor shall be responsible for obtaining the latest copy of the TSA IV&V test procedure (i.e. Checked Baggage Inspection Systems Performance & Commissioning Plan) to ensure their completed EDS system

meets all the protocols and requirements contained within, prior to the TSA IV&V. The BHS Contractor shall carry out a "dry test run" of the IV&V prior to the TSA testing.

11.) System Endurance and Stability Test

a.) In order to demonstrate that the system is stable and ready for operational use, a 40-hour test must be conducted in which the BHS Contractor simulates, as close as possible, actual operational conditions. This test shall be conducted after successful completion of all other inspections and acceptance tests.

b.) The BHS contractor shall submit a detailed 40 hour test script to be reviewed by the Owner or his representative at least 60 days prior to the intended date of testing

c.) The system shall be tested for a minimum of 40 hours under simulated design year operating conditions using test baggage and approved simulated baggage items. Simulated operating conditions shall include a minimum of 2 peaks during the day of 30 minutes each at a minimum of 80% of design throughput. During non-peak periods, a minimum of 10% of the design throughput shall be processed continuously through the system while in the testing period

d.) The BHS Contractor shall be responsible for supply of all labor, materials, test baggage, baggage tags, pseudo BSMs (as required), and anything else necessary for successfully completing the 40 hr test.

e.) The 40 hours of testing shall be conducted within a maximum elapsed time of three (3) calendar days (e.g. two 16-hour days and one 8-hour day).

f.) The BHS contractor shall not be allowed to tune; modify or otherwise work on the software of the system during any part of the 40-hour test as it is intended to mimic actual operation. Only standard automated control system clean up routines that are part of the normal operating routines shall be allowed to take place during the 40-hour test.

g.) The BHS contractor shall collect detailed statistics at the end of each test day during the 40-hour test and shall also summarize these statistics for the entire test period. Both the daily and summary statistics shall be presented to the Owner or his representative for review and approval prior to acceptance of the test.

h.) During the System Endurance and Stability Test the system shall meet both a minimum of 99% tracking accuracy and an ATR read rate of 90% for originating bags as required in Section 1.08 - System Design and Performance Requirements of Part 1 of this specification.

i.) A detailed list of observed programming/system deficiencies shall be generated and submitted with the test data. These deficiencies shall be corrected following the conclusion of the 40-hour system endurance and stability test.

j.) The System Endurance and Stability Test shall be followed by a complete system inspection for necessary corrections, adjustments, etc. Such adjustments may include the requirement for retraining of the belts, re-tensioning of the belts and any shorting of belting material required to meet the maximum take-up pulley adjustment as defined in Part II of this Specification.

k.) The subsystems, computer systems and the system in its entirety shall meet the availability requirements specified within these contract documents during the testing periods.

l.) Any component not operating within 5% of design speed shall be reworked to perform at the proper speed.

12.) Minimum IV&V Test Prerequisites (as required by TSA)

a.) The following requirements shall be completed by the BHS Contractor (or by others, in conjunction and with assistance from the BHS Contractor, as agreed upon by the Owner and/or his representative).

(1.) The system is substantially complete per the authorities' BHS specifications, including all BHS interfaces and reporting systems.

(2.) All required internal testing has been performed per the authorities' BHS specifications and/or commissioning documents, and these tests have passed or the system has passed sufficient tests to be declared in a state of Conditional Acceptance or its equivalent per the BHS specifications. In addition, a punch-list of all deficiencies resulting from testing has been turned over to TSA and/or their authorized Deployment Contractor.

(3.) The BHS programming is complete and can be held steady throughout testing except as needed to address deficiencies uncovered during testing as directed by TSA.

(4.) All modifications to the CBIS following an IV&V with a result of "Failed" or "Defects Found" have been previously approved by TSA OST, documented, and transmitted to TSA through the OST or through their Authorized Deployment Contractor.

(5.) System readiness has been demonstrated to TSA through the OST or through their Authorized Deployment Contractor, who in turn completes the Test Readiness Review (TRR) and submits the Test Readiness Notification (TRN) form.

(6.) A copy of the Programmable Logic Controller (PLC) Code, on Compact Disc (CD), must be supplied to the TSA representative by the BHS Contractor on successful completion of the TRR testing.

13.) Test Failure

a.) A failure during any test period shall be defined as any design characteristic or malfunction of the furnished equipment or materials that damages product or reduces any operating rate below those "specified".

b.) Conditions resulting from improper loading of product or loading product of sizes not included in specification requirements will not be considered as failures.

B. Conditional Acceptance

1. Conditional Acceptance for each phase will only be considered after the following are completed:

a. The Conditional Acceptance Inspection and Testing procedures presented below are successfully completed as specified.

b. Final Operation and maintenance manuals have been delivered.

c. Operation and maintenance training has been completed.

d. Spare parts as purchased by the Owner for that phase have been delivered.

e. All special tools and equipment required for maintenance purchased by the Owner have been delivered.

f. The name, address and a 24-hour phone number of a representative who has the authority and experience to make immediate replacements and repairs for the full life of all warranties has been provided.

2. Conditional Acceptance Inspection and Testing

a. The System, including all upper and lower level controls, shall demonstrate compliance with the approved Test Plan. The individual inspections and tests shall be performed in the order presented above. System deficiencies (punch list items) shall be corrected before performing the subsequent inspections or tests.

1.) Mechanical Static Inspection

2.) Electrical Static Inspection

3.) Electrical Testing

4.) Mechanical Testing

5.) Empirical Readings

6.) Load Testing

7.) Rate Testing

8.) Sortation Testing

9.) Redundancy Testing

10.) EDS Matrix Testing

11.) System Endurance and Stability Test

3. Upon successful completion of the specified Inspections and Testing, the Owner will issue a written notice of Conditional Acceptance.

4. A Conditional Acceptance status will indicate that the Owner or his representative have approved the equipment as worthy for operational use.

5. The Conditional Acceptance shall not relieve the responsibility for maintenance, security and insurance on the system.

6. In no case will Conditional Acceptance relieve the responsibility for performing all the work set forth in the Contract Documents.

7. At the time of Conditional Acceptance, the amount of retention held until issuance of a Certificate of Final Acceptance shall be a summation of 10% of the total value of the project and the assessed value of open punch list items (to be determined by the Owner).

8. Conditional Acceptance is applicable to each construction phase and must be issued in writing, by the Owner, prior to commencement of subsequent construction phases. Final Acceptance of individual construction phases or subsystems shall not apply.

9. Conditional Acceptance Operational Period

   a. Upon issue of a Certificate of Conditional Acceptance, a three (3) month Operational Period will commence in which the Owner will put all systems into on-line operations processing the daily flow of baggage.

   b. During this three (3) month Operational Period, the BHS Contractor shall provide full-time technical site representation during the actual hours of operation with a minimum of 16 hours per day, 7 days per week. Ensure that the representatives shall be capable and duly qualified to provide service for any problems, which occur during this period. At a minimum, the BHS contractor will have two qualified personnel per shift to trouble shoot and immediately resolve any problems which may arise. The BHS contractors on site personnel shall be capable of trouble shooting and resolving all electrical and controls related issues.

   c. During the three (3) month Operational Period, the BHS Contractor shall be responsible for all maintenance required on the BHS. During this time period the BHS Contractor will be responsible for ensuring that the BHS is fully operational during Jetport Operational hours.

      Should any downtime occur during these hours due to major faults in the BHS (i.e., PLC fault, motor overloads, motor faults, Sort Controller Fault, etc.) the BHS Contractor will be responsible for immediate rectification and assisting the Owner in any way so that Operations is not impacted in any way.

   d. During the three (3) month Operational Period, it shall also be the responsibility of the BHS Contractor to keep a detailed computer log, as detailed in the Submittal Requirements of this specification.

   e. If, at the Owner's discretion, site representation is deemed unnecessary, it shall be discontinued and the Owner shall receive a prorated credit.

   f. If a problem occurs within the BHS system, and the Owner has elected to not require full-time technical site representation during the three (3) month Operational Period, the BHS Contractor shall supply the name(s), address(s) and a 24-hour phone number of representative(s) that can be contacted who have the authority and experience to make immediate recommendations and assist the Owner or the Owner's Maintenance Contractor to return the system to a fully on-line state in the shortest possible time frame.

C. Conditional Acceptance With Defects

1. If the System is found to be unacceptable at the time of Conditional Acceptance Inspection and Testing, the Owner will issue a written "Defects List" report containing information about the particular defects that must be remedied before Final Acceptance will be granted. At this time, if the defects do not affect the functionality of

the System, the Owner may elect to advise in writing that "Conditional Acceptance with Defects" has been granted. All terms presented in the "Conditional Acceptance" portion of this Specification shall apply.

2. A "Conditional Acceptance with Defects" status, if issued, will indicate that the Owner has approved the equipment as worthy for operational use. Subsequent to "Conditional Acceptance with Defects" issuance, the three (3) month Operational Period will commence in which the Owner will put the System into on-line operations processing the daily flow of baggage. The Owner will maintain the right to judge whether any hazard may exist to personnel or equipment due to unacceptable inspection results and revoke this approval. In the event the approval is revoked, the three- (3) month Operational Period will be suspended until the hazard is remedied.

3. The Owner will be entitled to retain from the project payments an amount commensurate with the value of work remaining to be accomplished. Further, all outstanding work must be performed at times during periods convenient to the Owner and to the requirements of a fully operating system.

4. The Contractor must notify the Owner within the three - (3) month Operational Period that all outstanding items on the "Defects List" have been corrected and that Inspection and Testing may continue. When all items have been approved in accordance with the Specifications, this shall conclude Inspection and Testing of the BHS. Only the remaining time of the three - (3) month Operational Period will be required prior to application of the Final Acceptance conditions.

D. Delayed Conditional Acceptance With Defects List

1. If the System is found to be functionally unacceptable at the time of Conditional Acceptance Inspection and Testing, the Owner will issue a written "Defects List" report containing information about the particular defects that must be remedied before the three (3) month Operational Period will begin.

2. Items appearing on the "Defects List" will be considered incomplete, defective or not in conformance with the Specifications. The failure to include certain items does not alter the responsibility to complete the System in accordance with the Contract Documents.

3. A maximum period of 15 days will be allowed to correct the outstanding items on the "Defects List".

4. After all the items on the "Defects List" have been corrected, notify the Owner or his representative that the System is ready for continuing Conditional Acceptance Inspection and Testing.

5. Upon completion of "Conditional Acceptance Inspection and Testing", the terms presented in the "Conditional Acceptance" or "Conditional Acceptance With Defects List" portions of this Specification will apply, as appropriate.

E. Final Acceptance

1. Final Acceptance will only be considered after all phases have conformed to the Conditional Acceptance terms, all phases have successfully completed the three (3) month Operational Period, and the following criteria is met:

a. The System has not experienced repeated repairs and adjustments and is achieving the specified rate, accuracy and availability standards as required by this Specification.

b. The System has successfully completed the specified Inspections and Testing, with no outstanding punch list items.

c. The System is in full compliance with the Contract Documents.

d. The Owner and all other governing agencies have made their inspections and given their approvals.

e. Certificates of Installation Compliance have been issued to the Owner (e.g. weigh scale certifications)

f. Warranties for all materials and equipment received from Subcontractors and Suppliers have been assigned to the Owner.

g. A spare parts and tools audit has been conducted and all tools have been turned over to the Owner. All spare parts purchased by the Owner have been delivered.

h. The PLC and source codes for all programs in the BHS Computer System have been provided to the Owner

i. Accurate "As-built" drawings and all manuals as specified in this Specification have been delivered.

j. Operation and maintenance training have been completed.

- END OF PART IV -

Portland International Jetport (PWM)

Portland, Maine

Appendix A: Equipment Schedule

Number	Description	Manufacturer	Model #	Size (HxWxD)	Provided By	Installed By	Location	Remarks
E1	Computer				A	A		
E2	Ticket Printer				A	A		
E3	Bag Tag Printer				A	A		
E4	Bag scale			2'-6" X 3'-0"	CM	CM		
E5	Laser Printer				A	A		
E6	Scanner				A	A		
E7	Self Service Device 1		IER 918		CM	CM	SSCP Level	
E8	FID (Flight Information Display)	NEC	P401	36.2"x 21"x5.5	CM	CM		Portrait, flat mount at walls and millwork; Portrait, tilt mount at windcurt. Portrait, pull-out swivel mount at SSCP metal wall External CPU driver
E9	GID (Gate Information Display)	NEC	P401	36.2"x 21"x5.5	CM	CM		Landscape flat mount. External CPU driver
E10	Ticket Lift Station				A	A		
E11	NOT USED							
E12	NOT USED							
E13	Automatic Hand Dryer	Dyson	AB 02	25.25"x10.6"x10"	CM	CM		
E14	Television Display (CNN)	NEC	P401	36.2"x 21"x5.5	CM	CM		Landscape with speakers. Dual-screen ceiling mount. Provided escutheon ring at finished ceiling
E15	Smartcarte				Vendor	Vendor		
E16	NOT USED							
E17	NOT USED							
E18	Payphone				Vendor	Vendor		
E19	Coil Door				CM	CM		
E20	Concessionaire Coil Door				C	C		
E21	Coiling Door				CM	CM		Fire rated
E22	NOT USED							
E23	NOT USED							
E24	NOT USED							
E25	Scissor Lift							
E26	Dock Leveler	Rite Hite	Genisys Hydraulic Series		CM	CM	Loading Dock	With optional 3 phase, 480volt power
E27	NOT USED							
E28	NOT USED							
E29	NOT USED							
E30	NOT USED							
E31	NOT USED							
E32	NOT USED							
E33	NOT USED							
E34	NOT USED							
E35	NOT USED							
E36	NOT USED							
E37	BID (Baggage Information Display)	NEC	P401	36.2"x 21"x5.5	CM	CM		Landscape, Thermal Enclosure with post mount. External CPU driver
E38	PIDS (Passenger Information Display System)	NEC	P461	41.6" X 24"X5.5"	CM	CM		Landscape pull out swivel mount. External CPU driver
E39	SPIDS (Security Passenger Information Display System)	NEC	P401	36.2"x 21"x5.5	CM	CM		Landscape tilt mount. External CPU driver

Number	Description	Manufacturer	Model #	Size (HxWxD)	Provided By	Installed By	Location	Remarks
E40	NOT USED							
E41	NOT USED							
E42	NOT USED							
E43	Illuminated Advertising (wall mounted)				Vendor	Vendor		
E44	NOT USED							
E45	Self Service Device 2				A	A	Check-In Hall Level	
E46	Dock Light	DockLight LED			CM	CM	Loading Dock	Wall Mounted with Arm

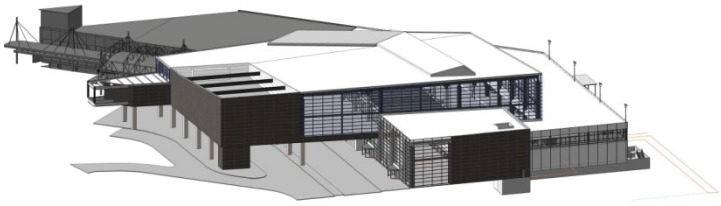
Key: CM - Construction Manager
V - Vendor
A - Airline
C - Concessionaire

Portland International Jetport (PWM)

Portland, Maine

Appendix B: Lighting Fixtures
Lighting Calculations

PORTLAND INTERNATIONAL JETPORT
Issued for Permit Set



Gensler
2020 K Street, Northwest
Suite 200
Washington, DC 20006

26 October 2009

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Partners in Architectural Lighting Design

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1 Lighting Fixture Specification

LIGHTING FIXTURE SPECIFICATION

for

PORTLAND INTERNATIONAL JETPORT
Portland, Maine

Gensler
2020 K Street, Northwest, Suite 200
Washington, DC, 20006

26 October 2009

Fisher Marantz Stone, Inc.
Architectural Lighting Design
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SECTION 16510

ARCHITECTURAL LIGHTING FIXTURES
(For fixtures with "F" prefix only)

Index to Articles

PART 1 - GENERAL

1.1 SUMMARY

A. General: This section includes interior and exterior architectural lighting fixtures, designated in the contract documents with an "F" prefix.

B. Related Sections of Electrical Work: See related sections of electrical work.

1.2 RELATED DOCUMENTS

A. Related Documents: Drawings, Contract and Special Provisions and Division 1 Specifications Sections apply to the work of this Section.

1.3 WORK INCLUDED

A. Furnish and Installation: Furnish and install a lighting fixture of the type indicated by letter at each location shown on the drawings.

B. Furnish all materials: Furnish all materials, accessories, and any other equipment necessary for the complete and proper installation of all lighting fixtures included in this Contract.

C. Lamps: Provide lamps for all lighting fixtures (furnished as part of the electric work).

D. Conformance: Fixtures shall be manufactured in strict accordance with the Contract Drawings and Specifications.

E. Intent: Specifications and scale drawings are only intended to convey the salient features, function and character of the fixtures, and do not undertake to illustrate or set forth every item or detail necessary for the work.

F. Details: Minor details**,** not usually indicated on the drawings nor specified, but that are necessary for the proper execution and completion of the fixtures, shall be included, the same as if they were herein specified or indicated on the drawings.

G. Responsibility of Fabrication: Accurate fabrication of the fixtures to the fulfillment of this specification rests with the Contractor. The Owner shall not be held responsible for the omission or absence of any detail, construction feature, etc. which may be required in the production of the fixtures.

1.4 SUBMITTALS

A. Submittals: Furnish submittals in accordance with the requirements of the related Section.

B. Shop Drawings: Shop Drawings shall clearly indicate the Contract Drawing fixture type detail designation used as reference in the development of the shop drawings and the names of the job, Architect and Lighting consultant. Shop drawings shall be complete submissions for approval and, where applicable, shall include the wiring diagram, scale plans, and details showing the method of installation of lampholders, lamps, reflectors,

transformers and secondary feeds as well as complete bill of materials. Where applicable, Contractor's verified field dimensions are to be included on shop drawings showing exact locations of lampholders, and lamp shapes and lengths. Provide three reproducible copies of approved shop drawings for owner's use in maintenance and lamp replacement.

C. Coordination: All lighting fixture drawings shall be coordinated with the drawings and details of the Architectural, Structural, Electrical, Mechanical, and other related trades to assure a perfect and efficient installation.

D. No Variations: No variations from the general arrangement and details indicated on the drawings shall be made on the shop drawings unless required to suit the actual conditions on the premises, and then only with the written acceptance of the Architect. All variations must be clearly marked as such on drawings submitted for approval.

E. Catalog Cuts: Catalog Cuts lacking sufficient detail to indicate compliance with contract documents will not be acceptable.

F. Photometric Data: Furnish complete photometric data for all fixtures, including optical performance rendered by independent testing laboratory developed according to methods of the Illuminating Engineering Society of North America as follows:

1. For direct, indirect, and direct-indirect fixtures used for general illumination:
   a. Coefficients of utilization
   b. Spacing to mounting ratio
   c. Candlepower data, presented graphically and numerically, in 5° increments (5°, 10°, 15°, etc.). Data developed for up and down quadrants normal, parallel, and at 22-½ °, 45°, 167-½ ° to lamps if light output is asymmetric
   d. Zonal lumens stated numerically in 10° increments (5°, 15°, etc.) as above

2. For area and roadway luminaires:
   a. Isocandela charts
   b. Coefficients of utilization
   c. IES roadway distribution classification

G. Maintenance Manual: At the completion of the project, the lighting fixture manufacturer shall furnish to the owner a recommended maintenance manual. Each maintenance manual shall include:

1. Tools required

2. Types of cleaners to be used

3. Replacement parts identification lists

4. Final, as-built shop drawings

H. Manufacturer's certification of low mercury/low lead compliance with U.S. EPA's TCLP procedure.

1.5 SAMPLES, PROTOTYPES, MOCK-UPS AND BENCHMARKS

A. Definitions:

1. Sample: A luminaire similar to or representative of the required luminaire, utilized to demonstrate and show the quality of the workmanship to be provided for the required luminaries.

2. Mock-up: A full-scale model of the required luminaire installed in a selected location used to verify and refine photometric performance, mounting integration, size and general characteristics.

3. Prototype: A working model of the luminaire to test the performance and show the workmanship and finishes, prior to manufacturing.

4. Benchmark: The first luminaire off the production line of the actual luminaire to be installed.

B. Submissions Required: After shop drawing review, and prior to release for manufacturing, furnish one mock-up, prototype and benchmark for each fixture as required by the contract drawings.

C. Voltage: Samples, mock-ups and prototypes containing ballasts shall be supplied with 120 volt ballasts. Benchmarks shall be supplied with ballasts at the specified voltage.

D. Shipping: Samples, mock-ups, prototypes and benchmarks shall be shipped prepaid to the Lighting Consultant, or as otherwise advised.

E. Ready to Energize: Samples, mock-ups, prototypes and benchmarks shall be submitted complete with specified lamp(s), fitted with 20A plugs, ready for installation, energizing, and examining.

F. Review: Allow two weeks from date received for thorough examination of the samples, mock-ups, prototypes and benchmarks by the Lighting Consultant.

G. Not Returnable: Samples, mock-ups, prototypes and benchmarks will be retained by the Owner, are not returnable, nor included in quantities listed for a project.

1.6 REFERENCE STANDARDS

A. Codes: Materials and installation shall be in accordance with the latest revision of the National Electrical Code and any applicable Federal, State, and local codes and regulations.

B. Listings: All fixtures shall be manufactured in strict accordance with the appropriate and current requirements of the National Electric Code as verified by Underwriters' Laboratories, Inc., or other testing agency as acceptable to local code authorities. Such a listing shall be provided for each fixture type and the appropriate label or labels shall be affixed to each fixture in a position concealing it from normal view.

1.7 QUALIFICATION OF BIDDERS

A. Listed Manufacturers: Manufacturers listed in the fixture schedule shall be assumed capable of supplying the listed fixtures unless exceptions are set forth in their quotations. Any such exceptions shall immediately be brought to the attention of the Architect and the Lighting Consultant.

B. Non-listed Manufacturers: Manufacturers not listed must be pre-qualified to bid as follows:

1. Experience: Manufacturer shall have not less than five years experience in design and manufacture of lighting fixtures of the type and quality shown. Pre-qualification submissions must include a list of completed projects and dated catalog pages or drawings indicating length of experience.

2. Prototypes: Manufacturer shall also submit a prototype of each fixture for review by the Architect. Prototypes shall be sufficiently detailed and operational to allow evaluation of compliance with the salient features of the specification. Preliminary design or shop drawings shall not be accepted in place of a prototype submission.

3. Qualification Determination: The Architect shall be the sole judge in determining whether the prototype complies with the specification, and shall reserve the right to disqualify any bidders.

1.8 QUALITY ASSURANCE

A. Standards: Materials, equipment and appurtenances as well as workmanship provided under this section shall conform to the highest commercial standard as specified and as indicated on drawings.

1.9 WARRANTY

A. Materials: Replace faulty materials and provide labor required for their replacement at no additional cost to the Owner.

B. Fixtures & Components: The fixture, its finishes, and all of its component parts, except ballasts and Alzak components, shall be warranted to be free from defects for a period of one year from date of acceptance.

C. Ballasts: Magnetic ballasts shall be warranted for two years. Electronic ballasts shall be warranted for three years.

D. Alzak: All Alzak reflectors, louvers and parabolic cones shall be guaranteed against discoloration for a minimum of ten years, and, in the event of premature discoloration, shall be replaced by the manufacturer, including both materials and the cost of labor.

1.10 BASE BID MANUFACTURERS

A. Base Bid Manufacturers: The Base bid lighting fixtures shall be from the manufacturers listed.

B. Alternate Manufacturers: Identification by means of manufacturers' names and catalog numbers is to establish basic features and performance standards. Any substitutions must meet or exceed these standards.

C. Qualifications: Within sixty days of placement of order, furnish independent photometric tests and samples for all alternative fixtures. If fixture fails to comply with specification requirements at that time, furnish acceptable fixture at no additional cost to the Owner, and with no delay to the project.

PART 2 - PRODUCTS

2.1 FIXTURE CONSTRUCTION (GENERAL)

A. Materials: All materials, accessories, and other related fixture parts shall be new and free from defects that in any manner may impair their character, appearance, strength, durability or function. These items shall be effectively protected from any damage or injury from the time of fabrication to the time of delivery and until final acceptance of the work.

B. Enclosures: Fixture enclosures shall be fabricated with a minimum of #20 gauge (0.0359 inch) thick cold rolled sheet steel. Enclosures may be constructed of other metals, provided they are equivalent in mechanical strength and acceptable for the purpose. Fabricated lighting fixtures to be finished in vitreous porcelain enamel from a minimum of #20 gauge enameling steel.

C. Sheet Metal Work: All sheet metal work shall be free from tool marks and dents, and shall have accurate angles bent as sharp as compatible with the gauges of the required metal. All intersections and joints shall be formed true of adequate strength and structural rigidity to prevent any distortion after assembly.

D. Accessibility: Housings shall be so constructed that all electrical components are easily accessible and replaceable without removing fixtures from their mountings, or disassembly of adjacent construction.

E. Castings: All castings shall be exact replicas of the approved patterns and shall be smoothly finished and free of blemishes including sand pits, scales and rust. Tolerance shall be provided for any shrinkage of the metal castings in order that the finished castings will accurately fit in their designated locations.

F. Lamp Sockets: All lamp sockets in lighting fixtures shall be suitable for the indicated lamps and shall be set so that lamps are positioned in optically correct relation to all lighting fixture components. If adjustable socket positions are provided, socket should be preset in factory for lamp specified. If different socket positions are specified for same fixture, sockets shall be preset for each type, and cartons marked accordingly.

G. Factory Wired: All fixtures shall be completely wired at the factory.

H. Mounting Frames and Rings: If ceiling system requires, each recessed and semi-recessed fixture shall be furnished with a mounting frame or ring compatible with the ceiling in which they are to be installed. The frames and rings shall be one piece or constructed

with electrically welded butt joints, and of sufficient size and strength to sustain the weight of the fixture.

I. Light Leaks: Light leaks between ceiling trims of recessed lighting equipment and the ceilings will not be tolerated. If fixture is used in partially transparent ceiling, light leaks above the ceiling line will not be tolerated.

J. Brackets and Supplementary Support: Furnish and install all yokes, brackets and supplementary supporting members needed to mount lighting fixtures to carrier channels or other suitable ceiling members.

K. Outdoor Fixtures: Fixtures for use outdoors or in areas designated as damp locations, shall be suitably gasketed to prevent the entrance of moisture. Provide approved wire mesh screens for ventilation openings. Dissimilar metals shall be separated by non-conductive material to prevent galvanic action.

L. Hardware: For steel and aluminum fixtures, all screws, bolts, nuts and other fastening and latching hardware shall be cadmium or equivalent plated. For stainless steel fixtures, all hardware shall be stainless steel. For bronze fixtures, all hardware shall be stainless steel or bronze.

M. Temperature: All fixtures and ballasts must operate within the temperature limits of their design and as specified by Underwriters' Laboratories, Inc. in the applications and mounting conditions herein specified.

N. Adjustable Angle Fixtures: Lighting fixtures that have beam angle adjustment shall have reliable angle locking devices.

O. Oval Beam Fixtures: Each lighting fixture that has a lamp with an oval shape beam pattern shall contain lamp orientation locking devices to insure that beam orientation is not disturbed during future lamp replacement or cleaning.

P. Spread Lens Fixtures: Each light fixture that has a spread lens shall contain lens orientation locking devices to insure that lens orientation is not disturbed during future lamp replacement or cleaning.

Q. Welds: Welding shall be done with electrodes and/or methods recommended by the manufacturers of the metals being welded. Welds shall be continuous, except where spot welding is specifically permitted. Welds exposed to view shall be ground flush and dressed smooth. All welds on or behind surfaces which will be exposed to view shall be done so that finished surface will be free of imperfections such as pits, runs, splatter, cracks, warping, dimpling, depressions or other forms of distortion or discoloration. Remove weld spatter and welding oxides from all welded surfaces.

R. Extruded Frames: Extruded aluminum frame and trim shall be rigid and manufactured from quality aluminum without blemish in the installed product. Mitre cuts shall be accurate, joints shall be flush and without burrs and cuts alignment maintained with the light fixture located in its final position.

2.2 REFLECTORS AND TRIM

A. Installation:

1. Completion: Reflectors, reflector cones and visible trim of all lighting fixtures shall not be installed until completion of plastering, ceiling tile work, painting, and general cleanup.

2. Clean: Reflectors, reflector cones and visible trim of all lighting fixtures shall be carefully handled to avoid scratching or fingerprinting. At the time of acceptance by the Owner, they shall be clean and free of any imperfections, including scratches, dents and fingerprints.

3. Reflector Finish: Aluminum reflectors shall be finished specular, semi-specular, or diffuse as required and shall meet or exceed Alzak specifications. Minimum requirements of reflector finishes for interior and exterior service shall be as follows:

Description of Service	Minimum Weight of Coating mg./square inch	Minimum Percent Reflectance	
		Specular	Diffuse
Normal interior commercial service	5.0	83	75
General interior industrial and exterior work reflector protected by glass covering	7.5	82	73
Exterior industrial and commercial reflector not protected	10.0	78	75
Exterior marine service reflector not protected	13.0	78	65

2.3 LENSES

A. Plastic: Plastic for clear lenses and diffusers shall be formed of colorless 100% virgin acrylic, as manufactured by Atohaas, DuPont or equally acceptable manufacturer. The quality of the raw material must meet or exceed IES, SPI, and NEMA Specifications and shall not exceed a yellowness factor of 3 after 2,000 hours of exposure in the Fade-meter or as tested by an independent testing laboratory. Acrylic plastic lenses and diffusers shall be properly cast, molded or extruded as specified, and shall remain free of any dimensional instability, discoloration, embrittlement, or loss of light transmittance for at least 10 years.

B. Glass: Glass used for lenses, refractors, and diffusers in incandescent lighting fixtures shall be tempered for high impact and heat resistance; where clear glass has been specified, the glass shall be crystal clear in quality with a transmittance of not less than 88%. For exterior fixtures use tempered Borosilicate glass tempered Corning #7740 or equal. For fixtures directly exposed to the elements and aimed above the horizontal with a radiant energy of 4.16 watts per square inch, or greater, use Corning Vycor glass or equal.

C. Optical: Where optical lenses are used, they shall be free from spherical and chromatic aberrations and other imperfections that may hinder the functional performance of the lenses.

D. Mechanical: All lenses, louvers, or other light diffusing elements shall be removable, but positively held so that hinging or other normal motion will not cause them to drop out.

E. Cleaning: All lenses shall be turned over to the Owner clean and free of dust.

2.4 FINISHES

A. Painted Surfaces: Synthetic enamel, with acrylic, alkyd, epoxy, polyester, or polyurethane base, light stabilized, baked on at 350°F minimum, catalytically or photo-chemically polymerized after application.

B. White Finishes: White finishes shall be a minimum of 90% reflectance.

C. Ceiling Opening Frames: Ceiling opening frames shall either be manufactured of non-ferrous metal, or be suitably rustproofed after fabrication.

D. Selection: Unless otherwise noted, finishes shall be as selected by the Architect.

E. Undercoat: Except for stainless steel give ferrous metal surfaces a five-stage phosphate treatment or other acceptable base bonding treatment before final painting.

F. Unpainted Non-Reflecting Surfaces: Unpainted non-reflecting surfaces shall be satin finished and coated with a baked-on clear lacquer to preserve the surface. Where aluminum surfaces are treated with an anodic process, the clear lacquer coating may be omitted.

G. Unpainted Aluminum Surfaces: Finish interior aluminum trims with an anodized coating of not less than 7 mg. per square inch, of a color and surface finish as selected by the Architect. Finish exterior aluminum and aluminum trims with an anodized coating of not less than 35 mg. per square inch, of a color and surface finish as selected by the Architect.

H. Porcelain Enamel Surfaces: Apply porcelain finishes smoothly. Finish shall be not less than .0075 inch thick of non-yellowing, white, vitreous porcelain enamel with a reflectance of not less than 85%.

2.5 LAMPS

A. Manufacturer: Lamps shall be manufactured by General Electric, Philips, or Osram-Sylvania unless otherwise specified. The same manufacturer shall supply all lamps of a given type.

B. Specific Manufacturers: If a specific manufacturer is noted in the schedule, only that manufacturer shall be acceptable.

C. Operation: Prior to final inspection, incandescent and tungsten halogen lamps shall not be operated other than for initial testing.

D. All lamps shall be recyclable and low mercury/low lead, as determined by the U.S. Environmental Protection Agency (EPA) Toxic Characteristic Leaching Procedure (TCLP) testing process.

2.6 FLUORESCENT LIGHTING FIXTURES

A. General Construction and Materials: Housing end plates, socket bridges, reflectors, wiring channels and ballast covers shall be die formed of not less than #20 gauge (0.0359 inch thick) cold rolled steel unless specified otherwise.

B. Lampholders:

1. Lampholders shall be heavy white thermoset urea plastic with definite locking-in features and silver-plated contacts for proper lamp operation and life.

2. Lampholders shall be UL listed, and meet IEC-604001, “International Standard: Lampholders for tubular fluorescent lamps and startholders.”

3. The wire/lampholder connection shall meet IEC60400 section 9.5.

4. Lampholders shall meet IEC 60400 sections 10 and 13, which specify contact force and endurance of the mechanical connection between lamp and lampholder.

5. Lampholders shall meet IEC 60400 sections 13 and 18, which specify impedance and endurance of electrical connection between lamp and lampholder.

6. Lampholder material shall be rated per IEC 60400 sections 17, 18, and 15.6, which specify mechanical resistance to heat, stress, and corrosion.

7. Lampholder housing shall not deform due to wire or lamp insertion.

C. Lampholder Wiring:

1. Rapid-start sockets shall be used with dimming ballasts. Instant-start sockets can not be used with dimming ballasts.

2. Wiring between ballast and lamp sockets shall follow diagram provided by ballast manufacturer.

3. Lampholders shall provide separate channel for each wire that connects to a lamp pin, and accommodate a specified range of wire diameters.

D. Lamp Installation:

1. Lampholder design shall have obvious indication that lamp installation is correct.

2. Lampholders shall be mounted according to recommendations of lampholder manufacturers.

3. Lampholder shall be mounted to the fixture so as to provide the correct spacing between the lamp and the grounded fixture.

4. Fixture design and packaging shall ensure lampholders meet this specification after shipping and installation.

E. Provisions for T-5 twin-tube lamps:

1. Fixtures for T-5 twin-tube lamps shall have mechanical support for the end opposite the cap.

2. The mechanical support for the T-5 twin-tube end opposite the cap shall be thermally isolated from the fixture.

3. T-5 twin-tube support shall withstand conditions of operation, including but not limited to temperature, UV exposure, and vibration.

4. Lampholders should be supported in the fixture to withstand insertion force of the lamp.

F. Outdoor Lampholders: Outdoor lampholders shall be neoprene gasketed and compression type. Sockets with open-circuit voltage over 300 volts shall be safety type designed to open supply circuit on lamp removal.

G. Lamp Mounting: Mount lamps on rapid-start circuits within one inch of grounded metal, minimum one inch wide, as long as lamp.

H. Ballast Access: Construct fixtures so that ballast may be serviced or replaced without removal of fixture housing.

I. Ballast Mounting: Secure ballasts firmly in lighting fixtures to prevent vibrations.

2.7 FLUORESCENT NON-DIMMING ELECTRONIC BALLASTS

A. General: Ballasts shall be UL listed (or equal), Class P with sound rating “A” unless otherwise noted, and comply with all ANSI specifications for lamp operation including: filament voltage, lamp current crest factor, lamp starting voltages and currents, lamp light output, etc. Ballasts shall be high frequency electronic type, operating lamps at a frequency of 20 kHz or higher with no detectable flicker. Ballasts shall be Advance Mark V, or Universal Triad unless otherwise specified.

B. Efficiency Standards: Ballasts shall meet minimum efficacy standards of all applicable state and local energy standards.

C. Ballast Factor: Relative light output (percentage of light emitted with reference lamp and ballast) shall not be less than 95% and not more than 100% unless otherwise specified.

D. Light Output Regulation: Ballasts shall maintain consistent light output of all fluorescent lamps over operating ranges of 90v to 145v (120v ballasts) and 200v to 320v (277v ballasts).

E. Harmonic Content: Input total harmonic content shall not exceed 10%.

F. Line Transients: Ballast shall withstand line transients as defined in IEEE Publication 587, Category A.

G. Case Temperature: Ballast case temperature shall not exceed 25°C temperature rise over 40°C ambient.

H. Power Factor: Ballast power factor shall be 90% or above.

I. Starting Circuit: Ballast shall provide continuous heating voltage to lamp cathodes and operate lamp(s) on a rapid start circuit unless otherwise noted.

J. Ballast Performance: At the request of the Lighting Consultant the Contractor shall submit written test data regarding ballast performance.

2.8 FLUORESCENT ELECTRONIC DIMMING BALLASTS

A. General: Ballasts shall be high frequency electronic type. Electronic dimming ballasts shall be U.L. listed and Class P thermally protected. Ballast shall be inaudible in a 27dB ambient throughout the dimming range. Ballasts shall be Lutron Hi-Lume dimming ballasts for architectural applications and Lutron ECO-10 controllable ballasts for Energy Management Applications.

B. Quality Assurance: The Contractor shall take sole responsibility for compatibility of electronic dimming ballasts and dimming controls. Manufacturer shall maintain ISO 9001 certification and provide a copy of the certificate upon request. Manufacturer shall functionally test each electronic dimming ballast at low, medium and high end of the dimming range. Manufacturer shall provide a toll-free phone number, with 24-hour emergency access, to answer technical and application questions.

C. Ballast Performance: Architectural dimming ballasts shall have a dimming range from 100% to 1% light level for T-12 and T-8 lamps, 100% to 5% light level for T-5 and T-4 (compact fluorescent) lamps. Controllable ballasts shall have a dimming range from 100% to 10% light level.

D. Light Output: Light level output shall be continuous, even and flicker-free over the entire dimming range. All linear lamps of different lengths (i.e., 2', 3', 4') on the same circuit must have the same current rating, and provide the same light output per unit length. See fixture schedule and/or dimming schedule for specific ballast model numbers. Manufacturer shall provide single, two, or three lamp electronic dimming ballasts as required. Ballast shall be capable of operating lamps from two or more lamp manufacturers.

E. Preheat Lamps: Dimming ballasts shall preheat lamp cathodes before applying arc voltage to ensure rated lamp life is not diminished. Ballast shall be capable of striking lamps at any light level. This shall be accomplished without first flashing to full light. Rush current not to exceed three amps at 277 volts or seven amps at 120 volts to avoid computer problems, nuisance circuit breaker trips, and control contact malfunctions.

F. Electrical Characteristics: Electrical characteristics of the dimming ballasts shall be the following: a power factor greater than .95; a ballast factor equal to .85; the magnitude of harmonic distortion current shall not exceed 20% of the total input current at full light output, throughout the entire dimming range; lamp current crest factor less than or equal to 1.7. Ballasts shall withstand 4000 volt surges as specified in ANSI C62.41. Ballasts must comply with FCC Part 18 regulations for non-consumer RF lighting devices. Ballasts shall have a minimum starting temperature of 10°C.

G. Installation: Lead length from ballast to lamp socket shall not exceed seven feet for T8 or three feet for T-5 lamps. Contractor shall ensure new fluorescent lamps are operated (aged) at full intensity for 100 hours. Electronic dimming ballast shall be securely mounted to a grounded metal surface (fixture).

2.9 OTHER FLUORESCENT BALLASTS

A. General: When electronic ballasts are not available, use two lamp and/or one lamp magnetic ballasts in any one fluorescent fixture. Fluorescent lighting fixture ballasts (except single reactor type) shall be equipped with an internal, automatic resetting thermal protector adjacent to the coils, and on-time non-resetting thermal device to protect the capacitor.

B. Reference Standards: Ballasts shall be acceptable and listed by Underwriters' Laboratories Inc. as Class "P" and comply with all ANSI specifications for lamp operation.

C. Sound Rating: Ballasts must be the Manufacturer's best sound rating, and the sound rating indicated on the ballast. Ballasts found by the Architect to be unduly noisy shall be replaced without charge prior to acceptance of the job.

D. Efficiency: Ballasts shall be high power factor, high efficiency, low loss type, similar to Universal (Magnetek), Valmont, or Advance Mark III for double-ended lamps, and Robertson, Advance, or Keystone for single-ended compact fluorescent.

E. Ballast Factor: Relative light output (percentage of light emitted with reference lamp and ballast) shall not be less than 95% and not more than 100% unless otherwise specified.

F. Operating Environment: Ballasts shall be designed and constructed to maintain a case temperature not greater than 90°C when operated at a room ambient temperature of 50°C when tested in accordance with UL, ANSI and CBM standards.

G. Electrical characteristics: Ballasts shall be designed for single frequency operation 60 Hz nominal, and shall operate at the nominal voltages indicated on label, 120 volt and/or 277 volt as required.

H. Outdoor Ballasts: Outdoor ballasts shall be suitable for operation and starting temperatures as low as 0°F(-18°C).

2.10 INCANDESCENT LIGHTING FIXTURES

A. General Construction and Materials: Incandescent lighting fixtures shall be listed and labeled by Underwriters' Laboratories, Inc. or other testing agency acceptable to local code authorities, for installation in fireproof or non-fireproof construction, damp or wet locations, as required.

B. Reflectors: Aluminum reflectors shall be Alzak (finish as selected) or as authorized, and not less than 0.057 inch thick unless specified otherwise.

C. Lampholders: Screw in lampholders shall be UL listed, heavy duty type constructed of high grade porcelain body with a nickel-plated brass screw shell (pre-lubricated) with silicone compound. Provide medium base sockets for lamps up to and including 250 watts, and mogul based sockets for lamps above 250 watts unless otherwise specified.

D. Tungsten Halogen: Incandescent lighting fixtures utilizing tungsten halogen sources shall be designed and constructed so that lamp seal temperatures do not exceed 350°C at an

ambient of 25°C when tested in accordance with UL Standard #57 and shall maintain an operating bulb wall temperature of approximately 600°C and not less than 250°C.

E. Lead Wires: Lead wires for fixtures utilizing tungsten halogen sources shall be rated for not less than 200°C operation, but shall be rated for 250°C if temperature warrants.

F. Temperature: Temperature on reflectors shall not exceed 205°C at any point.

G. Junction Boxes: All fixtures supplied for recessing in suspended ceilings shall be supplied with pre-wired junction boxes.

2.11 HIGH INTENSITY DISCHARGE FIXTURES

A. General Construction and Materials: Lamps and ballasts shall be of one Manufacturer to insure proper and consistent lamp performance.

B. Exterior Fixtures: Exterior high intensity discharge fixtures shall be enclosed completely.

C. Lime Glass: Lime glass shall not be used in refractors, lenses, and diffusers with high intensity discharge sources.

D. Acrylic: Where acrylic is used for lenses, refractors and diffusers with high intensity discharge sources, the fixtures shall be designed not to exceed 65°C fixture ambient temperature.

E. Lampholders shall have a porcelain body with nickel-plated brass screw shell (pre-lubricated with silicone compound) and spring-loaded silver-plated phosphor bronze contacts.

2.12 HIGH INTENSITY DISCHARGE BALLASTS

A. Reference Standards: Ballasts for high intensity lighting fixtures shall meet reference standards defined in paragraph 1.6.B.

B. Coils and Core Laminations: Fabricate core laminations of die-cut high quality steel precision welded. Coils shall be of high temperature enameled magnetic wire and precision wound. Coils shall be constructed using materials suitable for operation at 180°C.

C. Capacitors: Capacitors shall be highest quality aluminum can type for the type of service intended. Outdoor ballasts shall use capacitors with 90°C temperature rating.

D. Temperature: Ballast shall be rated for 55°C ambient temperature.

E. Fusing: Ballasts shall be suitably fused.

F. Potting: Ballasts shall be encapsulated or potted with solid fill where possible.

G. Sound: Ballasts shall be mounted in or on a lighting fixture to produce maximum sound attenuation unless otherwise specified.

H. Electronic Characteristics: Outdoor ballast shall be constant wattage autotransformer type with power factor of not less than 90%. Regulation: + 10% variation in line voltage shall vary lamp watts by no more than + 5%. Ballast shall sustain line voltage drop as much as 40% (typical) without extinguishing lamp. Outdoor ballasts shall provide reliable starting and proper lamp performance to -20°F (-29°C).

I. Metal Halide: Metal halide ballasts shall be auto-stabilized type with lead peaked circuiting, and power factor not less than 90%. Regulation: 10% variation in line voltage shall vary lamp watts not greater than + 10%. Ballast shall provide sufficient voltage at lamp with a line voltage drop as much as 40% below nominal to prevent the lamp from being extinguished.

J. High Pressure Sodium: High pressure sodium vapor ballasts shall be the voltage stabilized type with not less than 90% power factor. Regulation: 10% variation in line voltage will vary lamp watts not greater than + 3%. Ballast shall provide sufficient voltage at lamp with a line voltage drop as much as 30% below nominal to prevent the lamp from being extinguished. Ballast shall be complete with 180°C. insulation system and 80°C. rated capacitors. Ballast shall be capable of starting and operating lamps down to -29°C. and up to 35 feet away from the ballast.

2.13 METAL HALIDE ELECTRONIC BALLASTS

A. Ballast Design: The electronic ballast shall be specifically designed for a single lamp wattage to ensure optimal lamp performance.

B. Safety, Sound Rating and Mounting Distance: The metal halide electronic ballast shall be equipped with a 'Turn Off' safety function, be sound rated 'A' and have an acceptable remote mounting distance of not less than 15 feet.

C. Lamps Approved For Ballast: The specified lamps shall be approved or warranted by the lamp manufacturer for use on the designated metal halide electronic ballast.

D. Ballast Operation: Ballast shall be able to operate both ceramic and quartz arc tube metal halide lamps without possibility of non-passive lamp failure.

E. Ballast Manufacture Experience: The ballast manufacturer shall have at least 10 years of experience in the manufacturing of metal halide electronic ballasts for low wattage metal halide lamps.

F. Ballast Warranty: The ballast manufacturer shall provide a 5 year ballast warranty.

2.14 COLD CATHODE LIGHTING

A. General: Furnish the complete cold cathode lighting system and install as described in the architectural details. System shall be manufactured by a U.L. 48IFAY listed manufacturer, (National Cathode Corp., American Cathode, or approved equal).

B. Lamps: Lamps shall be made from nominal 1" diameter lead glass tri-phosphor coated and baked, with heavy duty coated right-angle electrodes and shall be fabricated to the shapes and sizes allowed for on the architectural details. They shall be silicone-coated, shall have adjustable snap-on lamp reflectors, and must be filled with argon, neon, and krypton for cold weather applications.

C. Lumen Output: Lamps shall produce 650 lumens per foot (tri-phosphor warm white) when operating at 200 mA and shall not depreciate more than 20% after 10,000 hours of operation.

D. Lampholders: Lampholders shall be right-angle type, approximately 96" o.c. maximum, for continuous line of sight. They shall be UL listed, white glazed porcelain with spring bronze clip contacts for proper electrical contact and lamp support.

E. Ballasts: Ballasts required for the cold cathode lamps shall be UL listed, HPF, 115 volt, 60 cycle, secondary 200 mA. as manufactured by National Cathode Corp., Architectural Cathode, or approved equal.

F. Transformers: High power factor transformers are to be 115 volt, 60 cycle, secondary 150 mA open circuit, mid-point grounded with voltage as required by lamp footage and no dimming. Normal power factor transformers are to be 115 volt, 60 cycle, secondary 120 mA open circuit, no mid-point ground with voltage as required by lamp for dimming by lamp footage.

G. Transformer and Ballast Locations: Transformers and Ballasts are to be located in accessible and ventilated areas (100°F maximum ambient temperature) with air circulation on all sides to dissipate about 300 watts each.

H. Installation: Install transformers and ballasts in compliance with National Electric Code and as close to lamps as possible in order to keep secondary feeds as short as possible. Wiring compartment shall be accessible. Installation of lamps, lampholders, secondary feeds, and transformers or ballasts, shall be in strict accordance with the intent of the contract drawings and approved shop drawings of the cold cathode manufacturer. Install lampholders so that all lamps make secure electrical contact in the lampholders.

I. Circuit Breakers and Switches: Circuit breakers and switches controlling the circuits feeding the cold cathode ballasts shall be capable of being locked in the open position. All cold cathode fixtures shall be supplied electrically through distribution transformers dedicated to lighting only, in order to prevent injection of "noise" into the electrical system which may affect other systems.

J. Shop Drawings: Shop drawings shall include scale plans and details showing the method of installation of lampholders, lamps, reflectors, ballasts, and secondary feeds, as well as a complete bill of materials. The shop drawings shall show the exact locations of the lampholders and lamp shapes and lengths, and four copies shall be supplied, incorporated in the maintenance manuals.

K. References: Provide the name of UL48IFAY listed manufacturer and list of previous jobs using nominal 1" diameter. lamps operating at 200 mA. within 60 days of signing of the contract.

L. Warranty: The entire system shall have a two year warranty. The power source shall have a ten year warranty.

2.15 NEON

A. General: Furnish and install the complete neon lighting system as described in the architectural details. It shall be manufactured by a U.L. “UYAM” listed manufacturer as indicated in drawings and fixture schedule.

B. Lamp: Lamp’s output and glass tubing diameter shall be in accordance with contract drawings. Lamp shall provide a continuous line of light. Maintained lamp lumen output shall meet specifications as indicated on drawings and fixture schedule, and shall not depreciate more than 20% after 10,000 hours of operation. Lamp color to be selected by Architect based on samples provided. Lamps to be processed with mechanical pump and accurate gauges and meters for measuring and controlling pressures, temperatures, carrier gas and mercury. Silicon coat and age completed lamps for 15 hours. Lamps showing darkening, stains, discoloration, spiraling or sputtering shall be rejected.

C. Lampholders: Lampholders shall be electrodes approximately 96" on center maximum with no splices, U.L. listed “UYAM” for 7500 volts minimum. All lamp terminations to be made in #200 Pyrex sockets or glass cups enclosed in metal. Lampholders to provide secure electrical contact and properly support the lamps. Provide additional lamp supports for curved or bent lamps.

D. Transformers: Transformer size shall not exceed 9,000 volts, 30 mA. Transformer shall be located as symmetrically as possible in relation to the lamp run. Provide self-contained, UL listed transformers in 16 gauge steel housings with secondary and primary wiring compartments, and a disconnect switch which will automatically disconnect the primary switch when the wiring compartment cover is removed. The wiring compartments must be accessible. Install transformers only in accessible and ventilated areas (100°F maximum ambient temperature) with air circulation on all sides to dissipate about 300 Watts each.

E. Wiring: Wiring shall be UL listed secondary feeds of GT0-15 cable with run to transformer not to exceed 20'-0" in metal conduit and 50’-0” in PVC. All feeds shall be within aluminum flexible conduit terminating within metal enclosure at Pyrex socket. Locate transformer as close to lamps as possible to avoid long secondary feeds in metallic conduit or PVC, and corona discharge, which can lead to overloading, transformer failure, shortened lamp life, and audible noise.

F. Shop Drawings: Shop drawings to be complete submissions for approval and maintenance. These shall include wiring diagram, scale plans and details showing the method of installation of lampholders, lamps, reflectors, transformers and secondary feeds as well as complete bill of materials. Verify field dimensions and include them on shop drawings showing exact locations of lampholders, and lamp shapes and lengths. Provide sepia copies of approved shop drawings for Owner's use in maintenance and lamp replacement.

G. Installation: Installation of lamps, lampholders, secondary feeds and transformers shall be in strict accordance with the intent of the contract drawings and approved shop drawings of the neon manufacturer. Install the lampholders so that all lamps make secure electrical contact in the lampholders. Apply paint finish prior to lamp installation within architectural coves.

H. Circuit Breakers: Circuit breakers controlling the circuits feeding the neon transformers shall be capable of being locked in the open position.

I. References: Provide the name of U.L. “UYAM” listed manufacturer and list of previous jobs using neon within 60 days of signing of the contract.

2.16 FIBER OPTIC LIGHT FIXTURES

A. General: Illuminators and fibers shall be of one manufacturer to insure compatibility.

B. Conditions: Illuminators shall meet all conditions for their respective sources.

C. Fans: Where fans are used for cooling, they shall be low noise and quiet running.

D. Filters: Illuminators shall have ultraviolet and infrared absorbing filters as required to prevent degradation of the fiber.

E. Safety Cutout: Metal halide illuminators shall have a safety cut out switch to prevent operation when the illuminator is opened for servicing.

F. Thermal Cutout: Provide suitable thermal cutout protection.

G. Installation: All fibers shall be cut and installed per manufacturers specifications under the supervision of the Manufacturer's representative.

2.17 LED (LIGHT EMITTING DIODE) SPECIFICATION

A. Complete System: The Contractor shall furnish the complete LED-based lighting system as described in the architectural and electrical details and specifications and shall be manufactured by specified manufacturer, or approved equal. All LED fixtures and drivers (power supplies) shall be from one manufacturer to insure compatibility.

B. LED Characteristics: LED fixtures shall provide a continuous and controllable light source. Lamp output and dimensions shall be in accordance with contract drawings and specifications. LED fixture lumen output will be in accordance with the specifications and shall not depreciate more than 20% after 10,000 hours of use. Rated lumen output for LED fixtures to operate in ambient temperature of -20°C to +50°C. White LEDs to have a minimum life of 50,000 hours and color LEDs to have a minimum of 100,000 hours. Color Changing LED systems shall be capable of 8-bit control of red, green and blue LEDs to produce 16.7 million colors. All LED fixture types shall be provided with complete photometric data including lumen output, life and distribution. All fixtures shall be capable of running in a stand-alone mode with built-in effects or have a selectable means of external control via a data network.

C. Light Color: Light color for color changing LED systems shall be selectable through stand-alone modes onboard the lights or through data communications means directly to the fixtures or through the power supplies. The communication protocol shall be in accordance with the international DMX-512 standard. For data communications driven systems, each fixture shall have the capability to set an address for the network through on-board switches or an address setting device; RJ45 connections for data connections shall be provided.

D. Listing: All LED fixtures shall be UL listed or UL classified and all power supplies shall also be UL listed. All power to the fixtures shall be low voltage supply (up to 24V as specified).

E. Quality: All LEDs used in the LED fixtures will be of high brightness and proven quality. All LEDs shall be driven digitally with pulse width modulation control to prolong life and maintain consistency of lumen output.

F. Connections: All connections to fixtures will be reverse polarity protected and provide high voltage protection in the event connections are reversed or shorted during the installation process.

G. Fuse Protections: All power supply outputs will be either fuse protected or PTC-protected as per Class 2 UL listing. All fixtures will have built-in fuse protection. All power supplies will provide for knockouts for conduit connections or clamp-style connection for the low-voltage wiring.

2.18 LED DRIVER (POWER SUPPLY)

A. All LED drivers to be compatible with LEDs. All LED fixtures and drivers (power supplies) shall be furnished by single manufacture to insure compatibility.

B. Electric Characteristics (at 25°C ambient temperature)

1. Input Voltage Range - 108V to 132V

2. Efficiency Minimum – 80%

3. Output Current Regulation Range (+/-) 5%A

4. Total Harmonic Distortion (THD) – 20% maximum

5. Power Factor – 0.9 minimum

6. Crest Factor (LED Current) – 1.5 maximum

C. FCC Classifications

1. FCC Class B for Conducted EMI

2. FCC Class A for Radiated EMI

D. Environmental Ratings

1. Operating Ambient Temperature -40/-40°C/°F minimum, +60/+140°C/°F maximum

2. Case Temperature +95/+203°C/°F maximum

3. Relative Humidity 80% maximum

4. Drivers life – 50,000 hours minimum

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fixture Locations: Do not scale electrical drawings for exact location of the lighting fixtures. In general, the architectural reflected ceiling plans indicate the proper locations of lighting fixtures.

B. Appurtenances: Install each fixture properly and safely. Furnish and erect hangers, rods, mounting brackets, supports, frames, and other equipment required.

C. Coordination: Furnish lighting fixtures complete with appurtenances required for the proper, safe and distortion-free installation in the various surfaces in which they appear. Determine surface types from the Architectural drawings.

D. Instructions: Each lighting fixture shall be packaged with complete instructions and illustrations showing how to install it. Install lighting fixtures in strict conformance with manufacturer's recommendations and instructions.

E. Alignment: Rigidly align continuous rows of lighting fixtures for true in-line appearance.

F. Pendant Fixtures: Install pendant lighting fixtures plumb and at a height from the floor as specified on the drawings. In cases where conditions make this impractical, refer to the Architect for a decision. Use ball aligners and canopies on pendant fixtures unless noted otherwise.

G. Installation Sequence: Do not install fixtures and/or parts such as finishing plates, lenses and trims for recessed fixtures until all plastering and painting that may mar fixtures finish has been completed. Install reflector cones, baffles, aperture plates, light controlling element for air handling fixtures, and decorative elements after completion of ceiling tile installation, painting and general cleanup.

H. Mechanical Rooms: Lighting fixture locations in mechanical and electrical equipment rooms are approximate. Coordinate mounting height and location of lighting fixtures to clear mechanical, electrical and plumbing equipment and to adequately illuminate meters, gauges and equipment.

I. Support: Support all lighting fixtures independently of duct work or piping.

J. Concealment: Whenever a fixture or its hanger canopy is applied to a surface mounted outlet box, a finishing ring shall be utilized to conceal the outlet box.

K. Wire Splices: Splices in internal wiring shall be made with approved insulated "wire nut" type mechanical connectors, suitable for the temperature and voltage conditions to which they are subjected.

L. Wire: All wire utilized for connections to or between individual lamp sockets and lamp auxiliaries (i.e., wires which do not constitute "through circuit" wiring) suitable for temperature, current, and voltage conditions to which it is subjected.

M. Fixture Replacements: Replace blemished, damaged or unsatisfactory fixtures as directed.

3.2 AIMING AND ADJUSTMENT

A. Aiming and Adjustment of Fixtures: Aim, adjust, focus, and lock, all adjustable lighting units under the supervision of the non-union Lighting Consultant. The Lighting Consultant shall indicate the number of crews (foreman and apprentice) required. All aiming and adjusting shall be carried out after the entire installation is complete. Furnish all ladders, scaffolds, etc. required at the direction of the Lighting Consultant. As aiming and adjusting is completed, locking mechanisms such as setscrews, bolts and nuts shall be tightened securely.

B. Night Work: Wherever possible, units shall be focused during the normal working day. However, where daylight interferes with seeing, aiming shall be accomplished at night.

3.3 CLEANUP

A. Final Acceptance: At the time of final acceptance by the Owner, all lighting fixtures shall have been thoroughly cleaned with materials and methods recommended by the manufacturers, all broken parts shall have been replaced, and all lamps shall be operative.

- END OF SECTION -

2 Lighting Fixture Schedule

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TYPE	DESCRIPTION	LOCATION	FINISH	LAMP	WATT	VOLT	MFR.	CATALOG #	ALT. MFR.#1	ALT. MFR.#2
FA	Surface wall bracket mounted nominal 8"diameter compact fluorescent downlight with etched clear reflector, integral electronic ballast located in mounting rectangular canopy and integral wall mounted cylindrical junction box. Fixture to match appearance of type 'FG'.	5 floor wood ceiling.	Custom color to match Sherwin-Williams SW7048 Urbane (Architect to confirm)	F42TTT/830	46W	Per EE	Edison Price Lighting	AMB/TRPV-42/8-COL-RSA, J-BOX/ RACO #942	Kurt Versen	Winona
FB	Bracket mounted asymmetric ceramic metal halide uplight with specular extruded aluminum reflector, micro-prismatic tempered glass lens, solid cutoff visor, integral magnetic ballast and modified conduit entry and mounting.	5 Floor	Custom color to match Sherwin-Williams SW7048 Urbane (Architect to confirm	PHILIPS CDMEliteMW210/T9/930/U/E	250W	Per EE	Elliptipar	M408-210C-2-02-xxx-V0-0- MOD Mounting	SPI	N/A
FC	Fully recessed 6" x 8' one lamp profile staggered linear fluorescent troffer with micro-pyramidal lens and integral electronic ballast.	Security Check Point, Hold Room	White (Architect to confirm)	(3) F39T5HO/830	136W	Per EE	Zumtobel	SLR6-X-3395-08-MPO-U-x	Selux	N/A

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TYPE	DESCRIPTION	LOCATION	FINISH	LAMP	WATT	VOLT	MFR.	CATALOG #	ALT. MFR.#1	ALT. MFR.#2
FD	Fully recessed 2' diameter 4-lamp profile linear fluorescent troffer with concave acrylic lens, and integral electronic ballast.	Concession	White (Architect to confirm)	(4) F17T8/830	66W	Per EE	Focal Point	FSD-22-D-4-T8-S-xxx-U-CR-xx-HW	Legion	Louise Poulsen
FD-1	Fully recessed 3' diameter 4-lamp profile linear fluorescent troffer with concave acrylic lens, and integral electronic ballast.	Concession	White (Architect to confirm)	(4) F25T8/830	96W	Per EE	Focal Point	FSD-33-D-4-T8-S-xxx-U-CR-xx-HW	Legion	Louise Poulsen
FD-2	Fully recessed 4' diameter 6-lamp profile fluorescent troffer with concave acrylic lens, and integral electronic ballast.	Concession	White (Architect to confirm)	(6) F32T8/830	177W	Per EE	Focal Point	FSD-44-D-6-T8-S-xxx-U-CR-xx-HW	Legion	Louise Poulsen
FE	Deleted									
FF	Recessed nominal 6" diameter aperture compact fluorescent downlight with semi-specular aluminum reflector and integral electronic ballast.	Throughout	White (Architect to confirm)	F26TTT/830	30W	Per EE	Edison Price Lighting	TRPH126/6-xxx-ECOL	Lightolier	Kurt Versen
FF-1	Recessed nominal 6" diameter aperture compact fluorescent double washlight with semi-specular aluminum reflector, 45° cut-off angle, and integral electronic ballast.	Throughout	White (Architect to confirm)	F26TTT/830	30W	Per EE	Edison Price Lighting	TRPV26/6DS-DWW-xxx-ECOL	Lightolier	Kurt Versen

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TYPE	DESCRIPTION	LOCATION	FINISH	LAMP	WATT	VOLT	MFR.	CATALOG #	ALT. MFR.#1	ALT. MFR.#2
FF-2	Recessed nominal 6" diameter aperture compact fluorescent washlight with semi-specular aluminum reflector, 45° cut-off angle, and integral electronic ballast.	Throughout	White (Architect to confirm)	F26TTT/830	30W	Per EE	Edison Price Lighting	TRPV26/6DS-WW-xxx-ECOL	Lightolier	Kurt Versen
FF-3	Recessed nominal 6" diameter aperture compact fluorescent corner washlight with semi-specular aluminum reflector, 45° cut-off angle, and integral electronic ballast.	Throughout	White (Architect to confirm)	F26TTT/830	30W	Per EE	Edison Price Lighting	TRPV26/6DS-CWW-xxx-ECOL	Lightolier	Kurt Versen
FG	Surface wall bracket mounted nominal 8"diameter ceramic metal halide downlight with etched clear reflector, integral electronic ballast located in mounting rectangular canopy and integral wall mounted cylindrical junction box. Fixture to match appearance of type 'FA'.	Throughout	Custom color to match Sherwin-Williams SW7048 Urbane (Architect to confirm	PHILIPS CDM100/ PAR38/FL/3K/ALTO	125W	Per EE	Edison Price Lighting	AMB/ARC 38/8-100-COL-RSA, J-BOX/ RACO #942	Kurt Versen	Winona
FH	Surface mounted compact fluorescent channel with flexible connectors, integral electronic ballast, nominal 12 inch spacing and located in architectural trough.	Column Top	White (Architect to confirm)	(11) F18TT5/830	242W	Per EE	Starfire	230-CF18HE-1-12-WH-FLX	Belfer	Legion
FI	Not Used									

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TYPE	DESCRIPTION	LOCATION	FINISH	LAMP	WATT	VOLT	MFR.	CATALOG #	ALT. MFR.#1	ALT. MFR.#2
FJ	Pendant mounted exterior 2-way linear fluorescent uplight with two fixture runs, cut-off visor, nominal 2'-10" stem and integral electronic ballasts. Contractor to coordinate fixture stem to locate bottom of fixture at 10'-0" AFF. Mounting height to be 10' from A.F.F to bottom of fixture. Suitable for Wet location.	Exterior canopy	Custom color to match Sherwin-Williams SW7048 Urbane Bronze (Architect to confirm)	(2) F32T8/830	59W	Per EE	Elliptipar	F164-A132-X-VXX-0 MOD Mounting	SPI	N/A
FK	Surface mounted nominal 5" diameter metal halide downlight with spread lens and attached electronic ballast. Contractor to coordinate mounting and wiring with field conditions.	Exterior canopy	Custom color to match Sherwin-Williams SW7048 Urbane (Architect to confirm)	PHILIPS CDM35/PAR30 L/M/FL/3K/ ALTO	45W	Per EE	BK lighting	SE-61-CUSTOM-10-B-RM-H35E-MT, PM3-RM-SM-H3RE-CUSTOM-MT	Bega	Winona
FL	Fully recessed nominal 6" diameter aperture compact fluorescent downlight with white decorative drop glass trim, semi-specular aluminum reflector, and integral electronic ballast. Fixture appearance to match 'FM'.	Ticket Hall	Custom color to match paint SW Porpoise SW7047 (Architect to confirm)	F42TTT/830	45W	Per EE	Zumtobel	CH7-1H42CFTQ 8-U-x-OD7525-SF-T-702-WH-AD	N/A	N/A

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TYPE	DESCRIPTION	LOCATION	FINISH	LAMP	WATT	VOLT	MFR.	CATALOG #	ALT. MFR.#1	ALT. MFR.#2
FM	Fully recessed nominal 5" diameter aperture ceramic metal halide downlight with white decorative drop glass trim, semi-specular aluminum reflector, and integral electronic ballast. Fixture appearance to match 'FL'.	Exterior Drop-Off	Custom color to match paint SW Porpoise SW7047 (Architect to confirm)	PHILIPS CDM39/T6/830	45W	Per EE	Zumtobel	CHD5-39T6MH-x-OD5810-SA-T-502-WH-AD	N/A	N/A
FN	Deleted									
FO	Not Used									
FP	Recessed nominal 5" diameter aperture compact fluorescent downlight with semi-specular aluminum reflector, and integral electronic ballast.	Ticket Hall Counter, Washrooms	Self-Flanged	F26TTT/830	30W	Per EE	Edison Price Lighting	TRPH126/5-ECOL-xxx	Lightolier	Kurt Versen
FQ	Fully recessed nominal 4" width aperture continuous staggered linear fluorescent perimeter mount wall grazing fixture with asymmetric distribution, white louver, and integral electronic ballast.	Ticket Hall Counter	White (Architect to confirm)	T8/830, Lengths as required.	8W/LF	Per EE	Selux	M1AJ1-1T8-AMP-PM-170'-WH-xxx	Neoray	LiteControl
FQ-1	Deleted									
FR	Cove mounted continuous T8 fluorescent staggered channel with one lamp profile and integral electronic ballast.	Bathroom Mirror	White	T8/830, Lengths as required.	8W/LF	Per EE	H.E.Williams	74-4-132-x-EBLH2-xxx	Barco	Legion

PORTLAND INTERNATIONAL JETPORT
Lighting Fixture Schedule
Gensler
Issued for Permit
26 October 2009

TYPE	DESCRIPTION	LOCATION	FINISH	LAMP	WATT	VOLT	MFR.	CATALOG #	ALT. MFR.#1	ALT. MFR.#2
FS	Fully recessed continuous T8 fluorescent perimeter downlight with nominal 9" wide aperture, 1-1/2" high white blade baffles located 1-1/2" and integral electronic ballast. Contractor coordinate mounting with selected ceiling type.	Bathroom	White	T8/830, Lengths as required.	8W/LF	Per EE	LiteControl	85N-1-X-T8-F-BW-CWM-X-ELB-X-xxx	Neoray	Linear Lighting
FT	Deleted									
FT-1	Deleted									
FU	Not Used									
FV	Pole mounted exterior metal halide flood lights with two fixtures, attached magnetic ballasts, suitable for wet location, two fixture bracket and nominal 10 foot high straight steel pole. Contractor and Architect to confirm exact pole heights.	Airside Apron	Dark Bronze	(2) PHILIPS MH1000/U/ BT37/637	2160W	Per EE	Widelite	A2M-1000-A-xxx-Y, Fixture Bracket: #PM-2-HD	Lumark	Elliptipar
FV-1	Pole mounted exterior metal halide flood lights with three fixtures, attached magnetic ballasts, suitable for wet location, three- fixture bracket and nominal 10 foot high straight steel pole. Contractor and Architect to confirm exact pole heights.	Airside Apron	Dark Bronze	(3) PHILIPS MH1000/U/ BT37/637	3240W	Per EE	Widelite	A2M-1000-A-xxx-Y, Fixture Bracket: #PM-3-HD	Lumark	Elliptipar
FW	Deleted									

PORTLAND INTERNATIONAL JETPORT
Lighting Fixture Schedule
Gensler
Issued for Permit
26 October 2009

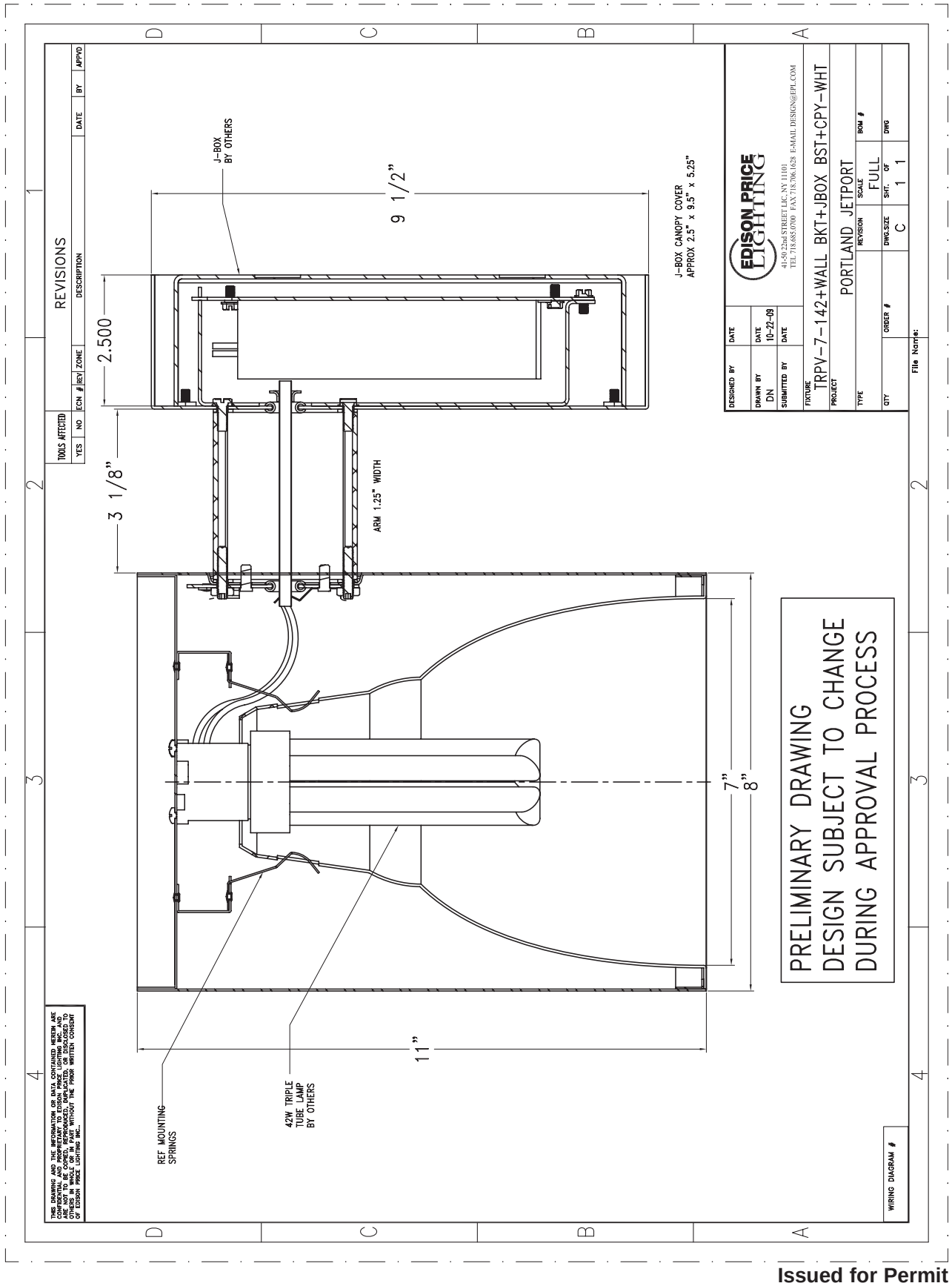
TYPE	DESCRIPTION	LOCATION	FINISH	LAMP	WATT	VOLT	MFR.	CATALOG #	ALT. MFR.#1	ALT. MFR.#2
FX	Fully recessed nominal 6" diameter aperture compact fluorescent downlight/wallwasher with semi-specular reflector and integral electronic ballast.	Bathroom	Self-Flanged	F26TTT/830	30W	Per EE	EPL	TRPH126/6-WW-ECOL-xxx	Lightolier	Kurt Versen
FY	Deleted									
FY-1	Deleted									
FZ	Cove mounted color-changing RGB LED striplight with clear polycarbonate lens, 10° beam angle, nominal 45" long extruded aluminum housing, mounting bracket, key pad and remote controller. Contractor coordinate mounting with cove construction, and provide 2 days of application engineering.	Ticket Hall Feature Wall	Standard Black	Color-changing LED	280W	120	Color Kinetics	Colorblaze 48 (#116-000016-00), Mounting bracket, iPlayer 3 (#103-000019-00), Key Pad (#103-000020-00)	N/A	N/A
FAA	Deleted									
FAB	Wall surface mounted 3" dia. x 7"H x 4"D tungsten halogen cylinder downlight in aluminum housing with spread lens and honeycomb baffle. Mount 7'-6" A.F.F to bottom of fixture.	Drop off	Custom paint to match Sherwin Williams Porpoise SW 7047 (Architect to confirm)	50W PAR20/NFL	50W	Per EE	BK lighting	CK-PAR20-0-CUSTOM-10-11	Winona	Lumiere

PORTLAND INTERNATIONAL JETPORT
Lighting Fixture Schedule
Gensler
Issued for Permit
26 October 2009

TYPE	DESCRIPTION	LOCATION	FINISH	LAMP	WATT	VOLT	MFR.	CATALOG #	ALT. MFR.#1	ALT. MFR.#2
FAC	Wall surface mounted 11"W x 11"H x 6"D compact fluorescent downlight in die-cast aluminum housing with internal semi-specular anodized aluminum reflector, cut-off shielding, etched tempered glass lens, louvered aluminum face plate, and integral electronic ballast. Suitable for wet location. Mount 9' A.F.F to center of fixture	Apron	Custom paint to match Sherwin Williams Porpoise SW 7044 Anazing Grax (Architect to confirm)	42WTTT/830	45W	Per EE	Bega	2240P	Lumark	We-ef

Note: Contractor to confirm all input wattages with specified voltages.
Architect confirm all fixture finishes.

3 Lighting Fixture Details



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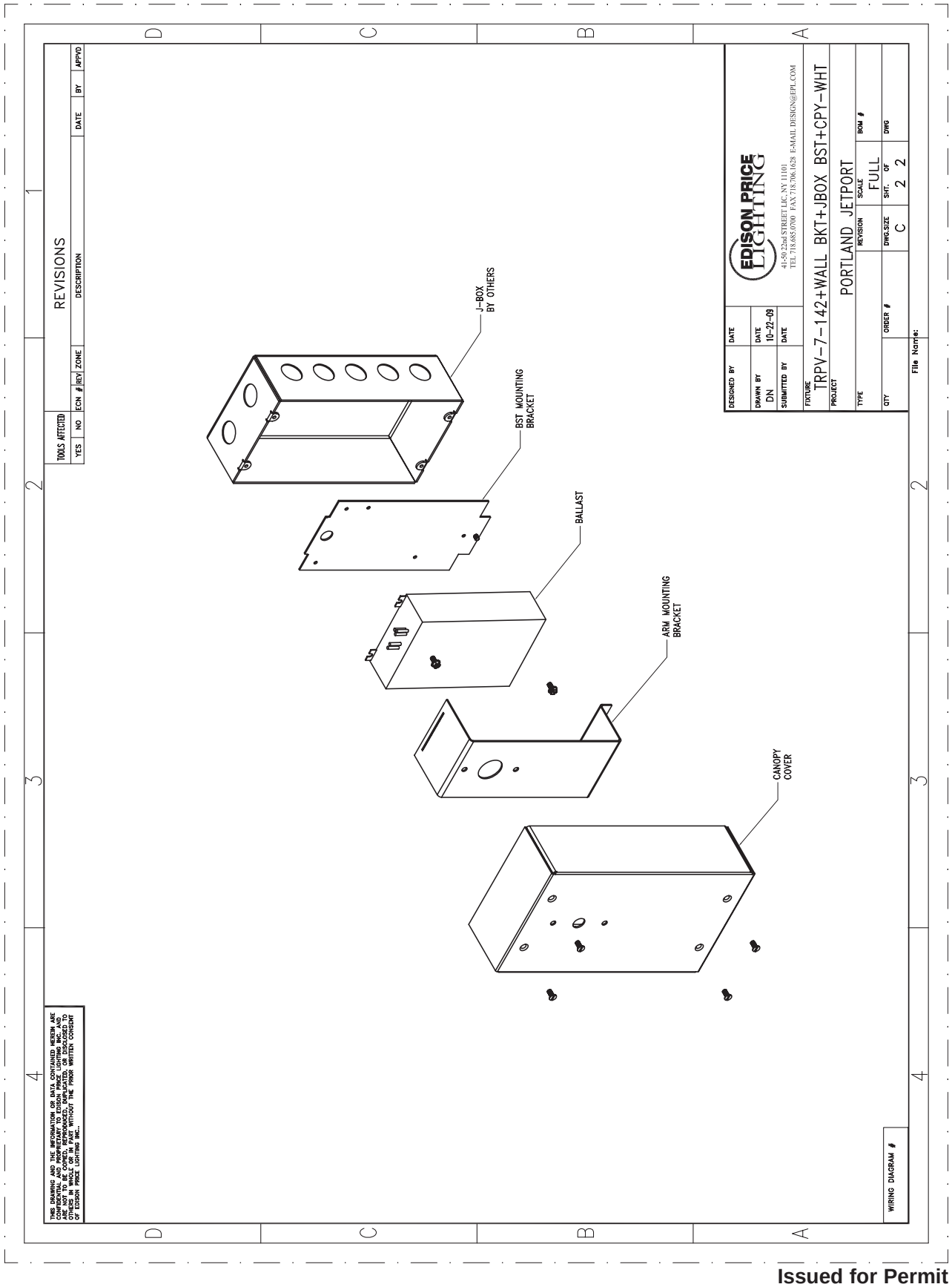

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Product Datasheet	Catalog Home · Home Page · Search

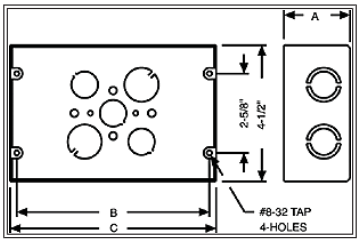
942 -- Gang Box, 3 Device, 2-1/2" Deep

Product Specifications	
Box Type	RACO Steel Boxes & Covers
Box Family	Multi-Device Gang Boxes & Covers
Box Category	Gang Boxes
Category	Gang Box
Wiring System	Conduit
Box Depth	2-1/2"
Side Knockout(s)	8, 3/4" & 2 concentric 3/4" & 1"
Bottom Knockout(s)	6, 1/2" & 4, 3/4"
End Knockout(s)	4 concentric 3/4" & 1"
Drawn or Welded	Welded
Number of Devices or Gangs	3
Cubic Inch Capacity	90.0
UPC Number	050169009420
Product UPC-A Labeled	Yes
Minimum Pack Qty.	5
Inner Leaf 2 of 5 Bar Code	50050169009425
Unit Carton Quantity	5
Ship Carton Length (In.)	9.25
Ship Carton Width (In.)	7.75
Ship Carton Height (In.)	9.5
Weight (Per/C)	197.5
Pallet Quantity	750
Dimension A	2-1/2"
Dimension B	8-3/16"
Dimension C	8-5/8"

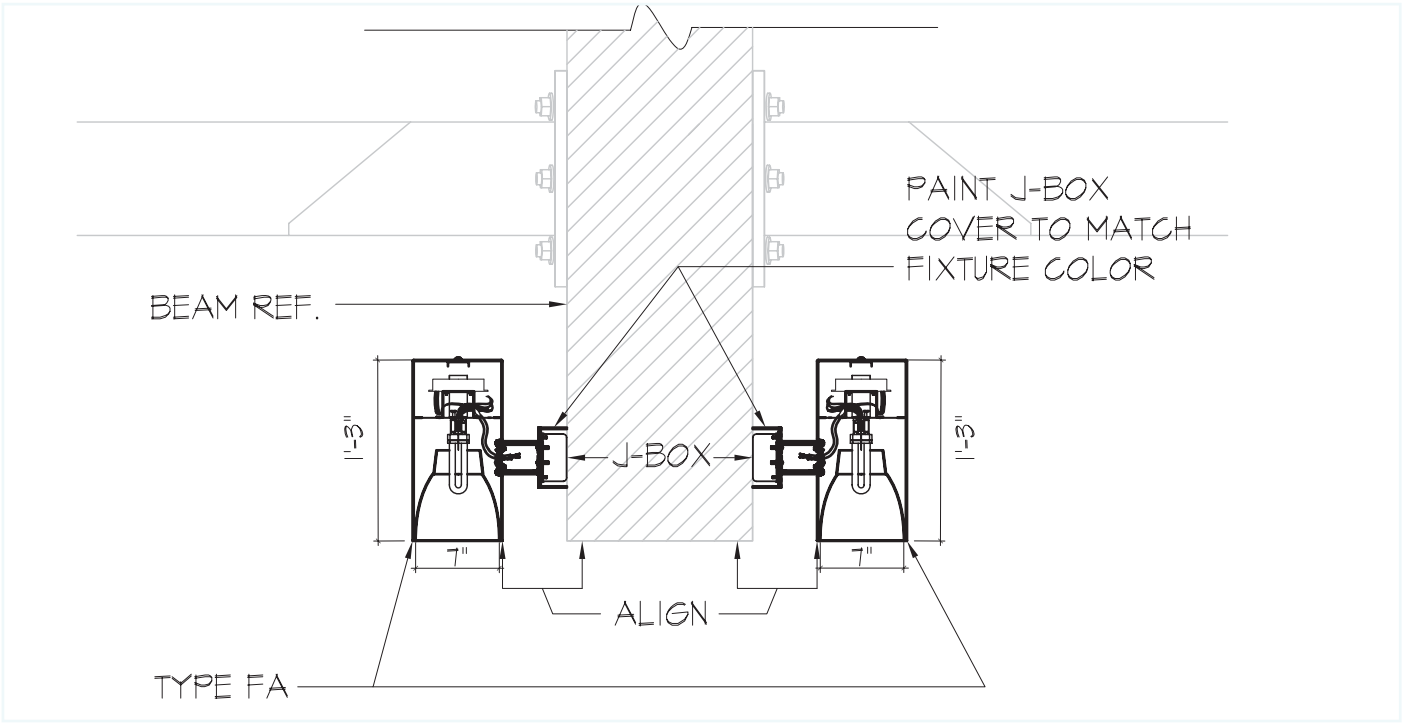
Applications
• Gang boxes are used where a number of wiring devices are to be centrally located

Product Features
• Combination cover screw heads provide for faster mudring/cover installation • Features 1/2" and 3/4" concentric knockouts for use with a wide variety wiring methods • Mounting slots in box make for easy installation of RACO #949 low voltage partition

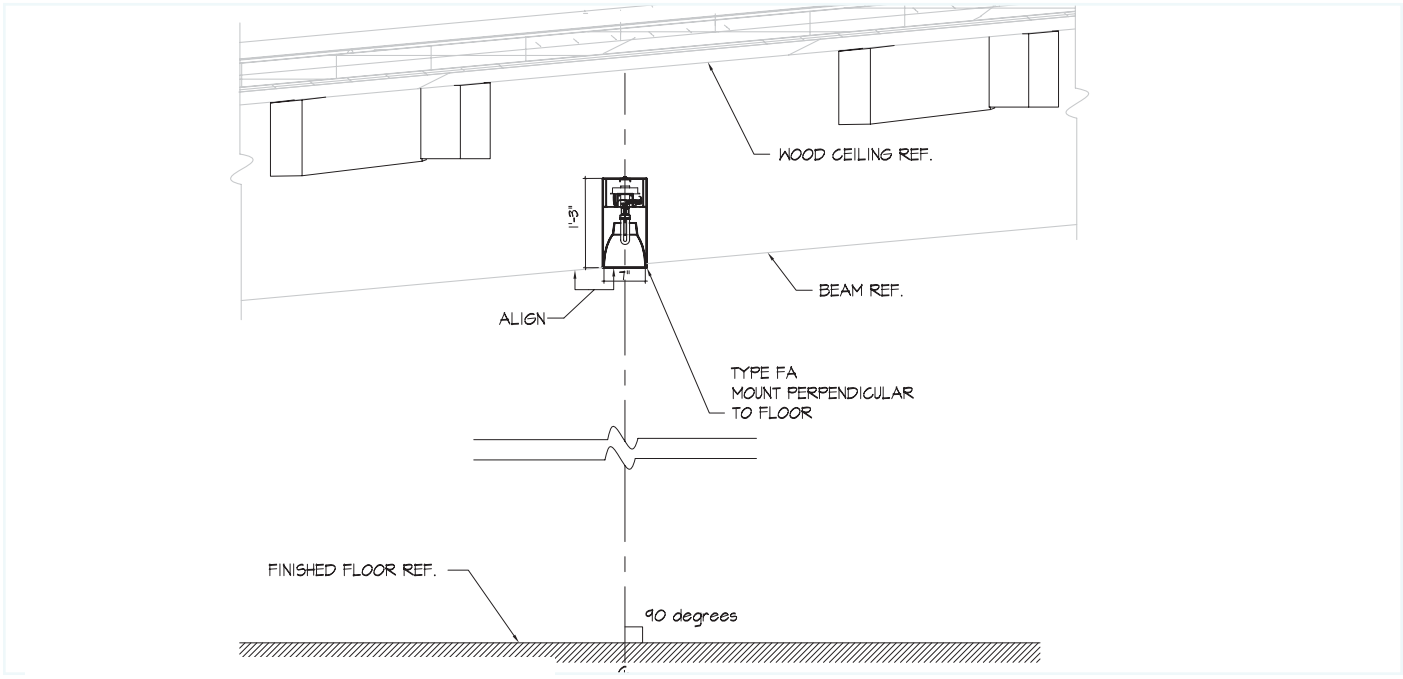
Compliances
UL 514-A listed, File



See attached Lighting Fixture Schedule



MOUNTING DETAIL SECTION
Scale: N.T.S



MOUNTING DETAIL ELEVATION
Scale: N.T.S

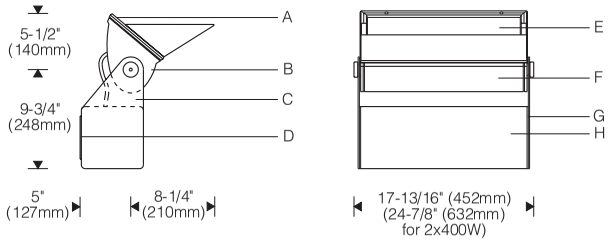
Issued for Permit

Lighting the Ceiling
Large fluted or smooth, integral

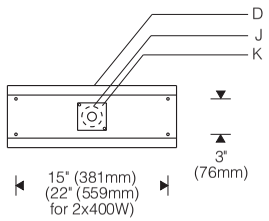
Metal Halide

Style 408 / 409

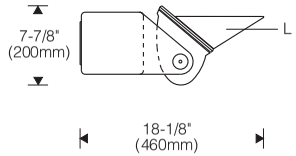
Position 1
1:16 Scale



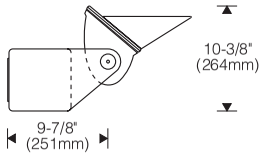
Mounting Plate



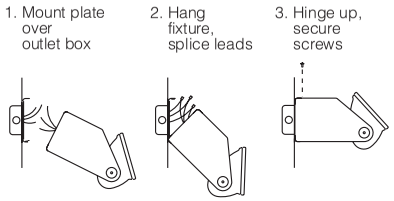
Position 2
1:16 Scale



Position 3
1:16 Scale



Installation



Specifications

- **A** Mitred extruded aluminum door with silicone gasket
- **B** Die-cast aluminum end plates
- **C** Aluminum side arms
- **D** Extruded aluminum mounting plate
- **E** Micro-prismatic tempered glass lens
- **F** Specular extruded aluminum reflector
- **G** Aluminum reveal plates (black)
- **H** Extruded aluminum ballast housing
- **J** 2" dia. opening to access recessed outlet box (by others)
- **K** Cover plate with 7/8" dia. conduit entry
- **L** Perforated or solid cutoff visor (included)

Finish:
Style 408 smooth - semi-gloss white housing, door frame, end plates, visor, side arms and ballast housing.

Style 409 fluted - bright clear anodized aluminum housing and door frame. Painted end plates, visor, side arms and ballast housing in choice of silver or semi-gloss black.

Visor available solid or perforated. Perforated visor supplied with diffusing translucent insert.

Painted surfaces - 6 stage pretreatment and electrostatically applied thermoset powder coat for stable, long lasting and corrosion resistant finish.

Reflector and internal end plates - extruded high purity aluminum with clear anodized specular finish. All luminaire hardware - stainless steel.

Mounting:
Mounting plate covers recessed outlet box or conduit feed and forms reveal at wall. Suitable backing structure required (by others) - weight up to approx. 60 lb/27 kg (2x400W MH). Fixture hinges on plate for hands-free access to splices.

Uplight pendant mounting assembly ordered separately (see Accessories); specify **X** mount 1-way or **Y** mount 2-way.

REV. 8/08

Electrical:
Use 90°C wire for supply connections. Mounting plate supplied with one 7/8" diameter entry for direct conduit feed and a 2" (50mm) diameter opening to access splices in recessed outlet box.

Integral constant wattage autotransformer (CWA) or electronic ballast.

Mogul lampholder is pulse rated for use with either horizontal or universal position reduced envelope pulse start lamps. End-of-lamp aligner ensures consistent optical performance.

For complete ballast specifications, see Accessories Section.

Standard:
UL listed or CSA certified for damp locations. (Style 408 painted model recommended for damp locations.) Suitable for use in natatorium (pool) environments (see Options). 2x400W units suitable for uplight orientation only.

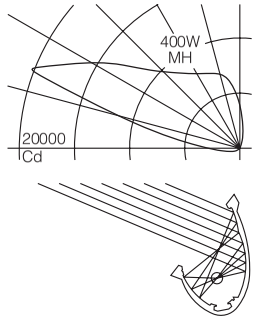
Features

- *Die-cast end plates; thick aluminum sidearms join at articulated black reveals - no exposed fasteners*
- *Multiple reflector/sidearm positions for design flexibility*
- *Hinging wall plate eases mounting - optional pendant stem*
- *Precured silicone gaskets - keep dirt and moisture out*
- *Integral CWA ballast for quiet operation*

C 49.0

Performance

Two parabolic reflector sections drive light across the ceiling from one edge. An elliptical section shields the lamp from normal viewing angles and redirects its light to a parabola. Glare is minimized and asymmetry of the beam is maximized resulting in high beam efficiency and superior surface uniformity.



For complete photometrics, visit www.elliptipar.com

elliptipar

See attached Lighting Fixture Schedule

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FMS

Architect Gensler
Project Portland International Jetport
Date 26 October 2009
Project No. 508667.00
Type FB

Fisher Marantz Stone Partners in Architectural Lighting Design 22 West 19th Street New York, NY 10011

To form a Catalog Number

M [ ] [ ] [ ] [ ] [ ] - V [ ] [ ]
1 2 3 4 5 6 7 8

1 Source

M = Metal halide

2 Style

408 = Large smooth surface, **integral** ballast
409 = Large fluted surface, **integral** ballast
Note: For damp locations, Style 408 is recommended.

3 Lamp

Lamp Code	*Watt-age*	*Lamp Number*	*Volt-ages*
Ceramic Arc Tube Pulse Start Metal Halide (90+ CRI)			
210C	210	CDM210/T9/930/U/E	**U**
315C	315	CDM315/T9/930/U/E	**U**
Ceramic Arc Tube Pulse Start Metal Halide (80+ CRI)*			
150G	150	CDM150/T6/830	**1, 2**
			T, U
250C	250	CMH250/U/830/R	**A, B**
400C	400	CMH400/U/830/R	**A, B**
240C	2x400	(2) CMH400/U/830/R	**A, B**
Quartz Arc Tube Pulse Start Metal Halide (68 CRI)*			
250P	250	MS 250W/H75/T15/PS/740	**A, B**
			U
320P	320	MS 320W/H75/T15/S/PS/740	**A, B**
			U
350P	350	MS 350W/H75/T15/PS/740	**A, B**
			U

For complete lamp and ballast information, see Accessories Section.
* Use only clear metal halide horizontal or universal position lamp with compact envelope. Standard lamp colors are 3000K for Ceramic Arc Tube Pulse Start lamps and 4000K for Quartz Arc Tube Pulse Metal Halide lamps.

C 49.1

4 Mounting

Surface: Mounting plate covers conduit feed or recessed outlet box (by others). Choice of three positions:
1 = Reflector positioned above ballast housing
2 = Reflector positioned in front of ballast housing,side arms sloping downward
3 = Reflector positioned in front of ballast housing, side arms sloping upward

Pendant: Reflector is oriented similar to position **2** (in front of ballast housing, side arms sloping downward). Pendant assemblies include appropriate number of luminaires. Order accessory VPN uplight pendant separately.
X = One-way assembly, **single** uplight
Y = Two-way assembly, **two (2)** uplights back-to-back

5 Finish

Style 409 Fluted
Bright anodized aluminum reflector and door frame with painted end plates, sidearms, ballast housing and visor in choice of
01 = silver, solid visor
P1 = silver, perforated visor
81 = semi-gloss black, solid visor
P8 = semi-gloss black, perforated visor

Style 408 Smooth
Semi-gloss white reflector, door frame, end plates, sidearms and ballast housing with choice of
02 = solid visor finished white
P2 = perforated visor finished white
99 = Custom RAL or computer matched color to be specified, consult sales representative

6 Voltage

Electronic (Metal Halide only)
T = 120V dim* **1** = 120V
U = 208-277V dim* **2** = 277V

Magnetic
A = 120V
B = 277V

*100-50% dimming, compatible controls by others.

7 Option (see Accessories Section for specifications)

V0 = Cutoff visor included, no other options
VP = Natatorium (pool) use (Style 408 painted model only)
VR = Halogen standby lamp with integral relay. 100W maximum (lamp included). Not available for 2x400W metal halide.
VX = For modification not listed, include detailed description. Consult factory prior to specification.
Note: Cutoff visor included unless specified otherwise.

8 Standard

0 = UL, Underwriters Laboratories
J = CSA, Canadian Standards Association

Example

M408 - 250C - 1 - 02 - B - V00

Large smooth surface model for use with 250 watt ceramic arc tube pulse start metal halide lamps. Mounting plate attaches to suitable structure over conduit or recessed outlet box (by others). Reflector positioned above ballast housing. Semi-gloss white. Integral 277V ballast. UL. Solid white cutoff visor included.

elliptipar
114 Boston Post Road, West Haven, Connecticut 06516, USA
Voice 203.931.4455 • Fax 203.931.4464 • **www.elliptipar.com**

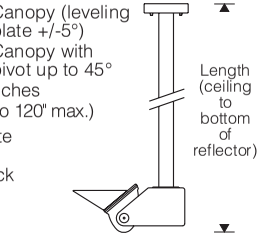
Project: [ ]

Type: [ ]

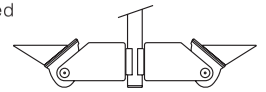
Accessories

Order separately. See Accessories Section for specifications.

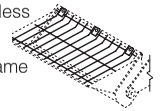
VPN [ ] [ ] [ ] [ ] [ ] [ ] = **Uplight pendant** 1.9" O.D. aluminum stem
0 = UL
J = CSA
0 = No option
P = Natatorium (pool)
F = Surface conduit feed
Q = Natatorium (pool) and surface conduit feed
C = Canopy (leveling plate +/-5°)
S = Canopy with pivot up to 45°
Length in inches (36" min. up to 120" max.)
Length (ceiling to bottom of reflector)
02 = semi-gloss white
07 = silver
08 = semi-gloss black
1 = one-way
2 = two-way



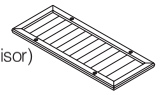
Note: Suitable structure required to support up to 130 lb/60kg. For additional pendant specifications, see **www.elliptipar.com**.



APG [ ] **0000** = **Wire guard**, welded stainless steel wire, nickel plated. Lays into visor with clips to attach to top of door frame
D = 150 - 400W MH
F = 2x400W

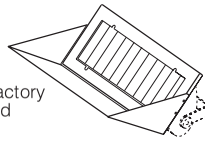


ACF = Stripped glass **color filter**, integral to door frame. (accepts standard cutoff visor)



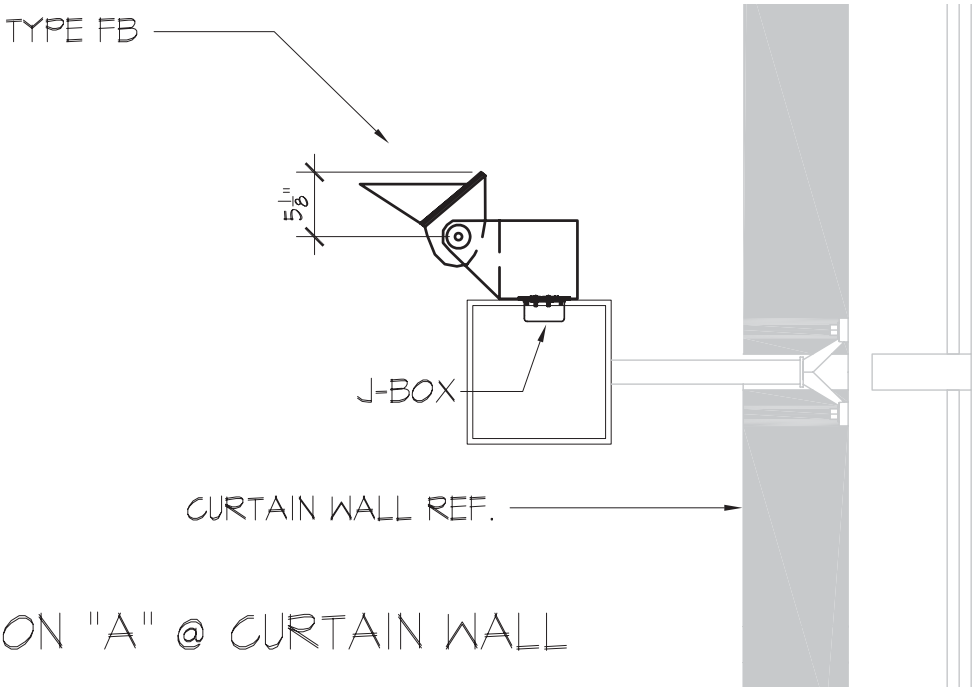
AXF = Interchangeable **color filter** assembly, exchangeable frame with stripped color glass, visor.

Note: **Color filters not suitable for all lamp wattages.** Consult factory for complete specifications and ordering information.



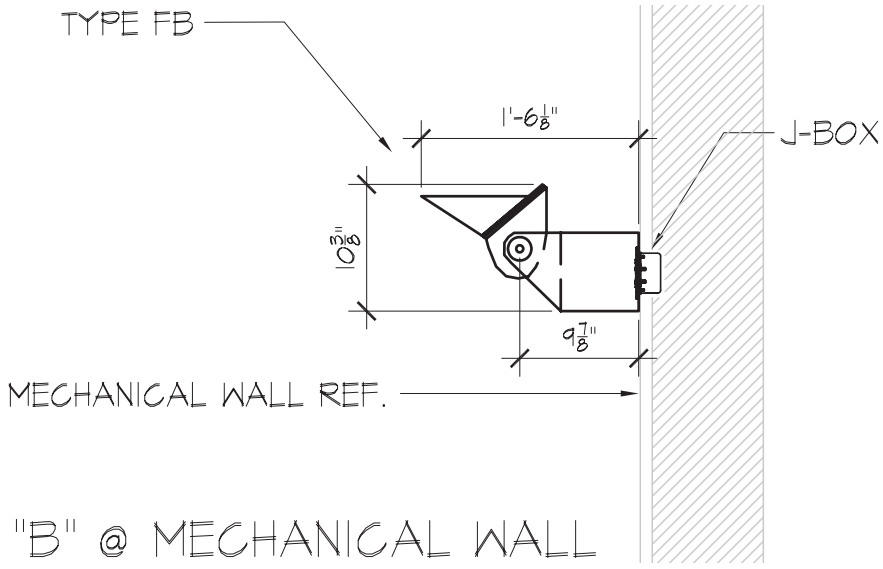
AFK000X [ ] = Ballast **fuse** kit
0 = UL
J = CSA

See attached Lighting Fixture Schedule



CONDITION "A" @ CURTAIN WALL

MOUNTING DETAIL SECTION
Scale: N.T.S



CONDITION "B" @ MECHANICAL WALL

MOUNTING DETAIL SECTION
Scale: N.T.S

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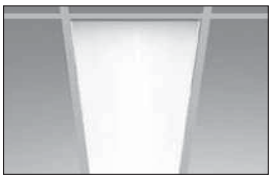
SLOTLIGHT PRO

Fluorescent
One Lamp Cross-section
T5 or T5 HO

6" Recessed, T-bar Ceiling or Perimeter



Applications: SLOTLIGHT PRO is a lighting solution as unobtrusive as it is sophisticated. The streamlined design with its sleek and contemporary image offering "ribbons of light" harmonizes perfectly with the architecture.

online Find it Fast 403

Type: _____ **Quantity:** _____ **Project:** _____

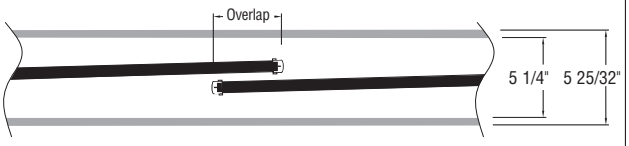
SLR6

FIXTURE	CEILING/ MOUNTING	LAMP	LENGTH	OPTIC	VOLTAGE/ BALLAST	WIRING OPTIONS	OTHER OPTIONS
SLR6 SLOTLIGHT PRO, 6" Recessed	**IN** 9/16" Lay-In, Flush **IW** 15/16" Lay-In, Flush **S** 9/16" Slot-Grid, Flush 9/16" Lay-In, Tegular **SW** 15/16" Lay-In, Tegular **PM_*** Perimeter Mount	**1285** (1) 28W T5 **1545** (1) 54W T5 HO **1355** (1) 35W T5 **1805** (1) 80W T5 HO **3215** (3) 21W T5 **3395** (3) 39W T5 HO **1215-2285** (1) 21W T5 (2) 28W T5 **1395-2545** (1) 39W T5 HO (2) 54W T5 HO **2285-1355** (2) 28W T5 (1) 35W T5 **2545-1805** (2) 54W T5 HO (1) 80W T5 HO **2215-3285** (2) 21W T5 (3) 28W T5 **2395-3545** (2) 39W T5 HO (3) 54W T5 HO **3285-2355** (3) 28W T5 (2) 35W T5 **3545-2805** (3) 54W T5 HO (2) 80W T5 HO **1215-6285** (1) 21W T5 (6) 28W T5 **1395-6545** (1) 39W T5 HO (6) 54W T5 HO	**04** 4' **05** 5' **08** 8' **10** 10' **12** 12' **16** 16' **20** 20' **24** 24'	**See page 34A for available optics.**	**U** Universal 120/277V **DA_*** Dimming, Analog (0-10V) **DD_*** Dimming, DALI **DE_*** Dimming, Lutron ECO-10™ **DH_*** Dimming, Lutron HiLume® **DSC_*** Dimming, Lutron EcoSystem™, Control Fixture **DSN_*** Dimming, Lutron EcoSystem, Non-control Fixture **STDM_*** Dimming, Step	**MS1** Master-Slave Switching, Single Circuit **AB2** A/B Switching, 2 Circuit **AB3** A/B/C Switching, 3 Circuit	**HP** Higher Performance Option **WF** Whip Flex 3/8" X 6' 14 AWG **WN_*** Whip Flex 3/8" X 6' 14 AWG (NYC) **EM1_*** Standby Battery Pack/ 1 Lamp **CP** Chicago Plenum **F** Fusing **QD** Power Feed Quick Disconnect

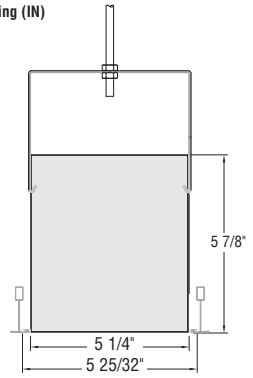
* Specify **IN**, **IW** or **S** for ceiling type

**** Specify "1" for 120V or "2" for 277V. Some lamp types may not be available.***
EM not available for (03), (04) or (05) lengths. Must be 8ft minimum length.
EM not available for 347V.
EM for 35W T5 listed as dry location only. Offered as MOD with customer approval.
EM not available for 80W T5 HO lamp.
DA not available for 39W T5 HO (120V/277V) or 80W T5 HO (120V) lamps.
DA for 80W T5 HO (277V) offered as MOD with customer approval.
DD not available for 21W T5, 39W T5 HO and 80W T5 HO lamps (120V/277V).
DE not available for 35W T5 or 80W T5 HO lamps (120V/277V).
DH not available for 21W T5, 28W T5, 35W T5 and 80W T5 HO lamps (120V/277V).
DSC/DSN not available with 80W T5 HO lamps (120V/277V).
STDM not available for 347V.
STDM not available with single lamp 21W T5, 28W T5 (120V/277V).
STDM not available with 39W T5 HO, 54W T5 HO, 35W T5 and 80W T5 HO lamps (120V/277V).

Bottom View (IN)



End View - T-bar Ceiling (IN)



c UL us LISTED

Suitable for Damp Locations
Approved for thru wiring
Above ceiling access not required

IBEW Union Made

Lead Time?Double-click on
http://www.zumtobel.us/PDBXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXX
A = ZOOM! Quick Ship - ships in 2 weeks
B = ships in 4 weeks **C =** ships in 8 weeks

COMPANION LUMINAIRE OPTIONS	FIF #
6" Recessed, T-bar Ceiling or Perimeter, MR-16	404
6" Recessed, T-bar Ceiling, Wallwasher	405
6" Recessed, Flanged Sheetrock Ceiling or Wall	395
6" Recessed, Flangeless Sheetrock Ceiling, Perimeter or Wall	399

Descriptions on next page

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3300 Route 9W
Highland, NY 12528-2630

TEL (845) 691-6262
(800) 932-0633
FAX (845) 691-6289

www.zumtobel.us

9/24/08

SL-34

ZUMTOBEL

Issued for Permit

Descriptions

1. Housing - Extruded aluminum housings in various standard lengths. Finish is powder coated high-reflectance white. Post painted. Specially designed joiner system allows uniform appearance with no light leaks. Aluminum endcaps. Feed from top or side.

2. Mounting - T-bar: Mounting brackets with 1/4-20 threaded rod (by others) and snap-on yoke (by Zumtobel) provided approximately every 4 feet. Fixture does not need to be disassembled for installation. Bend out tabs rest on ceiling tees for stability. Fixtures supported by yokes, not T-bars. **Perimeter Mount:** Mount perimeter fixture mounting rail (by Zumtobel) to wall making sure it is level. Hang fixture by yokes (by Zumtobel). Fixture supported by yokes, not ceiling.

3. Lamping and Length - One T5 or T5 HO in cross-section. Staggered lamps (only applicable for 2 or more lamps). Fixture lengths and lamping are as noted above. Consult factory for lengths other than those listed above.

4. Optic - Choose from Frosted Acrylic Lens or Micro-Pyramidal Lens, Matte or Specular Bivergence® Louver, White Louver. Each optic (except MPO) is available as either flush or regressed. Regressed optics offer a choice of corrugated side or smooth side. All flush louver optics are available with option of Overlay. See page 34A for list of available optics.

Choose Higher Performance Option (HP) for any available optic for higher efficiency.

5. Voltage/Ballast - Electronic, universal voltage (120/277V) or 347V. Prewired for thru wiring. Ballasts are mounted in geartray offering entry from below.

6. Dimming - In control fixtures with Lutron EcoSystem dimming, control wires are brought to an interface. Consult factory for location of control wire feed. Consult factory for specific dimming requirements other than those listed above.

7. Wiring Options - Standard wiring is single circuit with 1-lamp ballast. This will be supplied if no wiring option is chosen. Other options available are Single Circuit Master-Slave switching (MS1), 2 Circuit A/B Switching with separate neutral (AB2) and 3 circuit A/B/C switching with common neutral. See page 34E for more information.

8. Standby Battery Pack - Integral standby battery pack with integral test switch.

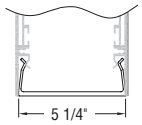
9. Power Feed Quick Disconnect - Available as an option for quick connection to power supply.

10. Weight - 5 lbs per linear foot

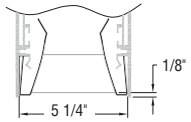
Optics

OLP	Frosted Acrylic Lens, Flush
MPO	Micro-Pyramidal Lens
C	Matte Bivergence® Louver, Flush
DX	Specular Bivergence Louver, Flush
WH	White Louver, Flush
OLRC	Regressed Frosted Acrylic Lens, Corrugated Side
OLRS	Regressed Frosted Acrylic Lens, Smooth Side
CRC	Regressed Matte Parabolic Louver, Corrugated Side
CRS	Regressed Matte Bivergence Louver, Smooth Side
DXRC	Regressed Specular Parabolic Louver, Corrugated Side
DXRS	Regressed Specular Bivergence Louver, Smooth Side
WHRC	Regressed White Louver, Corrugated Side
WHRS	Regressed White Louver, Smooth Side
CO	Matte Bivergence Louver, Flush, Opal Overlay
DXO	Specular Bivergence Louver, Flush, Opal Overlay
WHO	White Louver, Flush, Opal Overlay

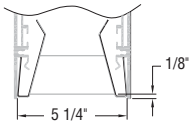
Optic	Side	Finish
Frosted Acrylic Lens	Smooth	High Reflectance White
Frosted Acrylic Lens	Corrugated	High Reflectance White
Matte Bivergence Louver	Smooth	Matte
Matte Bivergence Louver	Corrugated	Matte
Specular Bivergence Louver	Smooth	Specular
Specular Bivergence Louver	Corrugated	Matte
White Louver	Smooth	High Reflectance White
White Louver	Corrugated	High Reflectance White



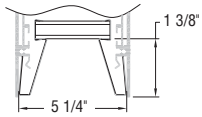
Frosted Acrylic Lens **OLP**
Micro-Pyramidal Lens **MPO**



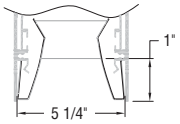
Bivergence Louver
Matte **C**
Specular **DX**



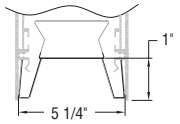
White Louver **WH**



Regressed Frosted Acrylic Lens
Corrugated side **OLRC**
Smooth side **OLRS**



Regressed Bivergence Louver
Matte
(Corrugated/Smooth) **CRC/CRS**
Specular
(Corrugated/Smooth) **DXRC/DXRS**



Regressed White Louver
Corrugated side **WHRC**
Smooth side **WHRS**

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9/24/08

SL-34A

ZUMTOBEL

2', 3' and 4' diameter

skydome™

FOCAL POINT®

features

2', 3' and 4' diameter recessed direct fluorescent with frosted acrylic lens.

Lens options include concave, convex or flat.

Frosted acrylic lens is textured on one side to provide smooth distribution and eliminate lamp image.

Universal ceiling trim rings are suitable for both grid & drywall applications.

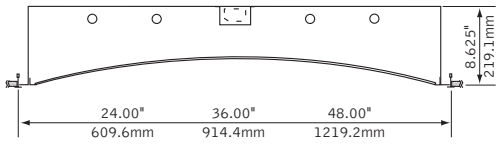
Skydome™ is an excellent choice for open public spaces such as airport concourses, large lobbies, reception areas and meeting rooms.

companion luminaire

surface/pendant mount

5' and 6' recessed

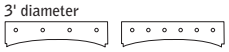
dimensional data



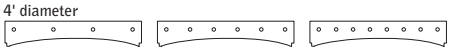
lamping options

2' diameter

3' diameter

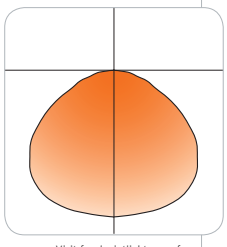


4' diameter



performance

4' Diameter, 6–Lamp T8
61% Efficiency
3646 cd @ 0°



Visit focalpointlights.com for complete photometric data.

september 2008

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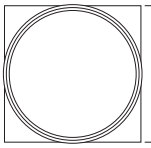
Architect **Gensler**
Project **Portland International Jetport**

Date **26 October 2009**
Project No. **508667.00**

Type **FD**

Fisher Marantz Stone Partners in Architectural Lighting Design 22 West 19th Street New York, NY 10011

mounting information



square housing installs easily into grid ceiling.

fixture must be installed prior to drywall ceiling.

specifications

construction

Two-piece 20 Ga. steel reflector and housing.
Spun steel trim ring and doorframe.
Bottom access 20 Ga. steel ballast compartment.

2' unit weight:	37 lbs.
3' unit weight:	53 lbs.
4' unit weight:	78 lbs.

optic

One-piece 20 Ga. steel reflector finished in High Reflectance White powder coat.
.125" white acrylic is held by one-piece spun steel doorframe and secured to the housing by torsion springs.
Lens available in concave, convex or flat.

electrical

Electronic ballasts are thermally protected and have a Class "P" rating.
Optional dimming ballasts available.
Consult factory for dimming specifications and availability.
UL and cUL listed.

finish

Polyester powder coat applied over a 5-stage pre-treatment.

ordering

luminaire series		FSD
Skydome	FSD	
nominal size		
2' Diameter	22	
3' Diameter	33	
4' Diameter	44	
distribution		D
Direct Symmetrical	D	
lamp quantity		
Two Lamp (2' Diameter Only)	2	
Four Lamp (Not recommended for 4' luminaires with Concave Lens due to lamp image)	4	
Six Lamp	6	
Eight Lamp (4' Diameter Only)	8	
lamp type		
40 Watt Biax (2' Diameter Only)	BX40	
50 Watt Biax (2' Diameter Only)	BX50	
55 Watt Biax (2' Diameter Only)	BX55	
T8	T8	
T5	T5	
T5HO	T5HO	
ballast		
Electronic Instant Start <20% THD	E	
Electronic Program Start <10% THD	S	
Electronic Dimming Ballast*	D	
voltage		
120 Volt	120	
277 Volt	277	
347 Volt	347	
mounting		U
Universal	U	
shielding		
Concave Lens	CR	
Flat Lens	FL	
Convex Lens	CX	
factory options		
Chicago Plenum	CP	
Emergency Battery Pack*	EM	
HLR/GLR Fuse	FU	
Flex Whip*	FW	
Include 3000K Lamp	L830	
Include 3500K Lamp	L835	
Include 4100K Lamp	L841	
Separate Circuit* (may cause loss of uniformity)	SC	
Lutron™ Sensor Feed* (EcoSystem ballast required)	SF	
finish		HW
High Reflectance White	HW	

* for more information see Reference section.

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FMS

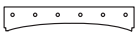
Architect **Gensler**
Project **Portland International Jetport**

Date **26 October 2009**
Project No. **508667.00**

Type **FD**

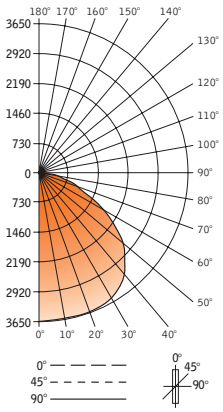
Fisher Marantz Stone Partners in Architectural Lighting Design 22 West 19th Street New York, NY 10011

skydome™



Filename: FSD446T8CR.IES
Catalog #: FSD-44-D-6-T8-E-120-U-CR-WH
Efficiency: 61%
Test #: 10198.0

CANDLEPOWER DISTRIBUTION



Vertical Angle	Horizontal Angle 0°	22.5°	45°	67.5°	90°	Zonal Lumens
0°	3646	3646	3646	3646	3646	
5°	3644	3644	3636	3631	3636	347
15°	3548	3541	3538	3534	3538	1003
25°	3236	3236	3240	3226	3243	1448
35°	2783	2777	2784	2790	2796	1750
45°	2451	2449	2448	2453	2463	1899
55°	1939	1934	1933	1937	1943	1737
65°	1321	1317	1317	1319	1326	1309
75°	714	717	714	717	721	758
85°	226	229	234	240	243	256
90°	0	0	0	0	0	
95°	0	0	0	0	0	0
105°	0	0	0	0	0	0
115°	0	0	0	0	0	0
125°	0	0	0	0	0	0
135°	0	0	0	0	0	0
145°	0	0	0	0	0	0
155°	0	0	0	0	0	0
165°	0	0	0	0	0	0
175°	0	0	0	0	0	0
180°	0	0	0	0	0	

Spacing 1.2
Criterion: 1.2

LUMEN SUMMARY

	Zone	Lumens	% Lamp	% Fixt
	0°-30°	2848	16.4	27.0
	0°-40°	4598	26.4	43.6
	0°-60°	8233	47.3	78.0
	0°-90°	10556	60.7	100.0
Total Luminaire	0°-180°	10556	61	100.0

LUMINANCE DATA (CD/M²)

Vertical Angle	0°	45°	90°
45°	3567	3563	3584
55°	3479	3468	3486
65°	3217	3207	3229
75°	2839	2839	2867
85°	2668	2763	2869

CO-EFFICIENTS OF UTILIZATION

Floor		80				70			20		50		30		10		00
Ceiling									50								
Wall	70	50	30	10	70	50	10		50	10	50	10	50	10	50	10	00
RCR 0	72	72	72	72	71	71	71		67	67	65	65	62	62	61		
1	66	64	61	59	65	62	58		60	56	57	54	55	53	51		
2	61	56	52	48	59	55	48		52	47	51	46	49	45	43		
3	56	49	45	41	54	48	40		47	40	45	39	43	38	37		
4	51	44	39	35	49	43	34		41	34	40	33	39	33	32		
5	46	39	33	29	45	38	29		37	29	35	28	34	28	27		
6	43	35	29	25	41	34	25		33	25	32	25	31	24	23		
7	39	31	26	22	38	31	22		30	22	29	22	28	21	20		
8	36	28	23	19	35	27	19		27	19	26	19	25	19	17		
9	33	25	20	16	32	25	16		24	16	23	16	22	16	15		
10	31	23	18	14	30	22	14		22	14	21	14	20	14	13		

Numbers indicate percentage values of reflectivity.

Go to www.focalpointlights.com for additional photometric data.

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FMS

Architect **Gensler**
Project **Portland International Jetport**

Date **26 October 2009**
Project No. **508667.00**

Type **FD**

Fisher Marantz Stone Partners in Architectural Lighting Design 22 West 19th Street New York, NY 10011

2', 3' and 4' diameter

skydome™

FOCAL POINT®

features

2', 3' and 4' diameter recessed direct fluorescent with frosted acrylic lens.

Lens options include concave, convex or flat.

Frosted acrylic lens is textured on one side to provide smooth distribution and eliminate lamp image.

Universal ceiling trim rings are suitable for both grid & drywall applications.

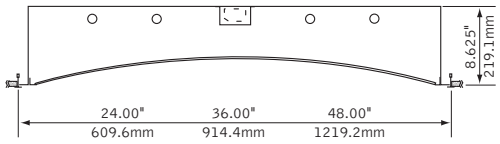
Skydome™ is an excellent choice for open public spaces such as airport concourses, large lobbies, reception areas and meeting rooms.

companion luminaire

surface/pendant mount

5' and 6' recessed

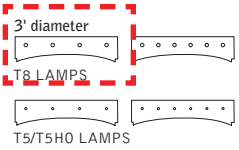
dimensional data



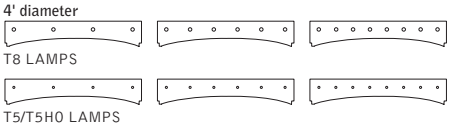
lamping options

2' diameter

3' diameter

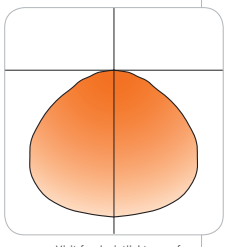


4' diameter



performance

4' Diameter, 6–Lamp T8
61% Efficiency
3646 cd @ 0°



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september 2008

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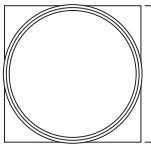
Project **Portland International Jetport**

Date **26 October 2009**
Project No. **508667.00**

Type **FD-1**

Fisher Marantz Stone Partners in Architectural Lighting Design 22 West 19th Street New York, NY 10011

mounting information



square housing installs easily into grid ceiling.

fixture must be installed prior to drywall ceiling.

specifications

construction

Two-piece 20 Ga. steel reflector and housing.
Spun steel trim ring and doorframe.
Bottom access 20 Ga. steel ballast compartment.

2' unit weight:	37 lbs.
3' unit weight:	53 lbs.
4' unit weight:	78 lbs.

optic

One-piece 20 Ga. steel reflector finished in High Reflectance White powder coat.
.125" white acrylic is held by one-piece spun steel doorframe and secured to the housing by torsion springs.
Lens available in concave, convex or flat.

electrical

Electronic ballasts are thermally protected and have a Class "P" rating.
Optional dimming ballasts available.
Consult factory for dimming specifications and availability.
UL and cUL listed.

finish

Polyester powder coat applied over a 5-stage pre-treatment.

ordering

luminaire series		FSD
Skydome	FSD	
nominal size		
2' Diameter	22	
3' Diameter	33	
4' Diameter	44	
distribution		D
Direct Symmetrical	D	
lamp quantity		
Two Lamp (2' Diameter Only)	2	
Four Lamp (Not recommended for 4' luminaires with Concave Lens due to lamp image)	4	
Six Lamp	6	
Eight Lamp (4' Diameter Only)	8	
lamp type		
40 Watt Biax (2' Diameter Only)	BX40	
50 Watt Biax (2' Diameter Only)	BX50	
55 Watt Biax (2' Diameter Only)	BX55	
T8	T8	
T5	T5	
T5HO	T5HO	
ballast		
Electronic Instant Start <20% THD	E	
Electronic Program Start <10% THD	S	
Electronic Dimming Ballast*	D	
voltage		
120 Volt	120	
277 Volt	277	
347 Volt	347	
mounting		U
Universal	U	
shielding		
Concave Lens	CR	
Flat Lens	FL	
Convex Lens	CX	
factory options		
Chicago Plenum	CP	
Emergency Battery Pack*	EM	
HLR/GLR Fuse	FU	
Flex Whip*	FW	
Include 3000K Lamp	L830	
Include 3500K Lamp	L835	
Include 4100K Lamp	L841	
Separate Circuit* (may cause loss of uniformity)	SC	
Lutron™ Sensor Feed* (EcoSystem ballast required)	SF	
finish		HW
High Reflectance White	HW	

* for more information see Reference section.

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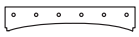
Architect **Gensler**
Project **Portland International Jetport**

Date **26 October 2009**
Project No. **508667.00**

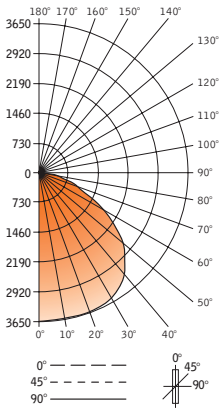
Type **FD-1**
2 of 3

skydome™



Filename: FSD446T8CR.IES
Catalog #: FSD-44-D-6-T8-E-120-U-CR-WH
Efficiency: 61%
Test #: 10198.0

CANDLEPOWER DISTRIBUTION



Vertical Angle	Horizontal Angle 0°	22.5°	45°	67.5°	90°	Zonal Lumens
0°	3646	3646	3646	3646	3646	
5°	3644	3644	3636	3631	3636	347
15°	3548	3541	3538	3534	3538	1003
25°	3236	3236	3240	3226	3243	1448
35°	2783	2777	2784	2790	2796	1750
45°	2451	2449	2448	2453	2463	1899
55°	1939	1934	1933	1937	1943	1737
65°	1321	1317	1317	1319	1326	1309
75°	714	717	714	717	721	758
85°	226	229	234	240	243	256
90°	0	0	0	0	0	
95°	0	0	0	0	0	0
105°	0	0	0	0	0	0
115°	0	0	0	0	0	0
125°	0	0	0	0	0	0
135°	0	0	0	0	0	0
145°	0	0	0	0	0	0
155°	0	0	0	0	0	0
165°	0	0	0	0	0	0
175°	0	0	0	0	0	0
180°	0	0	0	0	0	

Spacing 1.2
Criterion: 1.2

LUMEN SUMMARY

	Zone	Lumens	% Lamp	% Fixt
	0°-30°	2848	16.4	27.0
	0°-40°	4598	26.4	43.6
	0°-60°	8233	47.3	78.0
	0°-90°	10556	60.7	100.0
Total Luminaire	0°-180°	10556	61	100.0

LUMINANCE DATA (CD/M²)

Vertical Angle	0°	45°	90°
45°	3567	3563	3584
55°	3479	3468	3486
65°	3217	3207	3229
75°	2839	2839	2867
85°	2668	2763	2869

CO-EFFICIENTS OF UTILIZATION

Floor	80				70			20		10		00
Ceiling	70	50	30	10	70	50	10	50	10	50	10	00
Wall												
RCR 0	72	72	72	72	71	71	71	67	67	65	65	61
1	66	64	61	59	65	62	58	60	56	57	54	51
2	61	56	52	48	59	55	48	52	47	51	46	43
3	56	49	45	41	54	48	40	47	40	45	39	37
4	51	44	39	35	49	43	34	41	34	40	33	32
5	46	39	33	29	45	38	29	37	29	35	28	27
6	43	35	29	25	41	34	25	33	25	32	25	23
7	39	31	26	22	38	31	22	30	22	29	22	20
8	36	28	23	19	35	27	19	27	19	26	19	17
9	33	25	20	16	32	25	16	24	16	23	16	15
10	31	23	18	14	30	22	14	22	14	21	14	13

Numbers indicate percentage values of reflectivity.

Go to www.focalpointlights.com for additional photometric data.

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FMS

Architect **Gensler**
Project **Portland International Jetport**

Date **26 October 2009**
Project No. **508667.00**

Type **FD-1**

Fisher Marantz Stone Partners in Architectural Lighting Design 22 West 19th Street New York, NY 10011

2', 3' and 4' diameter

skydome™

FOCAL POINT®

features

2', 3' and 4' diameter recessed direct fluorescent with frosted acrylic lens.

Lens options include concave, convex or flat.

Frosted acrylic lens is textured on one side to provide smooth distribution and eliminate lamp image.

Universal ceiling trim rings are suitable for both grid & drywall applications.

Skydome™ is an excellent choice for open public spaces such as airport concourses, large lobbies, reception areas and meeting rooms.

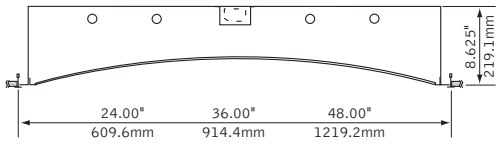
companion luminaire

surface/pendant mount

5' and 6' recessed

september 2008

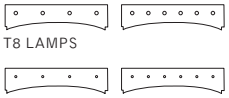
dimensional data



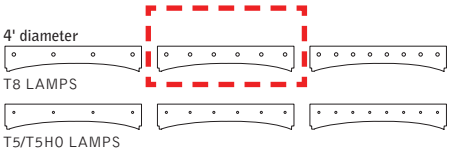
lamping options

2' diameter

3' diameter

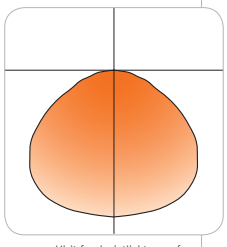


4' diameter



performance

4' Diameter, 6–Lamp T8
61% Efficiency
3646 cd @ 0°



Visit focalpointlights.com for complete photometric data.

Issued for Permit

FMS

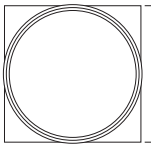
Architect **Gensler**
Project **Portland International Jetport**

Date **26 October 2009**
Project No. **508667.00**

Type **FD-2**
1 of 3

Fisher Marantz Stone Partners in Architectural Lighting Design 22 West 19th Street New York, NY 10011

mounting information



square housing installs easily into grid ceiling.

fixture must be installed prior to drywall ceiling.

specifications

construction

Two-piece 20 Ga. steel reflector and housing.
Spun steel trim ring and doorframe.
Bottom access 20 Ga. steel ballast compartment.

2' unit weight:	37 lbs.
3' unit weight:	53 lbs.
4' unit weight:	78 lbs.

optic

One-piece 20 Ga. steel reflector finished in High Reflectance White powder coat.
.125" white acrylic is held by one-piece spun steel doorframe and secured to the housing by torsion springs.
Lens available in concave, convex or flat.

electrical

Electronic ballasts are thermally protected and have a Class "P" rating.
Optional dimming ballasts available.
Consult factory for dimming specifications and availability.
UL and cUL listed.

finish

Polyester powder coat applied over a 5-stage pre-treatment.

ordering

luminaire series		FSD
Skydome	FSD	
nominal size		
2' Diameter	22	
3' Diameter	33	
4' Diameter	44	
distribution		D
Direct Symmetrical	D	
lamp quantity		
Two Lamp (2' Diameter Only)	2	
Four Lamp (Not recommended for 4' luminaires with Concave Lens due to lamp image)	4	
Six Lamp	6	
Eight Lamp (4' Diameter Only)	8	
lamp type		
40 Watt Biax (2' Diameter Only)	BX40	
50 Watt Biax (2' Diameter Only)	BX50	
55 Watt Biax (2' Diameter Only)	BX55	
T8	T8	
T5	T5	
T5HO	T5HO	
ballast		
Electronic Instant Start <20% THD	E	
Electronic Program Start <10% THD	S	
Electronic Dimming Ballast*	D	
voltage		
120 Volt	120	
277 Volt	277	
347 Volt	347	
mounting		U
Universal	U	
shielding		
Concave Lens	CR	
Flat Lens	FL	
Convex Lens	CX	
factory options		
Chicago Plenum	CP	
Emergency Battery Pack*	EM	
HLR/GLR Fuse	FU	
Flex Whip*	FW	
Include 3000K Lamp	L830	
Include 3500K Lamp	L835	
Include 4100K Lamp	L841	
Separate Circuit* (may cause loss of uniformity)	SC	
Lutron™ Sensor Feed* (EcoSystem ballast required)	SF	
finish		HW
High Reflectance White	HW	

* for more information see Reference section.

Focal Point LLC | 4141 S. Pulaski Rd, Chicago, IL 60632 | T: 773.247.9494 | F: 773.247.8484 | info@focalpointlights.com | www.focalpointlights.com.

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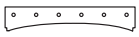
FMS

Architect **Gensler**
Project **Portland International Jetport**

Date **26 October 2009**
Project No. **508667.00**

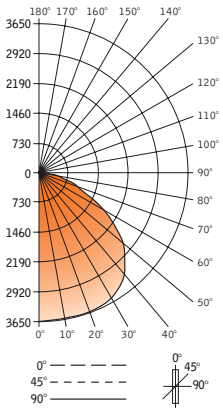
Type **FD-2**
2 of 3

skydome™



Filename: FSD446T8CR.IES
Catalog #: FSD-44-D-6-T8-E-120-U-CR-WH
Efficiency: 61%
Test #: 10198.0

CANDLEPOWER DISTRIBUTION



Vertical Angle	Horizontal Angle 0°	22.5°	45°	67.5°	90°	Zonal Lumens
0°	3646	3646	3646	3646	3646	
5°	3644	3644	3636	3631	3636	347
15°	3548	3541	3538	3534	3538	1003
25°	3236	3236	3240	3226	3243	1448
35°	2783	2777	2784	2790	2796	1750
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55°	1939	1934	1933	1937	1943	1737
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75°	714	717	714	717	721	758
85°	226	229	234	240	243	256
90°	0	0	0	0	0	
95°	0	0	0	0	0	0
105°	0	0	0	0	0	0
115°	0	0	0	0	0	0
125°	0	0	0	0	0	0
135°	0	0	0	0	0	0
145°	0	0	0	0	0	0
155°	0	0	0	0	0	0
165°	0	0	0	0	0	0
175°	0	0	0	0	0	0
180°	0	0	0	0	0	

Spacing 1.2
Criterion: 1.2

LUMEN SUMMARY

	Zone	Lumens	% Lamp	% Fixt
	0°-30°	2848	16.4	27.0
	0°-40°	4598	26.4	43.6
	0°-60°	8233	47.3	78.0
	0°-90°	10556	60.7	100.0
Total Luminaire	0°-180°	10556	61	100.0

LUMINANCE DATA (CD/M²)

Vertical Angle	0°	45°	90°
45°	3567	3563	3584
55°	3479	3468	3486
65°	3217	3207	3229
75°	2839	2839	2867
85°	2668	2763	2869

CO-EFFICIENTS OF UTILIZATION

Floor	80				70			20		10		00
Ceiling	70	50	30	10	70	50	10	50	10	50	10	00
Wall												
RCR 0	72	72	72	72	71	71	71	67	67	65	65	61
1	66	64	61	59	65	62	58	60	56	57	54	51
2	61	56	52	48	59	55	48	52	47	51	46	43
3	56	49	45	41	54	48	40	47	40	45	39	37
4	51	44	39	35	49	43	34	41	34	40	33	32
5	46	39	33	29	45	38	29	37	29	35	28	27
6	43	35	29	25	41	34	25	33	25	32	25	23
7	39	31	26	22	38	31	22	30	22	29	22	20
8	36	28	23	19	35	27	19	27	19	26	19	17
9	33	25	20	16	32	25	16	24	16	23	16	15
10	31	23	18	14	30	22	14	22	14	21	14	13

Numbers indicate percentage values of reflectivity.

Go to www.focalpointlights.com for additional photometric data.

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FMS

Architect **Gensler**
Project **Portland International Jetport**

Date **26 October 2009**
Project No. **508667.00**

Type **FD-2**

Fisher Marantz Stone Partners in Architectural Lighting Design 22 West 19th Street New York, NY 10011

See attached Lighting Fixture Schedule

DELETED

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Spec Sheet

COMPACT FLUORESCENT
1-370

TRIPLES-H 126/6

recessed compact fluorescent downlight/wallwasher

FEATURES

Triples-H 126/6 is an efficient 6" aperture low brightness downlight, for use with one 26-watt, 4-pin, triple tube compact fluorescent lamp by GE, Sylvania or Philips. Triples-H 126/6 provides shielding angles of 40° parallel to and 40° perpendicular to the lamps. Recess depth is only 6 ½".

One housing allows interchangeable use of downlight and wallwash reflectors, permitting housings to be installed first and reflectors to be installed or changed at any time.

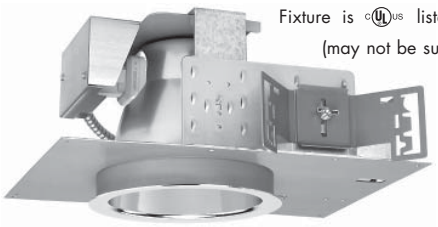
Triples-H 126/6 uses one 26-watt, 4-pin, triple tube lamp providing 1800 lumens (more than a 100-watt incandescent), a 10,000-hour life, a color rendering index (CRI) of 82, and color temperatures as warm as 2700°K (nearly duplicating the color qualities of incandescent).

Reflectors are available in clear, natural aluminum in three finishes: **EvenTone**, our standard clear finish, partially diffuse, anti-iridescent and gently luminous in appearance; **OptiTone**, specular and anti-iridescent, with minimum brightness and maximum efficiency; and **EasyTone**, diffuse and luminous. Additionally, reflectors are available in champagne gold, wheat, pewter, and bronze. Wallwash (120°) and double wallwash (2x120°) reflectors are also available.

Triples-H 126/6 includes a pair of mounting bars (¾" x 27" C channel). Specialty bars for wood joist and T-bar installations are available as accessories.

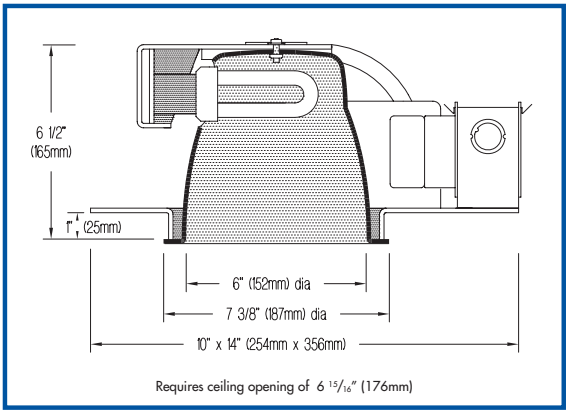
APPLICATIONS

Fixture is recommended for downlighting or wallwashing in offices, corridors, shops, banks, schools, hospitals and airports, as well as lobbies and public areas. The shallow recess depth allows mounting in constricted plenum situations.



Fixture is c UL us listed for Damp Location (may not be suitable for some outdoor environments). Fixture is prewired with high power factor Class P electronic ballast, suitable for use in a fire rated ceiling and approved for eight #12 wire 75°C branch circuit pull-through wiring. Removal of the reflector allows access to the ballast and junction box.

▶ We recommend the use of Sylvania Dulux® T/E (non-amalgam) lamps to virtually eliminate the possibility of reduced light output sometimes caused by a return air plenum or a nearby elevator, exterior door or air conditioning diffuser.



Requires ceiling opening of 6 15/16" (176mm)

PRODUCT CODE

For complete product code, list basic unit and select one item from each following box.

Basic Unit	TRPH 126/6

Reflector Type	
Downlight	no suffix
Wallwash	WW
Double Wallwash	DWW

Voltage			
120 volt service	120	277 volt service	277

Reflector and Flange Color	*Overlap*	*Flush*
EvenTone Clear	VOL	VFL
OptiTone Clear	COL	CFL
EasyTone Clear	ECOL	ECFL
Champagne Gold	GOL	GFL
Wheat	WHOL	WHFL
Pewter	POL	PFL
Bronze	ZOL	ZFL

Other reflector finishes are available on special order.

Standard reflector flange continues reflector finish. White painted flanges and custom painted flanges are available on special order. Add WF (white flange) or CCF (custom color flange).

OPTIONS

Specify by adding to the basic unit.

Dimmable 3-wire ballast; not for outdoor application ..... – DM

Emergency battery pack operates one lamp in event of power outage. Fixture footprint increases to 10 x 16 ¾" (254 x 425mm). Additional 1 ¼" (32mm) is required to remove EM pack through aperture. Not for outdoor application ..... – EM

⅛" (3mm) thick **clear acrylic shield**, spring-mounted within reflector ..... – PS

▶ For combinations of the Options above, contact factory or Edison Price Lighting representative.

▶ A modified fixture suitable for 2" maximum ceiling thickness is available on special order. Contact factory.

▶ A modified fixture suitable for 347-volt service is available on special order. Contact factory.

▶ An install-from-below version of this fixture, suitable for installation outside North America, is also available. Contact factory.

▶ Decorative reflector rings are available on special order. Contact factory.

EDISON PRICE LIGHTING
41-50 22ND STREET, LIC NY 11101 TEL 718.685.0700 FAX 718.786.8530 www.epl.com

11-07

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Architect **Gensler**
Project **Portland International Jetport**

Date **26 October 2009**
Project No. **508667.00**

Type **FF**

TRIPLES-H 126/6

EDISON PRICE LIGHTING

PHOTOMETRIC REPORT

LTL *Luminaire Testing Laboratory Report No. 05265. Original test report furnished upon request.*

Luminaire ..... recessed compact fluorescent downlight with spun aluminum reflector
Lamp ..... Philips 26-watt triple-tube compact fluorescent, 4-pin, GX24q-3 base, 1800 lumens
Efficiency 59.4%
Spacing Criteria.... 0°- 1.3, 90°-1.5, 180°-1.5
Axis orientation.... 0° plane is parallel to lamps, opposite sockets

BALLAST INFORMATION

Voltage	*120*	*277*
Input Watts	28	28
Line Current (A)	.25	.11
Power Factor (%)	>98	>98
THD (%)	<10	<10
Min. Starting Temp* (°F)	0	0

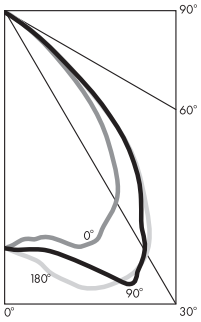
**Consult lamp manufacturers for specific temperatures.*

ZONAL LUMEN SUMMARY

Zone	*Lumens*	*% Lamp*	*% Fixture*
0 - 30°	509	28.3	47.6
0 - 40°	822	45.7	76.9
0 - 60°	1069	59.4	100.0
0 - 90°	1069	59.4	100.0
90 -180°	0	0.0	0.0
0 -180°	1069	59.4	100.0

CANDLEPOWER DISTRIBUTION *(Candela)*

Vertical Angle	*Horizontal Angle*				
	0.0	*45.0*	*90.0*	*135.0*	*180.0*
0	531	531	531	531	531
5	516	528	539	552	552
15	542	567	577	629	639
25	530	599	677	661	654
35	424	462	531	520	557
45	241	281	334	316	329
55	5	6	8	7	8
65	0	0	0	0	0
75	0	0	0	0	0
85	0	0	0	0	0
90	0	0	0	0	0



LUMINANCE DATA *(Candela/m²)*

Vertical Angle	*Average 0° Longitude*	*Average 90° Longitude*	*Average 180° Longitude*
45	18683	21784	25895
55	478	573	765
65	0	0	0
75	0	0	0
85	0	0	0

To convert cd/m² to footlamberts, multiply by 0.2919.

COEFFICIENTS OF UTILIZATION – ZONAL CAVITY METHOD

Effective Floor Cavity Reflectance 20%

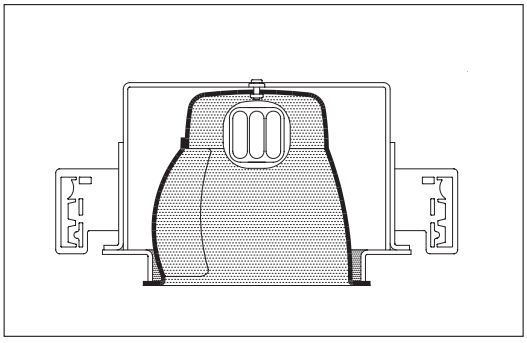
Ceiling Reflectance (%)	*80*				*70*				*50*			*30*			*10*			*0*
Wall Reflectance (%)	*70*	*50*	*30*	*10*	*70*	*50*	*30*	*10*	*50*	*30*	*10*	*50*	*30*	*10*	*50*	*30*	*10*	*0*
Room Cavity Ratio																		
0	71	71	71	71	69	69	69	69	66	66	66	63	63	63	61	61	61	59
1	67	65	64	62	66	64	63	61	62	61	60	60	59	58	57	57	56	55
2	64	61	58	56	62	59	57	55	58	56	54	56	54	53	54	53	52	51
3	60	56	53	50	59	55	52	50	53	51	49	52	50	48	51	49	47	46
4	56	51	48	45	55	51	47	45	49	46	44	48	46	44	47	45	43	42
5	53	47	43	40	52	47	43	40	46	42	40	44	42	40	44	41	39	38
6	50	44	40	37	49	43	39	37	42	39	36	41	38	36	41	38	36	35
7	46	40	36	33	45	40	36	33	39	35	33	38	35	33	37	34	32	31
8	43	36	32	29	42	36	32	29	35	32	29	35	31	29	34	31	29	28
9	40	33	29	26	39	33	29	26	32	28	26	31	28	26	31	28	26	25
10	37	30	26	23	36	30	26	23	29	25	23	29	25	23	28	25	23	22

TRIPLES-H 126/6 WW

WALLWASH INFORMATION

Distance From Ceiling (Feet)	*2'6" From Wall; 2'6" O.C.*		*3' From Wall; 3' O.C.*	
	Below Fixture	*Between Fixtures*	*Below Fixture*	*Between Fixtures*
1	8	7	5	4
2	11	10	7	7
3	15	15	9	9
4	16	16	11	11
5	14	14	11	11
6	12	12	10	10
7	10	9	9	9
8	8	7	7	7
9	6	6	6	6
10	5	5	5	5

All vertical footcandles are initial values with no contribution from ceiling or floor reflectances. Computation performed with at least five wallwashers.



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TRIPLES-V 26/6 DS

Spec Sheet

COMPACT FLUORESCENT
1-132

recessed compact fluorescent downlight/wallwasher

FEATURES

Triples-V 26/6DS is an efficient 6" aperture low brightness downlight designed for use with one 26-watt triple-tube compact fluorescent lamp of the 4-pin types made by GE, Sylvania or Philips. Triples-V 26/6DS provides a shielding angle of 45°.

One housing allows interchangeable use of downlight and wallwash reflectors, permitting housings to be installed first and reflectors to be installed or changed at any time.

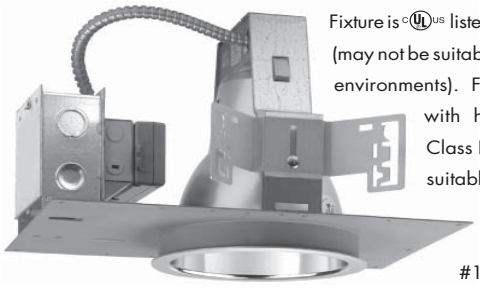
Triples-V 26/6DS uses one 26-watt lamp providing 1800 lumens (more than a 100-watt incandescent), a 10,000-hour life, a color rendering index (CRI) of 82, and color temperatures as warm as 2700°K (nearly duplicating the color qualities of incandescent).

Reflectors are available in clear, natural aluminum in three finishes: **EvenTone**, our standard clear finish, partially diffuse, anti-iridescent and gently luminous in appearance; **OptiTone**, specular and anti-iridescent, with minimum brightness and maximum efficiency; and **EasyTone**, diffuse and luminous. Additionally, reflectors are available in champagne gold, wheat, pewter and bronze. Wallwash (120°), corner wallwash (210°) and double wallwash (2x120°) reflectors are also available.

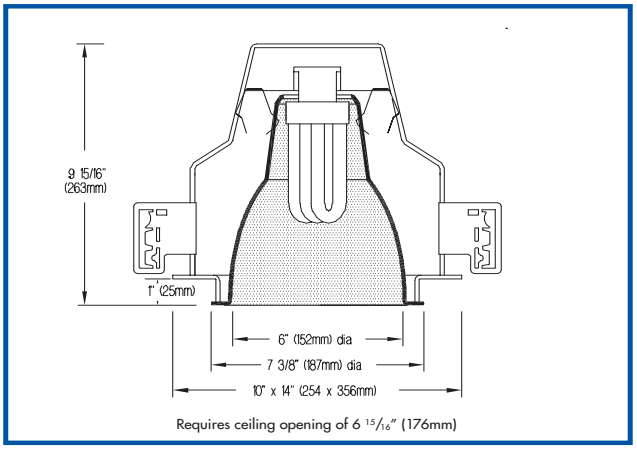
Triples-V 26/6DS includes a pair of mounting bars (¾" x 27" C channel). Specialty bars for wood joist and T-bar installations are also available.

APPLICATIONS

Fixture is suitable for downlighting or wallwashing in nearly all architectural environments, especially those spaces where non-directional luminaires are preferred over rectangular troffers. These include offices, stores, lobbies, corridors, restrooms and public areas.



Fixture is c UL us listed for Damp Location (may not be suitable for some outdoor environments). Fixture is prewired with high power factor Class P electronic ballast, suitable for use in a fire rated ceiling, and approved for ten #12 wire 75°C branch circuit pull-through wiring. Removal of the reflector allows access to the ballast and junction box.



Requires ceiling opening of 6 15/16" (176mm)

PRODUCT CODE

For complete product code, list basic unit and select one item from each following box.

Basic Unit	TRPV 26/6DS

Reflector Type			
Downlight	no suffix	Corner Wallwash	CWW
Wallwash	WW	Double Wallwash	DWW

Voltage			
120 volt service	120	277 volt service	277

Reflector and Flange Color	*Overlap*	*Flush*
EvenTone Clear	VOL	VFL
OptiTone Clear	COL	CFL
EasyTone Clear	ECOL	ECFL
Champagne Gold	GOL	GFL
Wheat	WHOL	WHFL
Pewter	POL	PFL
Bronze	ZOL	ZFL

Other reflector finishes are available on special order.

Standard reflector flange continues reflector finish. White painted flanges and custom painted flanges are available on special order. Add WF (white flange) or CCF (custom color flange).

OPTIONS

Specify by adding to the basic unit.

Dimmable 3-wire ballast; not for outdoor application ..... – DM

Emergency battery pack operates lamp in event of power outage. Fixture footprint increases to 10 x 17½" (254 x 444mm). Not available with a CWW reflector. Not for outdoor application ..... – EM

⅛" (3mm) thick **clear acrylic shield**, spring-mounted within reflector ..... – PS

- For combinations of the Options above, contact factory or Edison Price Lighting representative.
- A modified fixture suitable for 2" maximum ceiling thickness is available on special order. Contact factory.
- A modified fixture suitable for 347-volt service is available on special order. Contact factory.
- An install-from-below version of this fixture, suitable for installation outside North America, is available on special order. Contact factory.
- Decorative reflector rings are available on special order. Contact factory.

EDISON PRICE LIGHTING
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TRIPLES-V 26/6 DS

EDISON PRICE LIGHTING

PHOTOMETRIC REPORT

Report No. 51043. Original Independent Testing Laboratories, Inc. (ITL) test report furnished upon request.

Luminaire ..... recessed compact fluorescent downlight with spun aluminum reflector, specular finish
Lamp ..... Philips 26-watt triple-tube compact fluorescent, 4-pin GX24q-3 base, 1800 lumens
Efficiency 51.3%
Spacing Criteria ..... 0°-1.2, 90°-1.1

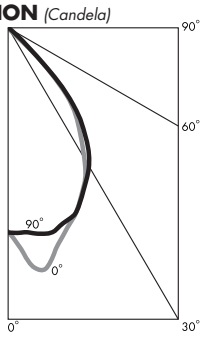
BALLAST INFORMATION

Voltage	*120*	*277*
Input Watts	28	28
Line Current (A)	.25	.11
Power Factor (%)	>98	>98
THD (%)	<10	<10
Min. Starting Temp* (°F)	0	0

**Consult lamp manufacturers for specific temperatures.*

CANDLEPOWER DISTRIBUTION *(Candela)*

Vertical Angle	*Horizontal Angle*		
	0.0	*45.0*	*90.0*
0	668	668	668
5	761	710	674
15	705	683	671
25	584	551	587
35	454	434	410
45	152	154	172
55	0	0	0
65	0	0	0
75	0	0	0
85	0	0	0
90	0	0	0



LUMINANCE DATA

(Candela/m²)

Vertical Angle	*Average 0° Longitude*	*Average 90° Longitude*
45	11305	12792
55	0	0
65	0	0
75	0	0
85	0	0

To convert cd/m² to footlamberts, multiply by 0.2919.

ZONAL LUMEN SUMMARY

Zone	*Lumens*	*% Lamp*	*% Fixture*
0 - 30°	529	29.4	57.2
0 - 40°	796	44.2	86.1
0 - 60°	924	51.3	100.0
0 - 90°	924	51.3	100.0
90 -180°	0	0.0	0.0
0 -180°	924	51.3	100.0

COEFFICIENTS OF UTILIZATION – ZONAL CAVITY METHOD

Effective Floor Cavity Reflectance 20%

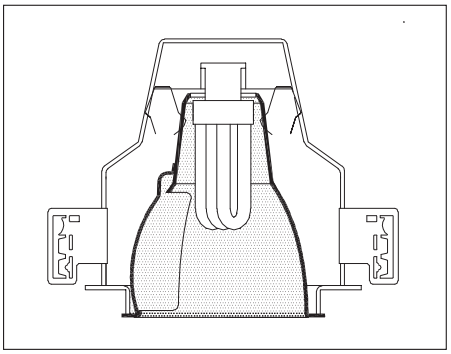
Ceiling Reflectance (%)	*80*				*70*				*50*			*30*			*10*			*0*
Wall Reflectance (%)	*70*	*50*	*30*	*10*	*70*	*50*	*30*	*10*	*50*	*30*	*10*	*50*	*30*	*10*	*50*	*30*	*10*	*0*
Room Cavity Ratio																		
0	61	61	61	61	60	60	60	60	57	57	57	55	55	55	52	52	52	51
1	58	56	55	54	57	55	54	53	53	52	51	51	51	50	50	49	48	48
2	55	52	50	48	54	51	49	48	50	48	47	48	47	46	47	46	45	44
3	52	48	45	43	51	47	45	43	46	44	42	45	43	42	44	42	41	40
4	49	45	42	39	48	44	41	39	43	40	38	42	40	38	41	39	38	37
5	46	41	38	36	45	41	38	36	40	37	35	39	37	35	38	36	35	34
6	43	38	35	33	43	38	35	33	37	34	32	36	34	32	36	34	32	31
7	41	36	32	30	40	35	32	30	35	32	30	34	31	30	33	31	29	29
8	39	33	30	28	38	33	30	28	32	30	27	32	29	27	31	29	27	26
9	36	31	28	26	36	31	28	26	30	27	25	30	27	25	29	27	25	25
10	35	29	26	24	34	29	26	24	28	26	24	28	25	24	28	25	23	23

TRIPLES-V 26/6 DS WW

WALLWASH INFORMATION

Distance From Ceiling (Feet)	*2'6" From Wall; 2'6" O.C.*		*3' From Wall; 3' O.C.*	
	Below Fixture	*Between Fixtures*	*Below Fixture*	*Between Fixtures*
1	4	4	2	2
2	8	7	5	5
3	12	12	7	6
4	14	14	9	9
5	13	13	10	10
6	11	11	9	9
7	9	9	8	8
8	7	7	7	7
9	6	6	6	6
10	5	5	5	5
11	4	4	4	4
12	3	3	3	3

All vertical footcandles are initial values with no contribution from ceiling or floor reflectances. Computation performed with at least five wallwashers.



Issued for Permit

TRIPLES-V 26/6 DS

recessed compact fluorescent downlight/wallwasher

Spec Sheet

COMPACT FLUORESCENT
1-132

FEATURES

Triples-V 26/6DS is an efficient 6" aperture low brightness downlight designed for use with one 26-watt triple-tube compact fluorescent lamp of the 4-pin types made by GE, Sylvania or Philips. Triples-V 26/6DS provides a shielding angle of 45°.

One housing allows interchangeable use of downlight and wallwash reflectors, permitting housings to be installed first and reflectors to be installed or changed at any time.

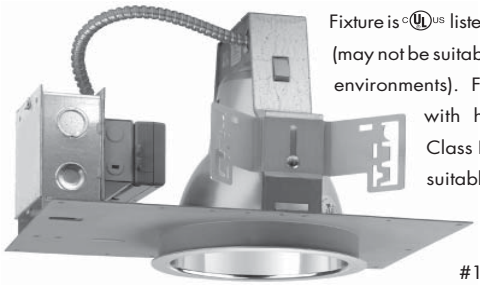
Triples-V 26/6DS uses one 26-watt lamp providing 1800 lumens (more than a 100-watt incandescent), a 10,000-hour life, a color rendering index (CRI) of 82, and color temperatures as warm as 2700°K (nearly duplicating the color qualities of incandescent).

Reflectors are available in clear, natural aluminum in three finishes: **EvenTone**, our standard clear finish, partially diffuse, anti-iridescent and gently luminous in appearance; **OptiTone**, specular and anti-iridescent, with minimum brightness and maximum efficiency; and **EasyTone**, diffuse and luminous. Additionally, reflectors are available in champagne gold, wheat, pewter and bronze. Wallwash (120°), corner wallwash (210°) and double wallwash (2x120°) reflectors are also available.

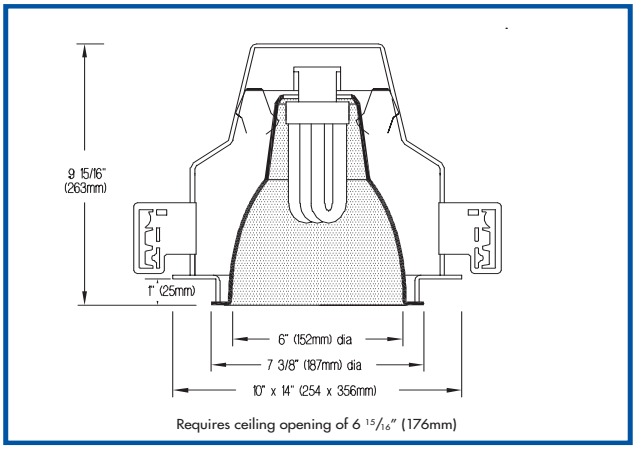
Triples-V 26/6DS includes a pair of mounting bars (¾" x 27" C channel). Specialty bars for wood joist and T-bar installations are also available.

APPLICATIONS

Fixture is suitable for downlighting or wallwashing in nearly all architectural environments, especially those spaces where non-directional luminaires are preferred over rectangular troffers. These include offices, stores, lobbies, corridors, restrooms and public areas.



Fixture is c UL us listed for Damp Location (may not be suitable for some outdoor environments). Fixture is prewired with high power factor Class P electronic ballast, suitable for use in a fire rated ceiling, and approved for ten #12 wire 75°C branch circuit pull-through wiring. Removal of the reflector allows access to the ballast and junction box.



Requires ceiling opening of 6 15/16" (176mm)

PRODUCT CODE

For complete product code, list basic unit and select one item from each following box.

Basic Unit	TRPV 26/6DS

Reflector Type			
Downlight	no suffix	Corner Wallwash	CWW
Wallwash	WW	Double Wallwash	DWW

Voltage			
120 volt service	120	277 volt service	277

Reflector and Flange Color	*Overlap*	*Flush*
EvenTone Clear	VOL	VFL
OptiTone Clear	COL	CFL
EasyTone Clear	ECOL	ECFL
Champagne Gold	GOL	GFL
Wheat	WHOL	WHFL
Pewter	POL	PFL
Bronze	ZOL	ZFL

Other reflector finishes are available on special order.

Standard reflector flange continues reflector finish. White painted flanges and custom painted flanges are available on special order. Add WF (white flange) or CCF (custom color flange).

OPTIONS

Specify by adding to the basic unit.

Dimmable 3-wire ballast; not for outdoor application ..... – DM

Emergency battery pack operates lamp in event of power outage. Fixture footprint increases to 10 x 17½" (254 x 444mm). Not available with a CWW reflector. Not for outdoor application ..... – EM

⅛" (3mm) thick **clear acrylic shield**, spring-mounted within reflector ..... – PS

- For combinations of the Options above, contact factory or Edison Price Lighting representative.
- A modified fixture suitable for 2" maximum ceiling thickness is available on special order. Contact factory.
- A modified fixture suitable for 347-volt service is available on special order. Contact factory.
- An install-from-below version of this fixture, suitable for installation outside North America, is available on special order. Contact factory.
- Decorative reflector rings are available on special order. Contact factory.

EDISON PRICE LIGHTING
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07-07

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FMS

Architect **Gensler**
Project **Portland International Jetport**

Date **26 October 2009**
Project No. **508667.00**

Type **FF-2**

TRIPLES-V 26/6 DS

EDISON PRICE LIGHTING

PHOTOMETRIC REPORT

Report No. 51043. Original Independent Testing Laboratories, Inc. (ITL) test report furnished upon request.

Luminaire ..... recessed compact fluorescent downlight with spun aluminum reflector, specular finish
Lamp ..... Philips 26-watt triple-tube compact fluorescent, 4-pin GX24q-3 base, 1800 lumens
Efficiency 51.3%
Spacing Criteria ..... 0°-1.2, 90°-1.1

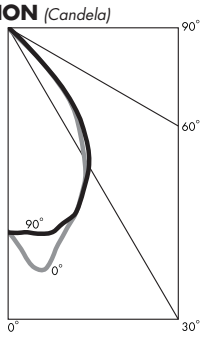
BALLAST INFORMATION

Voltage	*120*	*277*
Input Watts	28	28
Line Current (A)	.25	.11
Power Factor (%)	>98	>98
THD (%)	<10	<10
Min. Starting Temp* (°F)	0	0

**Consult lamp manufacturers for specific temperatures.*

CANDLEPOWER DISTRIBUTION *(Candela)*

Vertical Angle	*Horizontal Angle*		
	0.0	*45.0*	*90.0*
0	668	668	668
5	761	710	674
15	705	683	671
25	584	551	587
35	454	434	410
45	152	154	172
55	0	0	0
65	0	0	0
75	0	0	0
85	0	0	0
90	0	0	0



LUMINANCE DATA

(Candela/m²)

Vertical Angle	*Average 0° Longitude*	*Average 90° Longitude*
45	11305	12792
55	0	0
65	0	0
75	0	0
85	0	0

To convert cd/m² to footlamberts, multiply by 0.2919.

ZONAL LUMEN SUMMARY

Zone	*Lumens*	*% Lamp*	*% Fixture*
0 - 30°	529	29.4	57.2
0 - 40°	796	44.2	86.1
0 - 60°	924	51.3	100.0
0 - 90°	924	51.3	100.0
90 -180°	0	0.0	0.0
0 -180°	924	51.3	100.0

COEFFICIENTS OF UTILIZATION – ZONAL CAVITY METHOD

Effective Floor Cavity Reflectance 20%

Ceiling Reflectance (%)	*80*				*70*				*50*			*30*			*10*			*0*
Wall Reflectance (%)	*70*	*50*	*30*	*10*	*70*	*50*	*30*	*10*	*50*	*30*	*10*	*50*	*30*	*10*	*50*	*30*	*10*	*0*
Room Cavity Ratio																		
0	61	61	61	61	60	60	60	60	57	57	57	55	55	55	52	52	52	51
1	58	56	55	54	57	55	54	53	53	52	51	51	51	50	50	49	48	48
2	55	52	50	48	54	51	49	48	50	48	47	48	47	46	47	46	45	44
3	52	48	45	43	51	47	45	43	46	44	42	45	43	42	44	42	41	40
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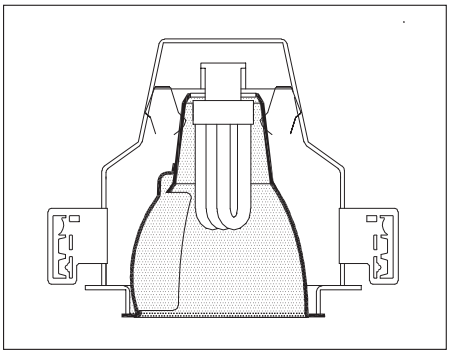
9	36	31	28	26	36	31	28	26	30	27	25	30	27	25	29	27	25	25
10	35	29	26	24	34	29	26	24	28	26	24	28	25	24	28	25	23	23

TRIPLES-V 26/6 DS WW

WALLWASH INFORMATION

Distance From Ceiling (Feet)	*2'6" From Wall; 2'6" O.C.*		*3' From Wall; 3' O.C.*	
	Below Fixture	*Between Fixtures*	*Below Fixture*	*Between Fixtures*
1	4	4	2	2
2	8	7	5	5
3	12	12	7	6
4	14	14	9	9
5	13	13	10	10
6	11	11	9	9
7	9	9	8	8
8	7	7	7	7
9	6	6	6	6
10	5	5	5	5
11	4	4	4	4
12	3	3	3	3

All vertical footcandles are initial values with no contribution from ceiling or floor reflectances. Computation performed with at least five wallwashers.



Issued for Permit

TRIPLES-V 26/6 DS

recessed compact fluorescent downlight/wallwasher

Spec Sheet

COMPACT FLUORESCENT
1-132

FEATURES

Triples-V 26/6DS is an efficient 6" aperture low brightness downlight designed for use with one 26-watt triple-tube compact fluorescent lamp of the 4-pin types made by GE, Sylvania or Philips. Triples-V 26/6DS provides a shielding angle of 45°.

One housing allows interchangeable use of downlight and wallwash reflectors, permitting housings to be installed first and reflectors to be installed or changed at any time.

Triples-V 26/6DS uses one 26-watt lamp providing 1800 lumens (more than a 100-watt incandescent), a 10,000-hour life, a color rendering index (CRI) of 82, and color temperatures as warm as 2700°K (nearly duplicating the color qualities of incandescent).

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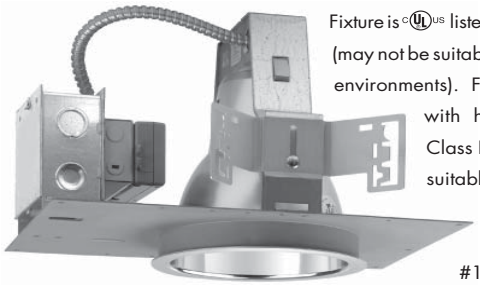
Triples-V 26/6DS includes a pair of mounting bars (¾" x 27" C channel). Specialty bars for wood joist and T-bar installations are also available.

APPLICATIONS

Fixture is suitable for downlighting or wallwashing in nearly all architectural environments, especially those spaces where non-directional luminaires are preferred over rectangular troffers. These include offices, stores, lobbies, corridors, restrooms and public areas.



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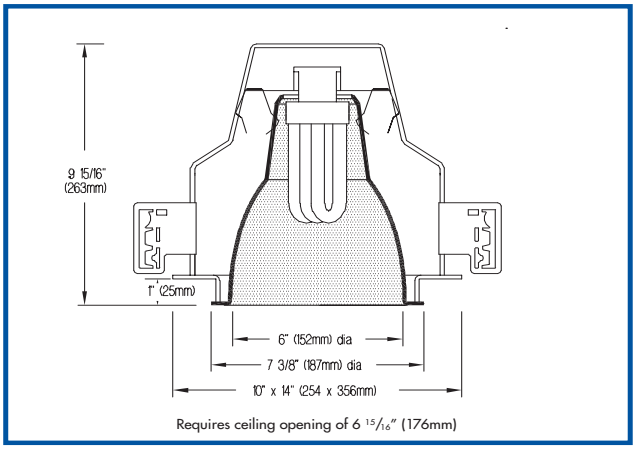

Requires ceiling opening of 6 15/16" (176mm)

PRODUCT CODE

For complete product code, list basic unit and select one item from each following box.

Basic Unit	TRPV 26/6DS		
Reflector Type			
Downlight	no suffix	Corner Wallwash	CWW
Wallwash	WW	Double Wallwash	DWW
Voltage			
120 volt service	120	277 volt service	277

Reflector and Flange Color	*Overlap*	*Flush*
EvenTone Clear	VOL	VFL
OptiTone Clear	COL	CFL
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Champagne Gold	GOL	GFL
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Other reflector finishes are available on special order.

Standard reflector flange continues reflector finish. White painted flanges and custom painted flanges are available on special order. Add WF (white flange) or CCF (custom color flange).

OPTIONS

Specify by adding to the basic unit.

Dimmable 3-wire ballast; not for outdoor application ..... – DM

Emergency battery pack operates lamp in event of power outage. Fixture footprint increases to 10 x 17½" (254 x 444mm). Not available with a CWW reflector. Not for outdoor application ..... – EM

⅛" (3mm) thick **clear acrylic shield**, spring-mounted within reflector ..... – PS

- For combinations of the Options above, contact factory or Edison Price Lighting representative.
- A modified fixture suitable for 2" maximum ceiling thickness is available on special order. Contact factory.
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FMS

Architect **Gensler**
Project **Portland International Jetport**

Date **26 October 2009**
Project No. **508667.00**

Type **FF-3**

TRIPLES-V 26/6 DS

EDISON PRICE LIGHTING

PHOTOMETRIC REPORT

Report No. 51043. Original Independent Testing Laboratories, Inc. (ITL) test report furnished upon request.

Luminaire ..... recessed compact fluorescent downlight with spun aluminum reflector, specular finish
Lamp ..... Philips 26-watt triple-tube compact fluorescent, 4-pin GX24q-3 base, 1800 lumens
Efficiency 51.3%
Spacing Criteria ..... 0°-1.2, 90°-1.1

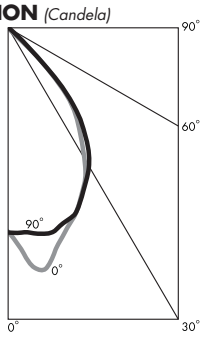
BALLAST INFORMATION

Voltage	*120*	*277*
Input Watts	28	28
Line Current (A)	.25	.11
Power Factor (%)	>98	>98
THD (%)	<10	<10
Min. Starting Temp* (°F)	0	0

**Consult lamp manufacturers for specific temperatures.*

CANDLEPOWER DISTRIBUTION *(Candela)*

Vertical Angle	*Horizontal Angle*		
	0.0	*45.0*	*90.0*
0	668	668	668
5	761	710	674
15	705	683	671
25	584	551	587
35	454	434	410
45	152	154	172
55	0	0	0
65	0	0	0
75	0	0	0
85	0	0	0
90	0	0	0



LUMINANCE DATA

(Candela/m²)

Vertical Angle	*Average 0° Longitude*	*Average 90° Longitude*
45	11305	12792
55	0	0
65	0	0
75	0	0
85	0	0

To convert cd/m² to footlamberts, multiply by 0.2919.

ZONAL LUMEN SUMMARY

Zone	*Lumens*	*% Lamp*	*% Fixture*
0 - 30°	529	29.4	57.2
0 - 40°	796	44.2	86.1
0 - 60°	924	51.3	100.0
0 - 90°	924	51.3	100.0
90 -180°	0	0.0	0.0
0 -180°	924	51.3	100.0

COEFFICIENTS OF UTILIZATION – ZONAL CAVITY METHOD

Effective Floor Cavity Reflectance 20%

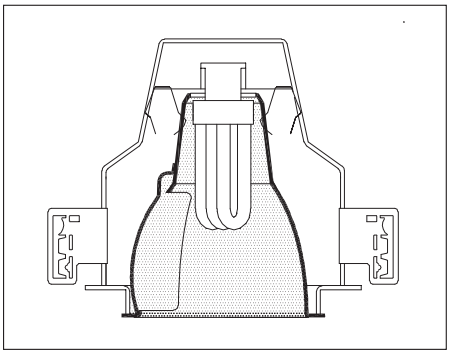
Ceiling Reflectance (%)	*80*				*70*				*50*			*30*			*10*			*0*
Wall Reflectance (%)	*70*	*50*	*30*	*10*	*70*	*50*	*30*	*10*	*50*	*30*	*10*	*50*	*30*	*10*	*50*	*30*	*10*	*0*
Room Cavity Ratio																		
0	61	61	61	61	60	60	60	60	57	57	57	55	55	55	52	52	52	51
1	58	56	55	54	57	55	54	53	53	52	51	51	51	50	50	49	48	48
2	55	52	50	48	54	51	49	48	50	48	47	48	47	46	47	46	45	44
3	52	48	45	43	51	47	45	43	46	44	42	45	43	42	44	42	41	40
4	49	45	42	39	48	44	41	39	43	40	38	42	40	38	41	39	38	37
5	46	41	38	36	45	41	38	36	40	37	35	39	37	35	38	36	35	34
6	43	38	35	33	43	38	35	33	37	34	32	36	34	32	36	34	32	31
7	41	36	32	30	40	35	32	30	35	32	30	34	31	30	33	31	29	29
8	39	33	30	28	38	33	30	28	32	30	27	32	29	27	31	29	27	26
9	36	31	28	26	36	31	28	26	30	27	25	30	27	25	29	27	25	25
10	35	29	26	24	34	29	26	24	28	26	24	28	25	24	28	25	23	23

TRIPLES-V 26/6 DS WW

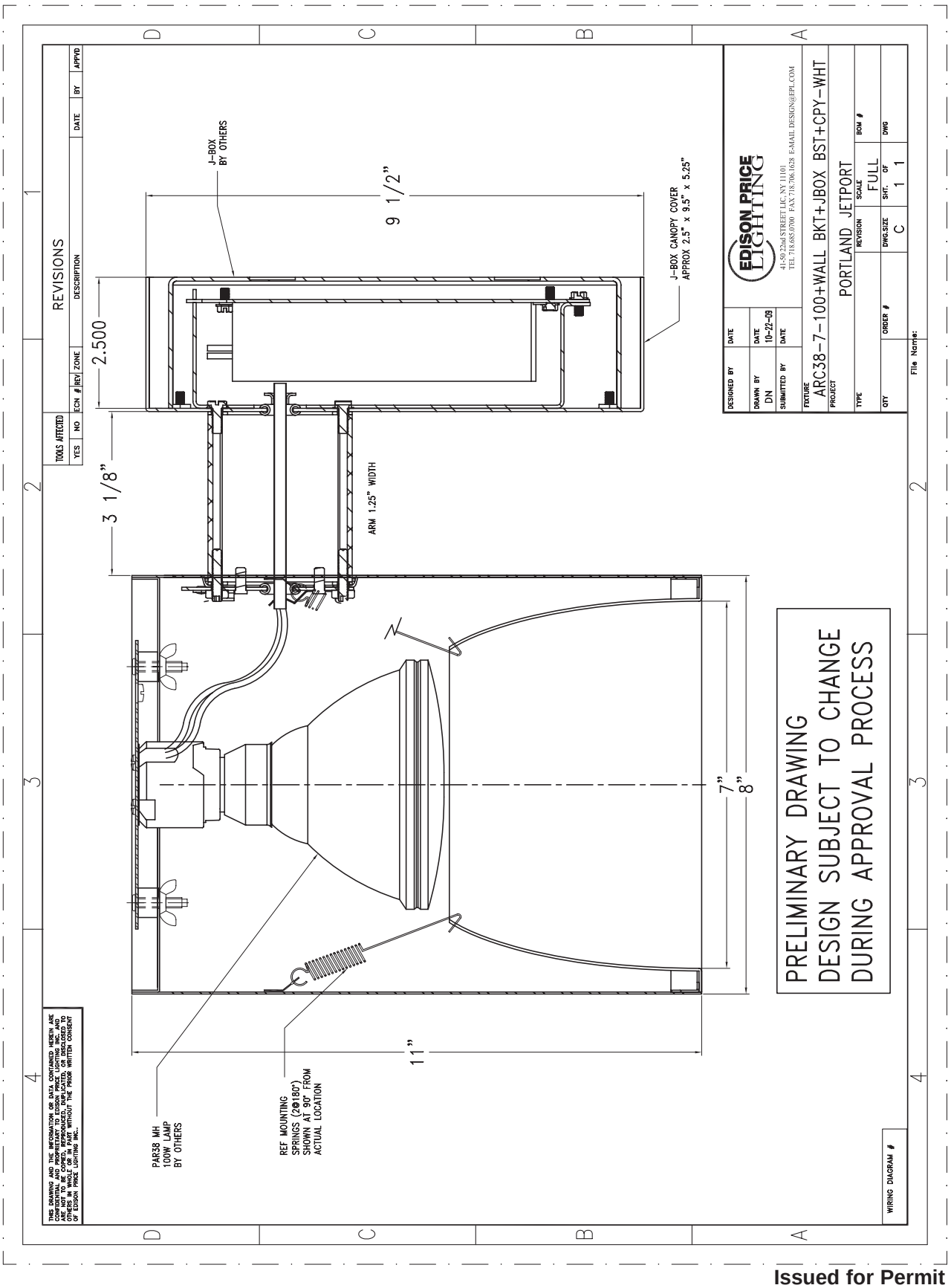
WALLWASH INFORMATION

Distance From Ceiling (Feet)	*2'6" From Wall; 2'6" O.C.*		*3' From Wall; 3' O.C.*	
	Below Fixture	*Between Fixtures*	*Below Fixture*	*Between Fixtures*
1	4	4	2	2
2	8	7	5	5
3	12	12	7	6
4	14	14	9	9
5	13	13	10	10
6	11	11	9	9
7	9	9	8	8
8	7	7	7	7
9	6	6	6	6
10	5	5	5	5
11	4	4	4	4
12	3	3	3	3

All vertical footcandles are initial values with no contribution from ceiling or floor reflectances. Computation performed with at least five wallwashers.



Issued for Permit



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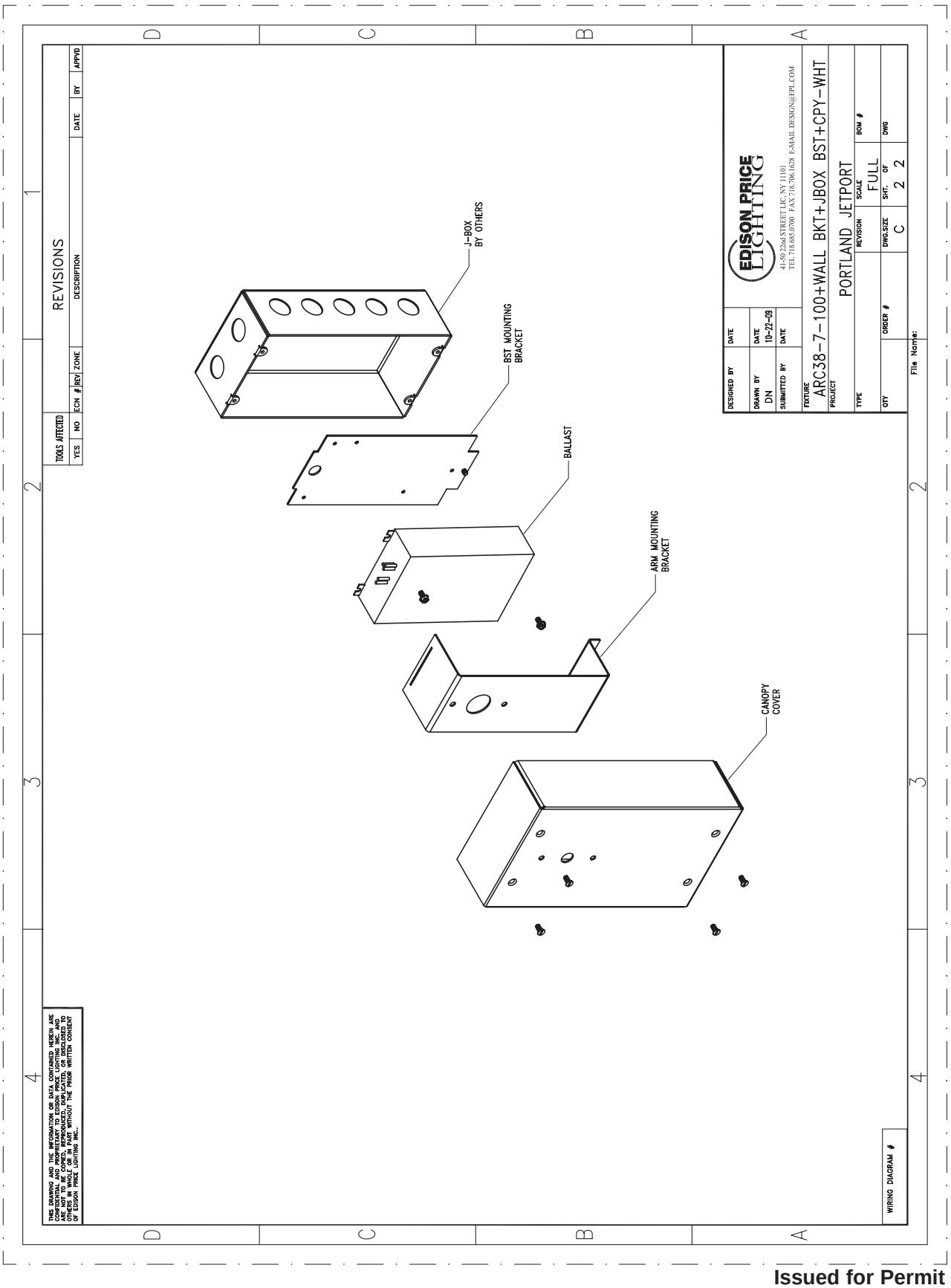

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ARCLITE 38/7

EDISON PRICE LIGHTING

PHOTOMETRIC REPORT – FLOOD

Report No. 41363. Original Independent Testing Laboratories, Inc. (ITL) test report furnished upon request.

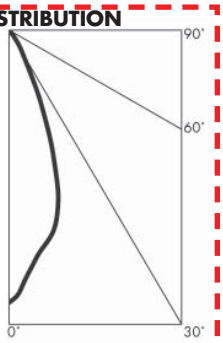
Luminaire ..... recessed metal halide with spun aluminum reflector, specular finish
Lamp ..... MP100PAR38/U/FL35, 5500 lumens
Efficiency 88.2%
Spacing Criterion 0.6

BALLAST INFORMATION

Voltage	120	277
Input Watts	110	110
Maximum Current (A)	.9	.41
Line Current (A)	.9	.41
Power Factor (%)	>90	>90
Min. Starting Temp (°F)	–22	–22

CANDLEPOWER DISTRIBUTION

Vertical Angle	Candela
0	12799
5	11196
15	8701
25	2519
35	305
45	40
55	0
65	0
75	0
85	0
90	0



ZONAL LUMEN SUMMARY

Zone	Lumens	% Lamp	% Fixture
0 – 30°	4591	83.5	94.7
0 – 40°	4818	87.6	99.3
0 – 60°	4850	88.2	100.0
0 – 90°	4850	88.2	100.0
90 – 180°	0	0.0	0.0
0 – 180°	4850	88.2	100.0

LUMINANCE DATA

Vertical Angle	Candela/m²
45	2082
55	0
65	0
75	0
85	0

To convert cd/m² to footlamberts multiply by 0.2919.

COEFFICIENTS OF UTILIZATION – ZONAL CAVITY METHOD (Effective Floor Cavity Reflectance 20%)

Ceiling Reflectance (%)	80				70				50			30			10		0
Wall Reflectance (%)	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
Room Cavity Ratio																		
0	105	105	105	105	103	103	103	103	98	98	98	94	94	94	90	90	90	88
1	101	99	97	96	99	97	96	94	94	92	91	90	89	89	87	87	86	85
2	97	94	91	89	96	92	90	88	90	88	86	87	85	84	85	83	82	81
3	94	89	86	83	92	88	85	82	86	83	81	84	82	80	82	80	79	78
4	90	85	81	79	89	84	81	78	83	80	77	81	78	76	79	77	75	74
5	87	82	78	75	86	81	77	74	79	76	74	78	75	73	77	74	72	71
6	84	78	74	71	83	78	74	71	76	73	70	75	72	70	74	72	70	69
7	81	75	71	68	80	74	71	68	73	70	68	73	69	67	72	69	67	66
8	79	72	68	65	78	72	68	65	71	67	65	70	67	65	69	66	64	63
9	76	69	65	63	75	69	65	63	68	65	62	68	64	62	67	64	62	61
10	74	67	63	60	73	67	63	60	66	62	60	65	62	60	65	62	60	59

PHOTOMETRIC REPORT – SPOT

Report No. 41362. Original Independent Testing Laboratories, Inc. (ITL) test report furnished upon request.

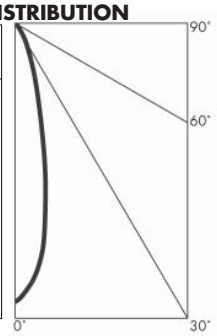
Luminaire ..... recessed metal halide with spun aluminum reflector, specular finish
Lamp ..... MP100PAR38/U/SP20, 5200 lumens
Efficiency 97.2%
Spacing Criterion 0.4

BALLAST INFORMATION

Voltage	120	277
Input Watts	110	110
Maximum Current (A)	.9	.41
Line Current (A)	.9	.41
Power Factor (%)	>90	>90
Min. Starting Temp (°F)	–22	–22

CANDLEPOWER DISTRIBUTION

Vertical Angle	Candela
0	25318
5	22249
15	7289
25	1772
35	262
45	24
55	0
65	0
75	0
85	0
90	0



ZONAL LUMEN SUMMARY

Zone	Lumens	% Lamp	% Fixture
0 – 30°	4859	93.4	96.1
0 – 40°	5036	96.9	99.7
0 – 60°	5054	97.2	100.0
0 – 90°	5054	97.2	100.0
90 – 180°	0	0.0	0.0
0 – 180°	5054	97.2	100.0

LUMINANCE DATA

Vertical Angle	Candela/m²
45	1413
55	0
65	0
75	0
85	0

To convert cd/m² to footlamberts multiply by 0.2919.

COEFFICIENTS OF UTILIZATION – ZONAL CAVITY METHOD (Effective Floor Cavity Reflectance 20%)

Ceiling Reflectance (%)	80				70				50			30			10		0
Wall Reflectance (%)	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
Room Cavity Ratio																		
0	116	116	116	116	113	113	113	113	108	108	108	103	103	103	99	99	99	97
1	112	110	108	106	110	108	106	105	104	103	102	100	99	99	97	96	96	94
2	108	105	102	100	106	103	101	99	100	98	96	98	96	94	95	94	93	91
3	105	101	97	95	103	99	96	94	97	94	92	95	93	91	93	91	90	88
4	102	97	93	90	100	96	92	90	94	91	89	92	90	88	90	88	87	86
5	99	93	90	87	98	93	89	86	91	88	86	90	87	85	88	86	84	83
6	96	90	86	84	95	90	86	83	88	85	83	87	84	82	86	84	82	81
7	94	88	84	81	93	87	83	81	86	83	80	85	82	80	84	82	80	79
8	91	85	81	78	90	85	81	78	84	80	78	83	80	78	82	79	77	77
9	89	83	79	76	88	82	79	76	81	78	76	81	78	76	80	77	75	75
10	87	80	77	74	86	80	76	74	79	76	74	79	76	74	78	76	74	73

Issued for Permit

Product Datasheet	Catalog Home Home Page Search

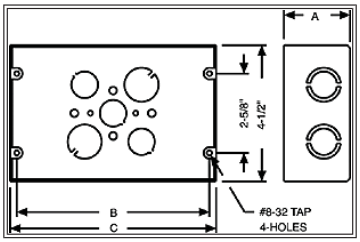
942 -- Gang Box, 3 Device, 2-1/2" Deep

Product Specifications	
Box Type	RACO Steel Boxes & Covers
Box Family	Multi-Device Gang Boxes & Covers
Box Category	Gang Boxes
Category	Gang Box
Wiring System	Conduit
Box Depth	2-1/2"
Side Knockout(s)	8, 3/4" & 2 concentric 3/4" & 1"
Bottom Knockout(s)	6, 1/2" & 4, 3/4"
End Knockout(s)	4 concentric 3/4" & 1"
Drawn or Welded	Welded
Number of Devices or Gangs	3
Cubic Inch Capacity	90.0
UPC Number	050169009420
Product UPC-A Labeled	Yes
Minimum Pack Qty.	5
Inner Leaf 2 of 5 Bar Code	50050169009425
Unit Carton Quantity	5
Ship Carton Length (In.)	9.25
Ship Carton Width (In.)	7.75
Ship Carton Height (In.)	9.5
Weight (Per/C)	197.5
Pallet Quantity	750
Dimension A	2-1/2"
Dimension B	8-3/16"
Dimension C	8-5/8"

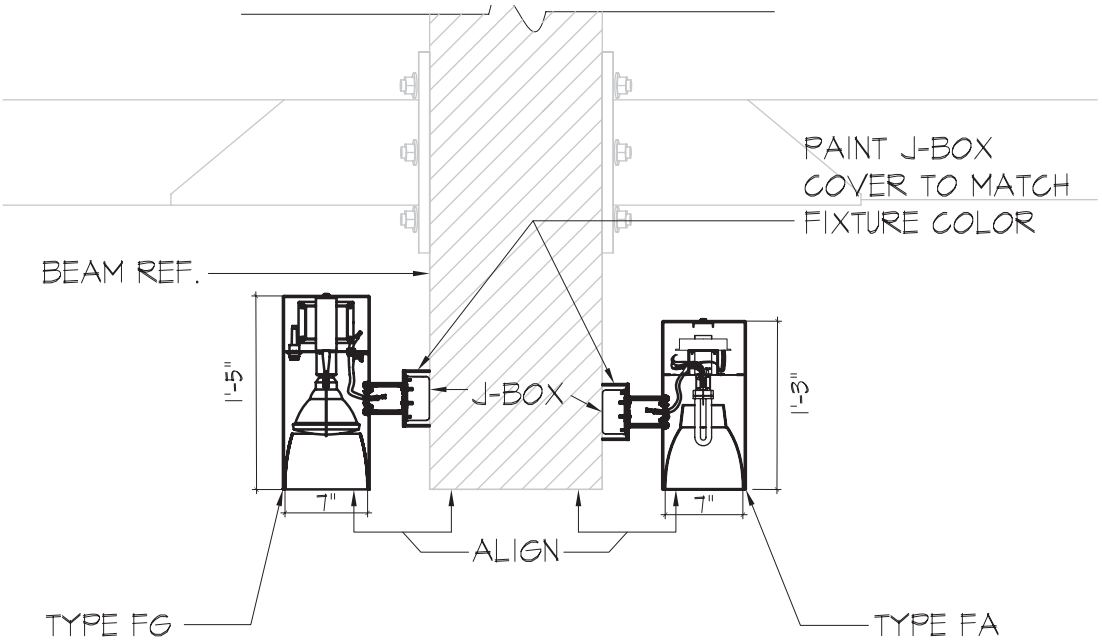
Applications
• Gang boxes are used where a number of wiring devices are to be centrally located

Product Features
• Combination cover screw heads provide for faster mudring/cover installation • Features 1/2" and 3/4" concentric knockouts for use with a wide variety wiring methods • Mounting slots in box make for easy installation of RACO #949 low voltage partition

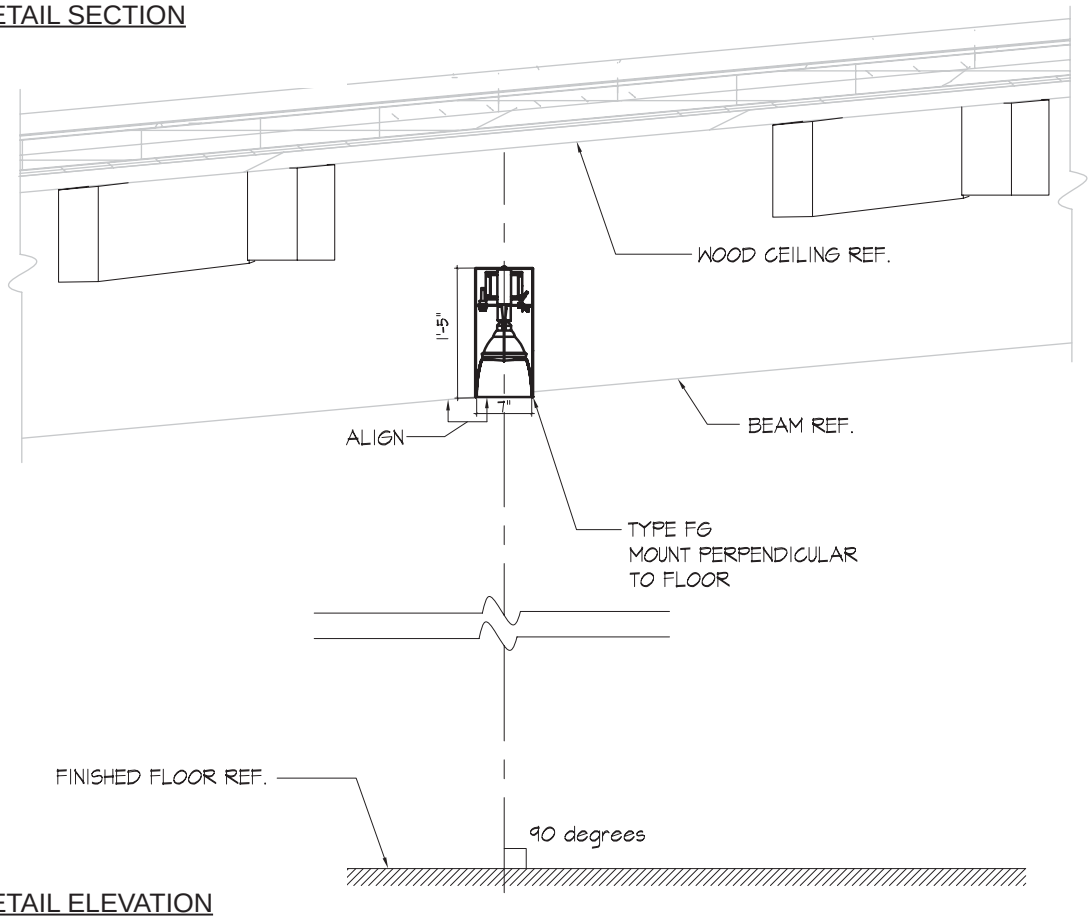
Compliances
UL 514-A listed, File



See attached Lighting Fixture Schedule



MOUNTING DETAIL SECTION
Scale: N.T.S



MOUNTING DETAIL ELEVATION
Scale: N.T.S

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TECHTRAC™ CF

Compact Fluorescent

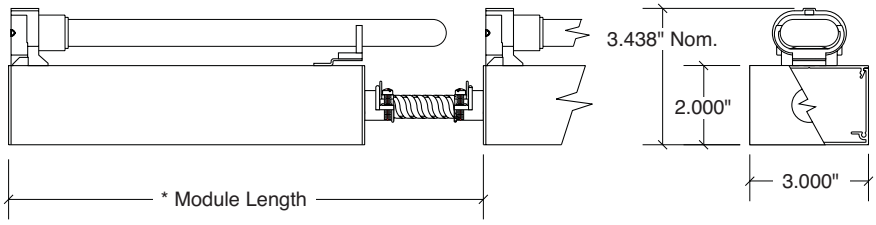
Product Code:

230 - CF18HE - _____ - 12 - _____ - FLX
(Length) (Spacing) (Finish)

Fixture Type:

230 / CF18 - In-Line Lamps, Flex / Integral HPF Electronic Ballast

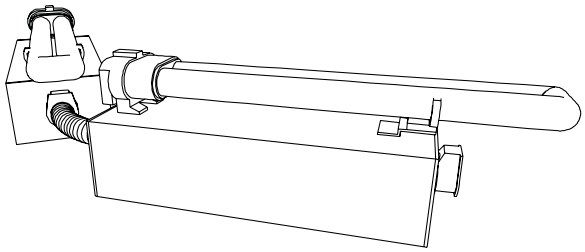
CF18



Side View
Scale: 1:4

End View
Scale: 1:4

Number Lamps	* Module Length
1	12.000"
2	24.000"
4	48.000"
8	96.000"



Perspective View
Scale: NTS

Notes

1-Fixture ambient temperature **not to exceed** 100˚F. Fixture is NYC approved Calendar No. 37559.

2-Unless otherwise specified, all exposed metal parts to have a standard semi-gloss White painted finish. Consult factory for alternate finishes.

3-Lamps provided by others. Recommended Lamps to be 18 watt compact fluorescent quad. Warning, risk of fire. Do not exceed maximum recommended wattage.

4-Fixture provided with Ø.875" knockout centered on each end cap.

5-Fixture is intended to be powered by integral high power factor electronic ballast; **primary voltage as specified.**

Finishes

☐ **WH** White Paint (Std)
☐ Custom (Specify)

Power Option

☐ 120 VAC
☐ 277 VAC

Starfire Lighting, Inc.
7 Donna Drive, Wood-Ridge, NJ 07075
(201) 438-9540 **FAX:** (201) 438-9541
Toll Free: (800) 443-8823
E-Mail: info@starfirelighting.com

Date:

Starfire Agent:

Drawing No: **0131**

Project:

Specified by:

06-24-03

Issued for Permit

FMS

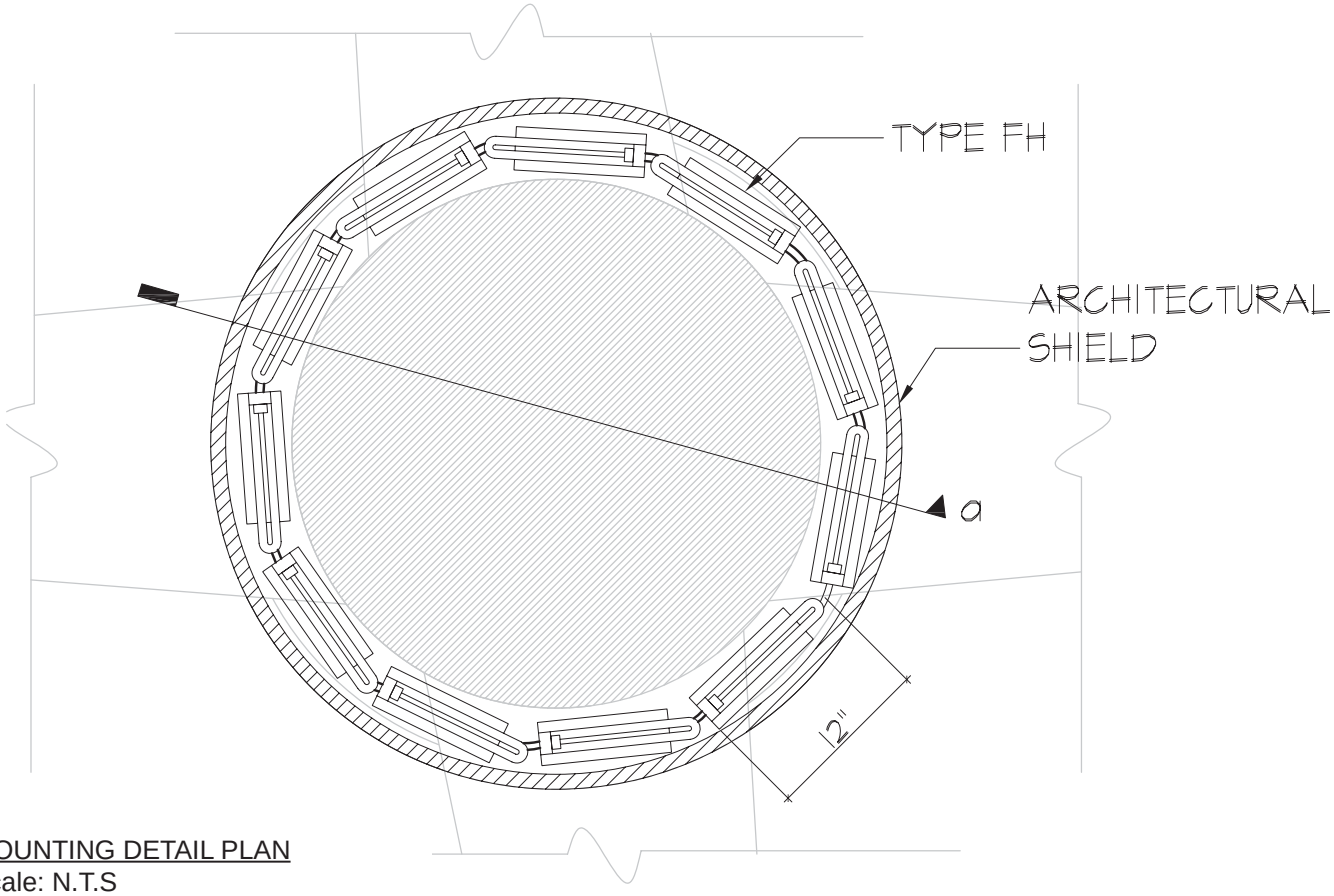
Architect **Gensler**
Project **Portland International Jetport**

Date **26 October 2009**
Project No. **508667.00**

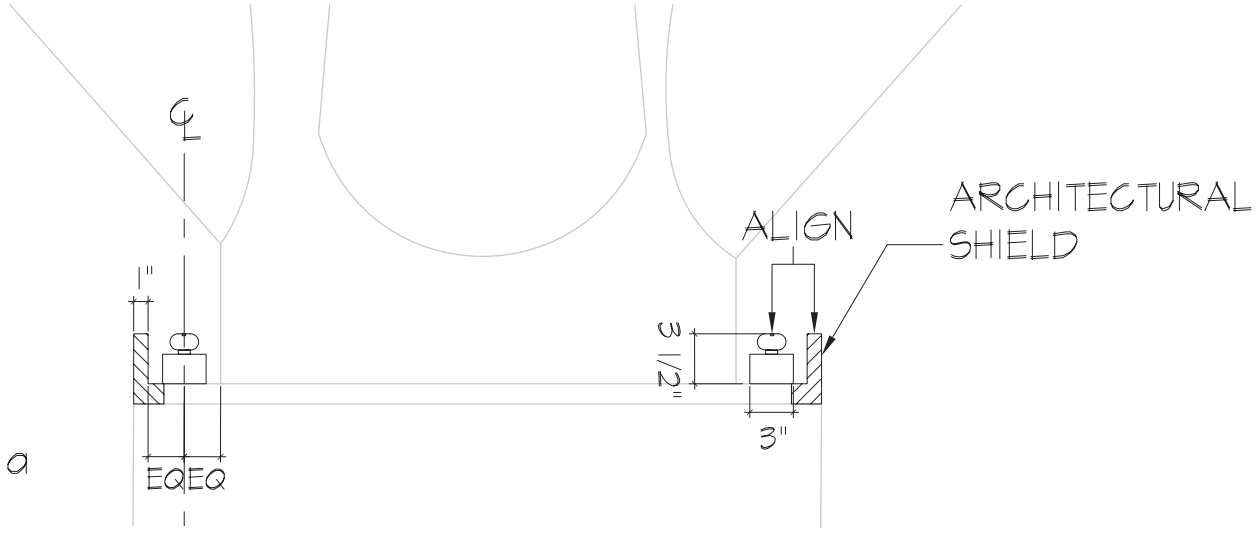
Type **FH**

Fisher Marantz Stone Partners in Architectural Lighting Design 22 West 19th Street New York, NY 10011

See attached Lighting Fixture Schedule



MOUNTING DETAIL PLAN
Scale: N.T.S



MOUNTING DETAIL SECTION
Scale: N.T.S

Issued for Permit

FMS

Architect **Gensler**

Project **Portland International Jetport**

Date **26 October 2009**

Project No. **508667.00**

Type **FJ**

Fisher Marantz Stone Partners in Architectural Lighting Design 22 West 19th Street New York, NY 10011

Issued for Permit

See attached Lighting Fixture Schedule

CATALOG NUMBER:
F164 –T132 – H – 02 – ? – VXX – 0

STYLE	LAMP	MOUNT	FINISH	VOLTAGE	OPTION	STANDARD
SEE PAGE U2.2	(1)32W T8 FLUORES	HUB MOUNT	SEMI–GLOSS WHITE	PLEASE SPECIFY	SEE BELOW	UL

VXX=NOM. 4FT F164 FIXTURE WITH (1) 32W T8 LAMP PER REFLECTOR, AS PER APS–A–3954B

CATALOG NUMBER:
F164 –T232 – H – 02 – ? – VXX – 0

STYLE	LAMP	MOUNT	FINISH	VOLTAGE	OPTION	STANDARD
SEE PAGE U2.2	(2)32W T8 FLUORES	HUB MOUNT	SEMI–GLOSS WHITE	PLEASE SPECIFY	SEE BELOW	UL

VXX=NOM. 8FT F164 FIXTURE WITH (2) 32W T8 LAMPS PER REFLECTOR, AS PER APS–A–3954B

ACCESSORY CATALOG NUMBER:
HBF – 02 – ?? – XX – 0

STYLE	FINISH	LENGTH	OPTION	STANDARD
SEE PAGE U2.3	SEMI–GLOSS WHITE	PLEASE SPECIFY	SEE BELOW	U.L.

XX=HBF PENDANT MOUNTING PLATE AND INTERMEDIATE STEM, MODIFIED TO ALLOW MOUNTING (2) F164 FIXTURES BACK–TO–BACK AS PER APS–A–3954B.

ACCESSORY CATALOG NUMBER:
HBG – 02 – ?? – XX – 0

STYLE	FINISH	LENGTH	OPTION	STANDARD
SEE PAGE U2.3	SEMI–GLOSS WHITE	PLEASE SPECIFY	SEE BELOW	U.L.

XX=PAIR OF HBG CANTILEVER MOUNTING PLATES AND END STEMS, (1) WITH SURFACE FEED CONDUIT BOX, BOTH MODIFIED TO ALLOW MOUNTING (2) F164 FIXTURES BACK–TO–BACK AS PER APS–A–3954B.

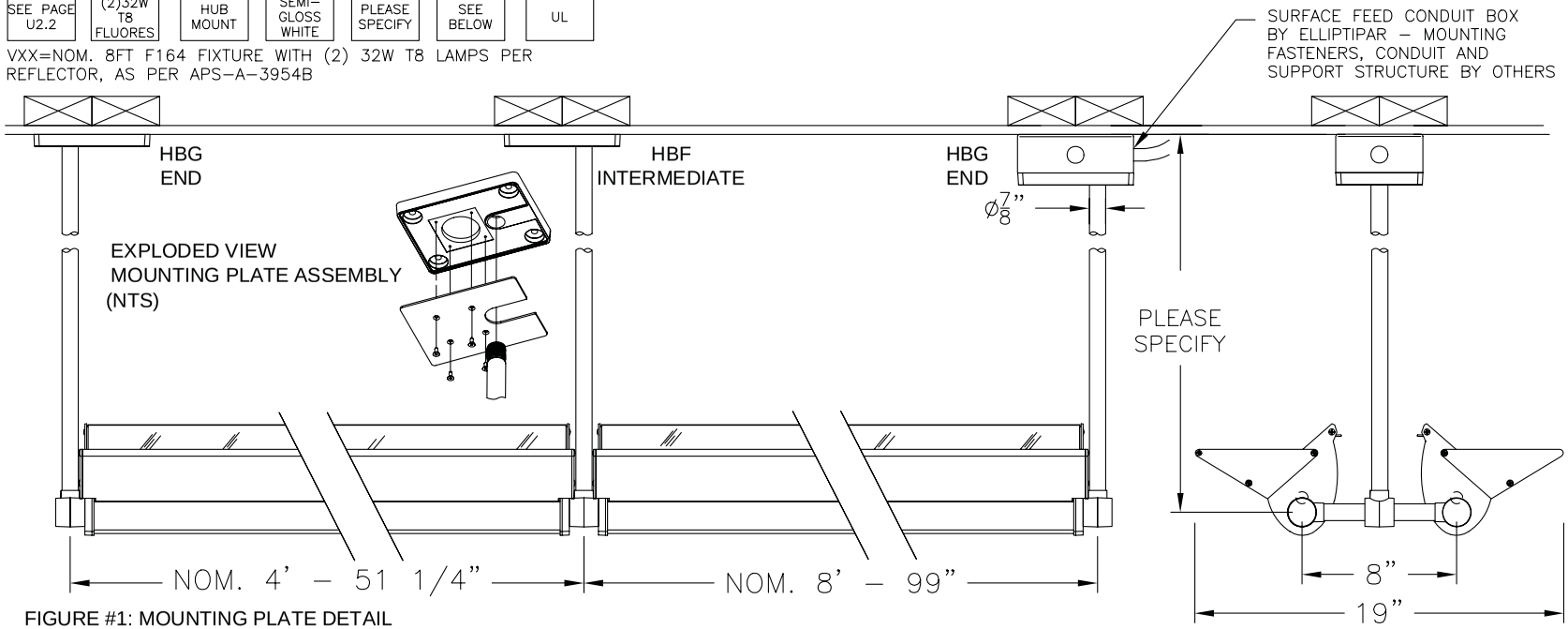
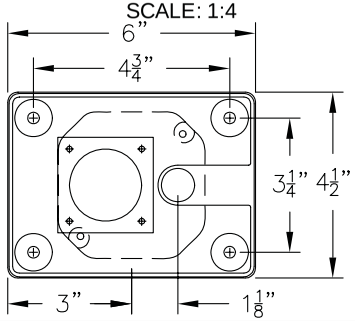


FIGURE #1: MOUNTING PLATE DETAIL
SCALE: 1:4



APPROVAL SIGNATURE REQUIRED

NOTE:
1.) ESTIMATED WEIGHT 28 LBS PER 4' ASSEMBLY, 54 LBS PER 8' ASSEMBLY

ORDERING INFORMATION
1.) REFERENCE APS–A–3954B
2.) REQUIRES (2) NOM. 4' F164 OR (2) NOM. 8' F164 FIXTURES FOR EACH LINEAR BACK–TO–BACK SECTION
3.) REQUIRES (1) HBG END HUB KIT FOR EACH CONTINUOUS ROW.
4.) TOTAL QTY OF BACK–TO–BACK SECTIONS –1 EQUALS QTY OF HBF INTERMEDIATE HUBS REQUIRED.

PLEASE SPECIFY VOLTAGE & PENDANT LENGTH

APPROVAL: Date:

Signature:

FIRM:

TITLE: PORTLAND JETPORT
F164–Txxx (T8) HBF/HBG MOD.

DRAWING NUMBER: APS–A–3954B

DR. BY: DWW

SCALE: 1 : 8

DATE: 11–19–08

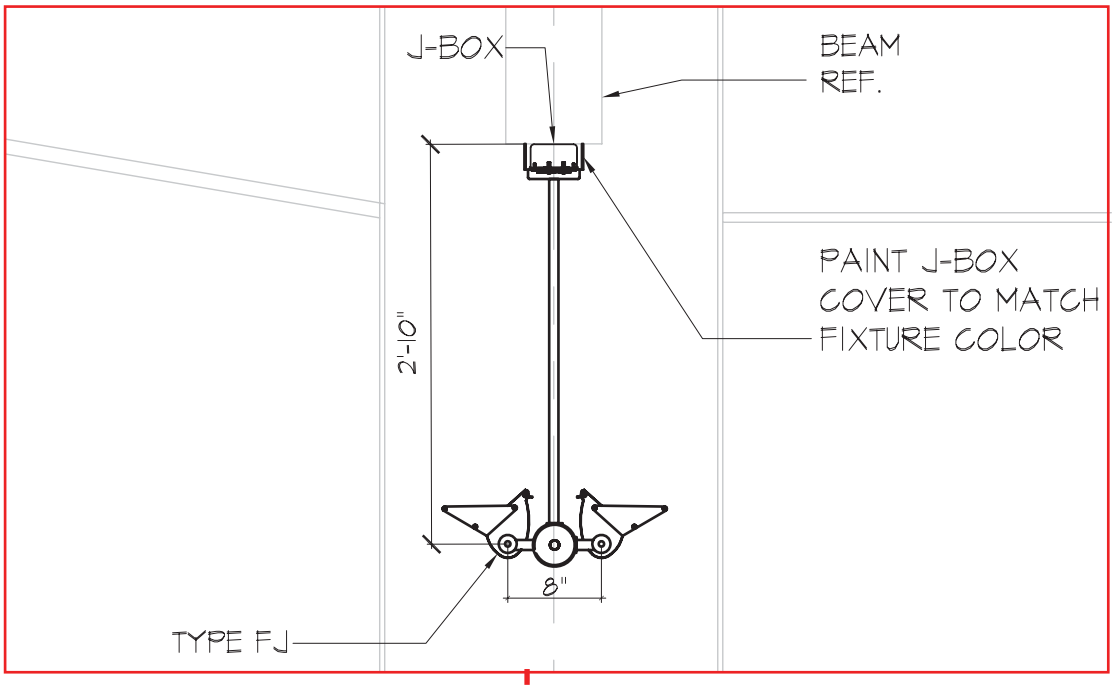
REVISIONS

A	FIRST SUBMITTAL
B	ADD SURF. CONDUIT BOX DWW 12–22–08
C	
D	

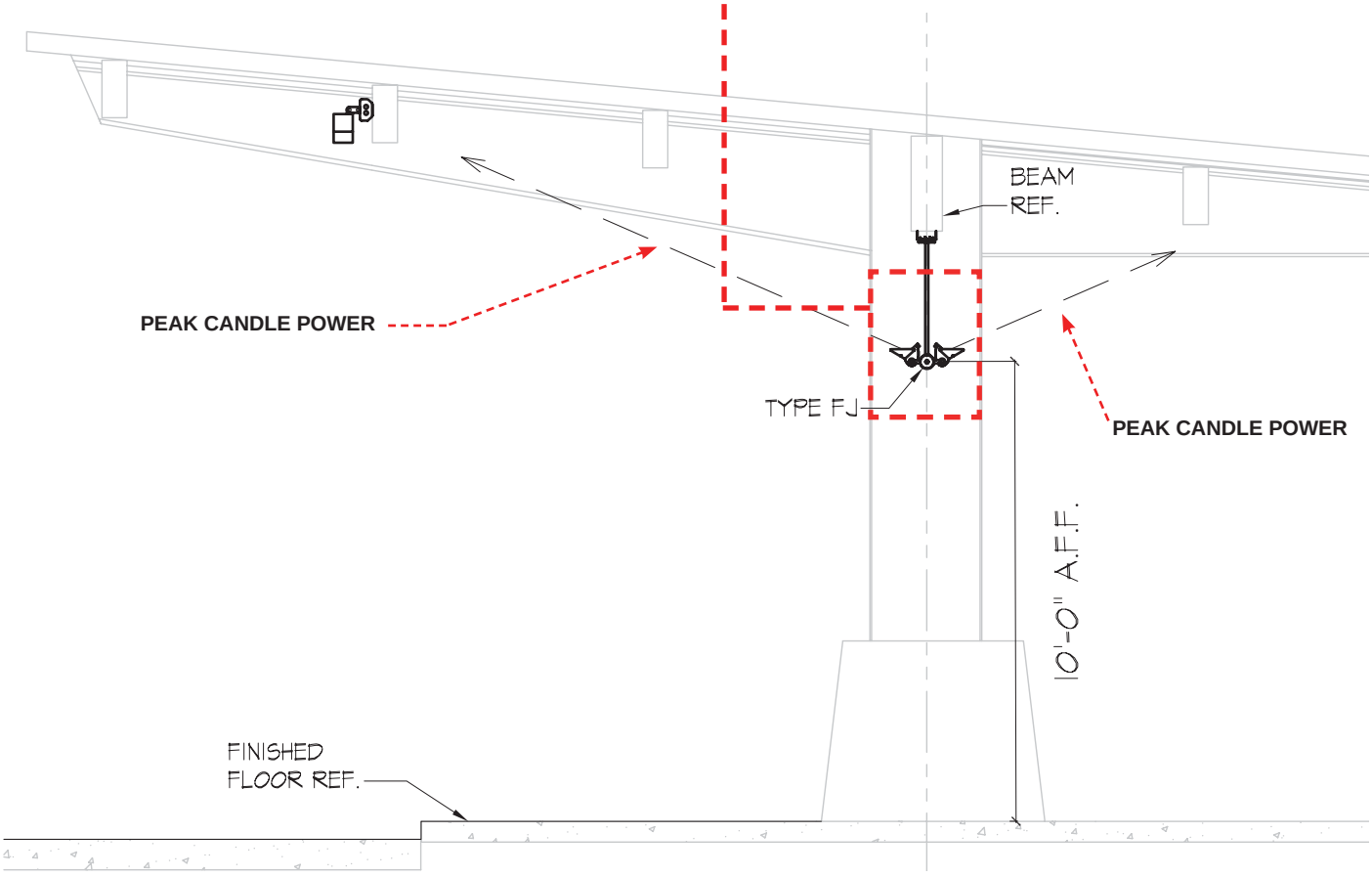
elliptipar®
...there is no equal™

114 BOSTON POST RD, WEST HAVEN, CONNECTICUT, 06516

See attached Lighting Fixture Schedule



MOUNTING DETAIL SECTION
Scale: N.T.S



Issued for Permit

FMS

Architect **Gensler**
Project **Portland International Jetport**

Date **26 October 2009**
Project No. **508667.00**

Type **FJ**

Fisher Marantz Stone Partners in Architectural Lighting Design 22 West 19th Street New York, NY 10011

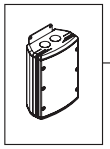
Issued for Permit

FMS

Architect **Gensler** Date **26 October 2009** Type **FK**

Project **Portland International Jetport** Project No. **508667.00**

Fisher Marantz Stone Partners in Architectural Lighting Design 22 West 19th Street New York, NY 10011



UNIVERSAL POWER MODULE UPM

HID

PM3RM SURFACE MOUNT

PROJECT:	
TYPE:	
CATALOG NUMBER:	
LAMP(S):	
NOTES:	

CATALOG NUMBER LOGIC

Example **PM3RM - SM - H50E - VER - MT**

Series
PM3RM - Remote Universal Power Module3

Mounting
SM - Surface Mount (requires side conduit entry)

Wattage
H35E - One (1) 35W Electronic Ballast
H50E - One (1) 50W Electronic Ballast
H70E - One (1) 70W Electronic Ballast
H100E - One (1) 100W Electronic Ballast
H150E - One (1) 150W Electronic Ballast

Finish

Aluminum Finish

Powder Coat Color	Satin	Wrinkle
Bronze	**BZP**	**BZW**
Black	**BLP**	**BLW**
White (Gloss)	**WHP**	**WHW**
Aluminum	**SAP**	—
Verde	—	**VER**

Also available in Premium Finishes
See submittal SUB-1439-00 for Premium Finishes

Input Voltage
MT - 120/208/240/277 Volt Multi Tap (Electronic Ballast)

B-K LIGHTING
40429 Brickyard Drive • Madera, CA 93636 • USA
559.438.5800 • FAX 559.438.5900
www.bklighting.com • info@bklighting.com

SUBMITTAL DATE	DRAWING NUMBER
8-3-07	SUB-1528-00

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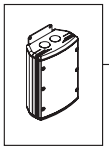


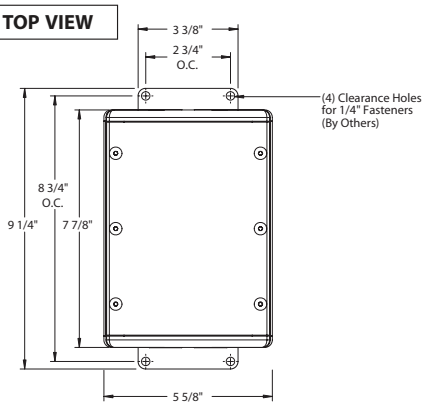
UNIVERSAL POWER MODULE UPM

HID

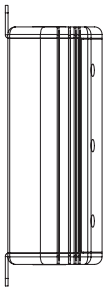
PM3RM SURFACE MOUNT

PROJECT:	
TYPE:	

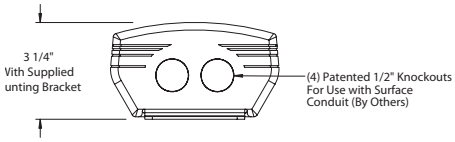
TOP VIEW



SIDE VIEW



END VIEW



SPECIFICATIONS

Body
Copper free, extruded aluminum and die cast end caps. (6) #10-24 Stainless Steel black oxide screws.

Installation
Stainless Steel Mounting Brackets with (4) clearance holes for 1/4" fasteners. (Finish to Match Housing). For use with surface conduit.

Patented Knockouts
(4) 3/4" NPT threaded patented Knockouts. IP-65 rated for wet location. High temperature O-Ring provides water tight seal upon reinsertion. For use with Surface Conduit (By Others).

Faceplate Tether
Cable wire attached to the inside cover with hook to loop over threaded stud located on one end of the housing. This allows faceplate to hang from UPM and makes for easy installation of ballast.

Hardware
Tamper-resistant, stainless steel hardware. UPM faceplate screws are additionally black oxided.

Ballast
[1] 35-150 watt, integral, high power factor, electronic ballast. Multi-Tap (120/208/240/277V) primary voltage. 50/60Hz.

Wiring
Teflon® coated wire, 18AWG, 600V, 250° C rated and certified to UL 1659 standard.

Finish
StarGuard® (Pat. Pend.), a 15 stage chromate-free process cleans and conversion coats aluminum components prior to application of Class 'A' TGIC polyester powder coating.

Warranty
5 year limited warranty.

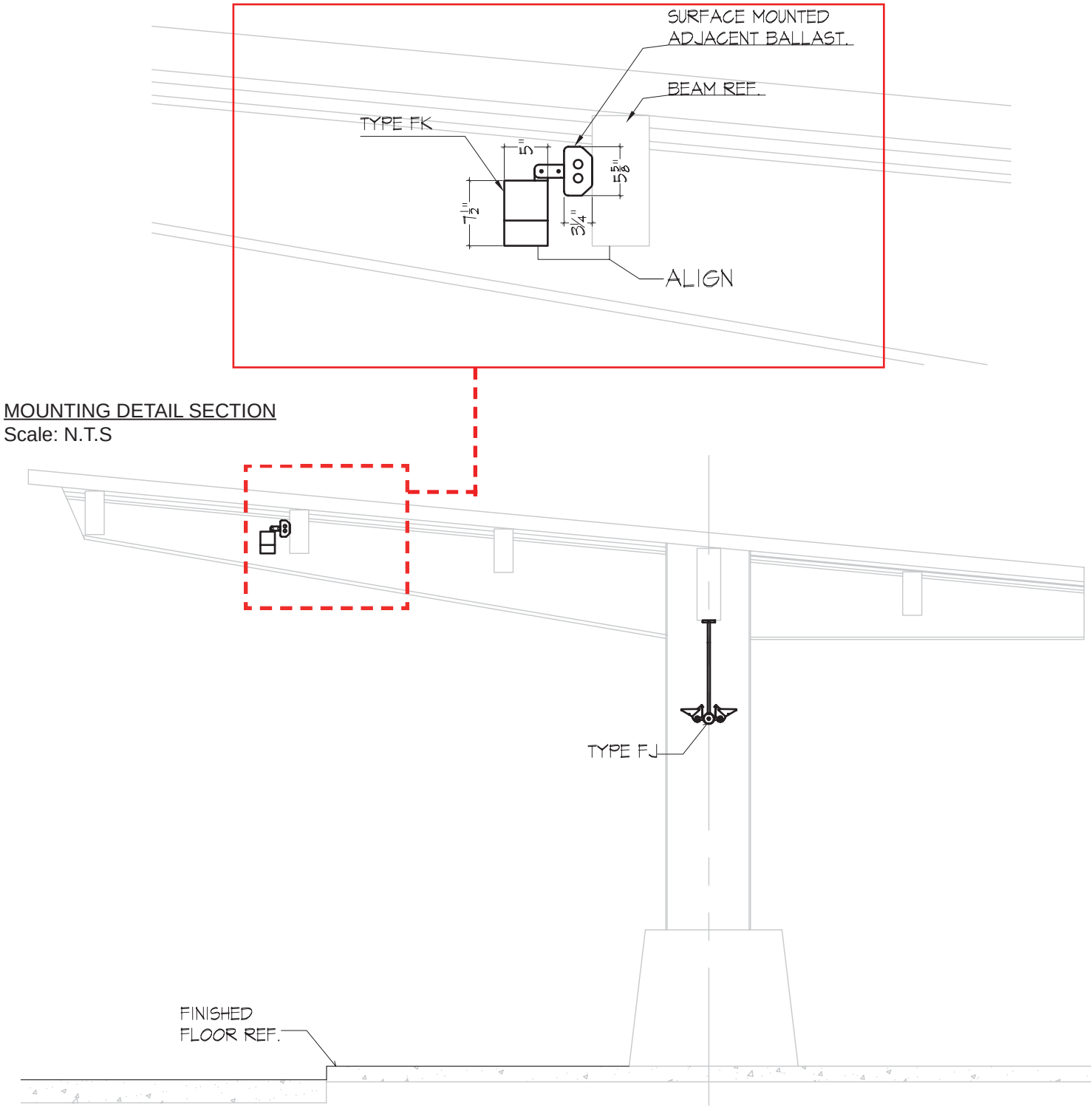
Listings
ARL and CSA listed.

®Teflon is a registered trademark of DuPont Corporation.
U.S. Patent Number 6,940,012 (Knockout)

B-K LIGHTING	40429 Brickyard Drive • Madera, CA 93636 • USA 559.438.5800 • FAX 559.438.5900 www.bklighting.com • info@bklighting.com	SUBMITTAL DATE 8-3-07	DRAWING NUMBER SUB-1528-00

Issued for Permit

See attached Lighting Fixture Schedule



MOUNTING DETAIL SECTION
Scale: N.T.S

Issued for Permit

PANOS

Horizontal Compact Fluorescent
(1) 18W, 26W, 32W or 42W Triple Tube

Open Recessed Downlight 7"

online Find it Fast 92

Applications: High quality performance, recessed downlights designed by architects, PANOS is a modular system providing outstanding optics, easier installation and maintenance, and unique accessories designed to provide better lighting and better visual appearance in modern spaces.

Type:_____

Project:_____

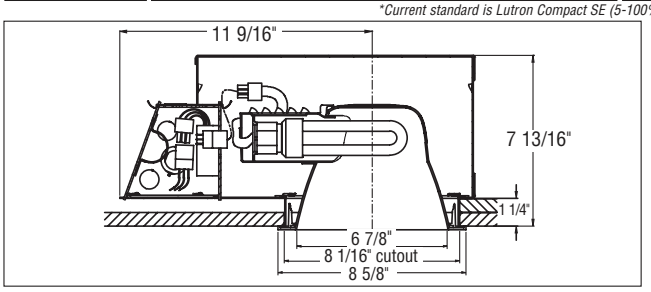
PANOS may be ordered as a complete fixture (see below) or as separate components.

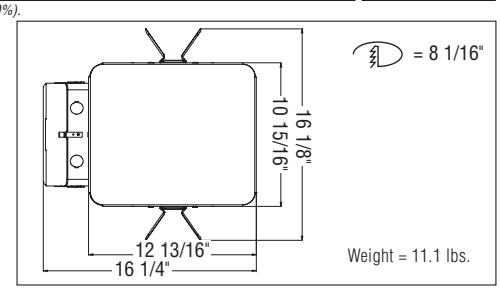
TO ORDER COMPLETE FIXTURE:

❶ Choose frame-in kit. ❷ Choose power module. ❸ Choose trim. Include accessories and options, if applicable.

1. FRAME-IN KIT	2. POWER MODULE/SOCKET			3. TRIM			4. ACCESSORIES
▼ Housing/ Aperture	▼ Lamp	▼ Ballast	▼ Options	▼ Trim Type	▼ Reflector Finish	▼ Trim Ring Finish	
CH7				OD7525			*See page PAN-13A and PAN-13B for accessories and other options available (glass elements, llouvers, mounting brackets)*
CH7 7" Covered Housing	**1H18CFTQ8** (1) 18W Triple Tube, horizontal **1H26CFTQ8** (1) 26W Triple Tube, horizontal **1H32CFTQ8** (1) 32W Triple Tube, horizontal **1H42CFTQ8** (1) 42W Triple Tube, horizontal	**U** 120V/277V **D1*** 120V dimming **D2*** 277V dimming	**EM1** Stand-By Battery Pack 120V **EM2** Stand-By Battery Pack 277V **F** Fusing	**OD7525** Open Downlight	**SF** Specular **MF** Matte **FF** Faceted **WF** White	**T** Titan **W** White	

**Current standard is Lutron Compact SE (5-100%).*





1. FRAME-IN KIT

May be ordered separately, depending on your installation, or may be ordered with plug-in Power Module pre-installed.

Mounting Frame - 16 gauge galvanized die-formed plaster frame suitable for accessible or inaccessible ceiling types. Rust-free aluminum aperture throat with a fixed depth of 1 1/4". Ceiling cutout: 8 1/16".

Mounting Brackets - Rigid mounting brackets provide 5" vertical adjustment from inside aperture and plenum side of housing. Built to accept numerous mounting options including C-channel mounting bars.

2. POWER MODULE

Plug-in module may be ordered with Frame-in Kit, alone, or with trim, depending upon your installation.

Lamp/Socket - (1) 18W, 26W, 32W or 42W compact fluorescent triple tube with socket (GX24q-2 for 18W, GX24q-3 for 26W/32W, and GX24q-4 for 42W). Lamps supplied by others.

Ballast/Wiring - Electronic 120/277 universal voltage ballast mounted on plug-in internal cover plate of junction box. Special wiring connections allow plug-in of reflector in preinstalled housings. Stand-By Battery Pack is IOTA I-42, integrally mounted on junction box cover. A remote test light/ switch is supplied. Operates on 120V or 277V, 60Hz only.

3. TRIM

May be ordered separately, or with Power Module, or with Frame-in Kit and Power Module for a complete fixture.

Reflector - 7" aperture molded, available in four finishes - specular for highest light output, matte for visual appearance and high output, facets for modern look and low brightness, and white for the softest output and consistency of brightness in ceiling.

Trim Ring - Allows for installation of reflector and ease of maintenance from below the ceiling, and allows attachment of lenses, louvers and decorative accessories.

4. ACCESSORIES

Lenses, louvers, decorative glass - See page PAN-13A and PAN-13B for details.

Suitable for damp locations
Approved for thru-wiring
Above ceiling access not required
Thermally protected

IBEW Union Made

NOTE: National or municipal codes must be followed regarding set back of thermal insulating material from fixture. **Fixtures are not designed for direct contact with thermal insulation.**

In a continuing effort to offer the best product possible we reserve the right to change, without notice, specifications or materials that in our opinion will not alter the function of the product. Technical specification sheets that appear on www.zumtobel.us are the most recent version and supersede all other versions that exist in any other printed or electronic form.

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5/3/06

ZUMTOBEL

Issued for Permit

FMS

Architect **Gensler** Date **26 October 2009** Type **FL**

Project **Portland International Jetport** Project No. **508667.00**

PANOS

Horizontal Compact Fluorescent
(1) 18W, 26W, 32W or 42W Triple Tube

Open Recessed Downlight, Accessories

7"

4. ACCESSORIES

▼ Accessories

DECO DROP GLASS

701-GR-AK	AKAMAR green drop glass
701-BL-AK	AKAMAR blue drop glass
701-WH-AK	AKAMAR white drop glass
702-GR-AD	ADHARA green drop glass
702-BL-AD	ADHARA blue drop glass
702-WH-AD	ADHARA white drop glass
703-WH-AL	ALHENA white drop glass

DECO DROP DISKS

704-CF-DD	Drop disk, clear outside, frosted inside
705-MC-DD	Drop disk, matte outside, clear inside
709-CM-DD	Drop disk, clear outside, matte inside

DECO DROP RINGS

706-CO-DR	Drop ring, clear open
707-MO-DR	Drop ring, matte open
708-BO-DR	Drop ring, blue open

DECO FLUSH-MOUNTED LENSES

701-FRD-LN	Flush-mounted lens, regressed diffused
702-FMD-LN	Flush-mounted lens, flush medium diffused
703-FC-LN	Flush-mounted glass lens, clear
704-FS-LN	Flush-mounted glass lens, UV
705-FO-LN	Flush-mounted glass lens, opal diffusion

DEKC LOUVERS

701-FT-LV	Flush turbo louver
702-FCB-LV	Flush cross-baffle louver

DECO SIGNAGE

701-INFO	Telephone signage
702-INFO	Info signage
703-INFO	Elevator signage
704-INFO	Women's rest room signage
705-INFO	Men's rest room signage

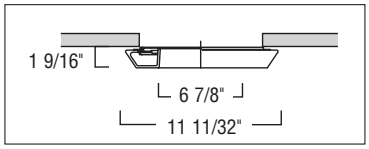
OTHER OPTIONS

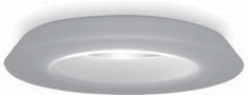
▼ Options

9930	Set of (2) 27" C-channel mounting bars
9952	Set of (2) 52" C-channel mounting bars
9954	Set of (2) 1-piece hanger bars w/ clips
9956	Set of (2) 28" 10 ga. 1-piece universal mounting bars

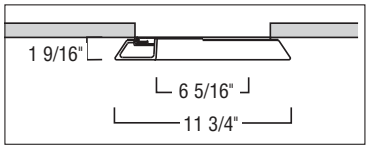
DECO DROP GLASS

AKAMAR drop glass

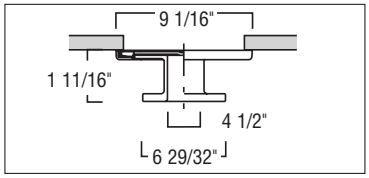




ADHARA drop glass

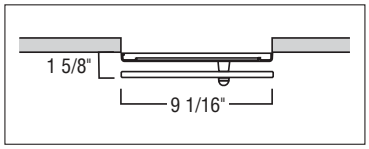


ALHENA drop glass (white only)

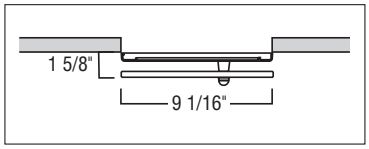


DECO DROP DISKS

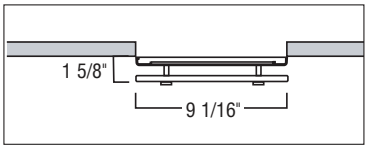
Drop disk, matte outside, clear inside



Drop disk, clear outside, matte inside



OPTOS-style drop disk, clear outside, frosted inside



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PAN-13A

ZUMTOBEL

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Photometric Data

CH7 1H32CFTQ8 OD7525 SF (1) 32W CFT

7" OPEN DOWNLIGHT, SPECULAR REFLECTOR

PRORATED FROM ST5133

Total Luminaire Efficiency 43%

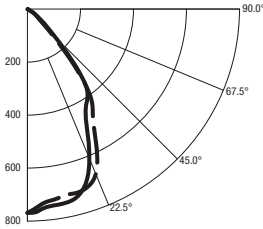
0% Uplight 100% Downlight

Spacing Criteria

Lateral Plane	0°	90°
	1.0	1.0

TOTAL LAMP LUMENS = 2400
INPUT WATTS = 36

Candela Distribution



Vertical Angle	Horizontal Angle 0°	45°	90°	Zonal Lumens
0°	769	769	769	
5°	733	751	752	66.8
15°	718	740	732	204.4
25°	623	587	542	266.0
35°	423	407	396	245.6
45°	113	133	145	110.6
55°	38	34	38	32.4
65°	2	2	1	3.2
75°	0	0	0	0.0
85°	0	0	0	0.0
90°	0	0	0	

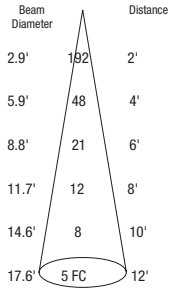
Luminance Data in Candela / Sq. Meter

Angle in Vertical°	Average 0°	Average 45°	Average 90°
45°	5110	5995	6541
55°	2115	1914	2115
65°	166	113	83
75°	0	0	0
85°	0	0	0

Coefficients of Utilization

Effective Floor Cavity Reflectance = 20%

pcc	0.8				0.7				0.5			0.3		
pw	0.7	0.5	0.3	0.1	0.7	0.5	0.3	0.1	0.5	0.3	0.1	0.5	0.3	0.1
0	52	52	52	52	51	51	51	51	48	48	48	46	46	46
1	49	48	47	46	48	47	46	45	45	44	44	44	43	42
2	47	44	42	41	46	44	42	40	42	41	39	41	40	39
3	44	41	39	37	43	40	38	36	39	37	36	38	36	35
4	41	38	35	33	41	37	35	33	36	34	33	35	34	32
5	39	35	32	30	38	35	32	30	34	32	30	33	31	30
6	37	33	30	28	36	32	30	28	32	29	27	31	29	27
7	35	30	27	25	34	30	27	25	29	27	25	29	27	25
8	33	28	25	23	32	28	25	23	28	25	23	27	25	23
9	31	26	24	22	31	26	24	22	26	23	22	25	23	22



Beam center footcandles shown in ''cone of light'' are initial, LLF = 1.0

CH7 1H32CFTQ8 OD7525 WF (1) 32W CFT

7" OPEN DOWNLIGHT, WHITE-PAINTED REFLECTOR

PRORATED FROM ST5134

Total Luminaire Efficiency 40%

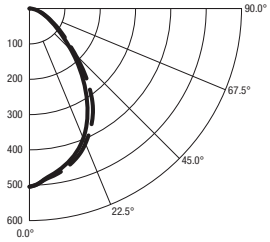
0% Uplight 100% Downlight

Spacing Criteria

Lateral Plane	0°	90°
	1.1	1.0

TOTAL LAMP LUMENS = 2400
INPUT WATTS = 36

Candela Distribution



Vertical Angle	Horizontal Angle 0°	45°	90°	Zonal Lumens
0°	504	504	504	
5°	487	487	485	43.0
15°	455	455	444	127.7
25°	396	394	377	180.2
35°	307	296	274	184.0
45°	182	182	168	139.4
55°	101	96	91	87.7
65°	54	53	51	53.3
75°	27	26	26	28.4
85°	7	7	7	7.5
90°	1	1	1	

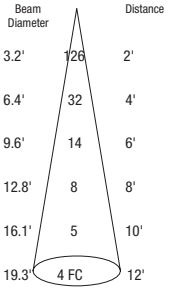
Luminance Data in Candela / Sq. Meter

Angle in Vertical°	Average 0°	Average 45°	Average 90°
45°	8229	8211	7579
55°	5615	5348	5059
65°	4094	4011	3882
75°	3305	3256	3169
85°	2454	2454	2454

Coefficients of Utilization

Effective Floor Cavity Reflectance = 20%

pcc	0.8				0.7				0.5			0.3		
pw	0.7	0.5	0.3	0.1	0.7	0.5	0.3	0.1	0.5	0.3	0.1	0.5	0.3	0.1
0	47	47	47	47	46	46	46	46	44	44	44	42	42	42
1	44	43	41	40	43	42	40	39	40	39	38	38	38	37
2	41	38	36	34	40	37	35	34	36	34	33	35	33	32
3	38	34	32	29	37	34	31	29	33	30	29	32	30	28
4	35	31	28	26	34	31	28	26	30	27	25	29	27	25
5	33	28	25	23	32	28	25	23	27	25	23	26	24	22
6	31	26	23	21	30	26	23	20	25	22	20	24	22	20
7	29	24	21	19	28	24	21	19	23	20	18	22	20	18
8	27	22	19	17	26	22	19	17	21	19	17	21	18	17
9	25	20	17	15	25	20	17	15	20	17	15	19	17	15



Beam center footcandles shown in ''cone of light'' are initial, LLF = 1.0

For additional photometric data (for other wattages or finishes), please contact the Zumtobel Tech Center for assistance.

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PAN-13C

ZUMTOBEL

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PANOS

Metal Halide
(1) T6-MH, 150W max.

Enclosed Recessed Downlight 5"

online Find it Fast 88

Applications: Unusually small diameter T6 metal halide recessed downlights designed by architects, PANOS is a modular system providing outstanding optics, easier installation and maintenance, and offers unique accessories designed to visually enhance modern spaces.

Type:_____

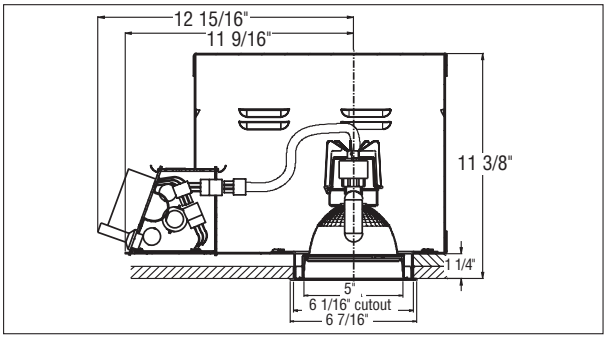
Project:_____

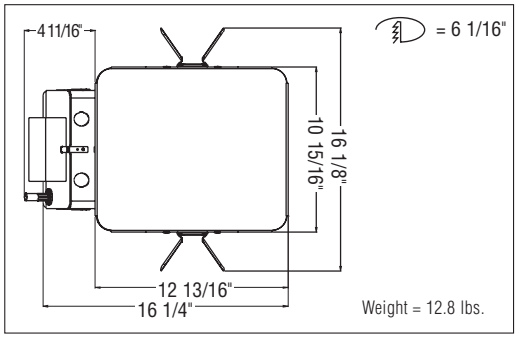
PANOS may be ordered as a complete fixture (see below) or as separate components.

TO ORDER COMPLETE FIXTURE:

❶ Choose frame-in kit. ❷ Choose power module. ❸ Choose trim. Include accessories and options, if applicable.

1. FRAME-IN KIT	2. POWER MODULE/SOCKET		3. TRIM			4. ACCESSORIES
▼ Housing/Aperture	▼ Lamp	▼ Ballast	▼ Trim Type	▼ Reflector Finish	▼ Trim Ring Finish	
CHD5	_____	_____	OD5810	SA	_____	*See page PAN-9A and PAN-9B for accessories and other options available (glass elements, lenses, and mounting brackets)*
CHD5 5" Covered Housing Deep	**39T6MH** (1) T6-MH, 39W **70T6MH** (1) T6-MH, 70W **150T6MH** (1) T6-MH, 150W	**1** 120V **2** 277V *Quartz restrike not available.*	**OD5810** Enclosed Downlight	**SA** Specular Alzak	**T** Titan **W** White	





1. FRAME-IN KIT

May be ordered separately, depending on your installation, or may be ordered with plug-in Power Module pre-installed.

Mounting Frame - 16 gauge galvanized die-formed plaster frame suitable for accessible or inaccessible ceiling types. Rust-free aluminum aperture throat with a fixed depth of 1 1/4". Ceiling cutout: 6 1/16".

Mounting Brackets - Rigid mounting brackets provide 5" vertical adjustment from inside aperture and plenum side of housing. Built to accept numerous mounting options including C-channel mounting bars.

2. POWER MODULE

Plug-in module may be ordered with Frame-in Kit, alone, or with trim, depending upon your installation.

Ballast/Wiring - 120V or 277V electronic ballast mounted on plug-in internal cover plate of junction box. Special wiring connections allow plug-in of ballast and reflector in preinstalled housings.

3. TRIM

May be ordered separately, or with Power Module, or with Frame-in Kit and Power Module for a complete fixture.

Lamp/Socket - (1) T6 metal halide lamp,150W max., with bi-pin G12 socket. Lamps supplied by others.

Reflector - 5" aperture specular aluminum reflector for high efficiency with precision facetted upper reflector beam control and cut-off. Safety glass supplied as standard.

Trim Ring - Allows for installation of reflector and ease of maintenance from below the ceiling, and allows attachment of lenses and decorative accessories.

4. ACCESSORIES

Lenses, decorative glass - See page PAN-9A and PAN-9B for details.

c UL us **LISTED**

Suitable for damp locations
Approved for thru-wiring
Above ceiling access not required
Thermally protected

IBEW Union Made

NOTE: National or municipal codes must be followed regarding set back of thermal insulating material from fixture. **Fixtures are not designed for direct contact with thermal insulation.**

In a continuing effort to offer the best product possible we reserve the right to change, without notice, specifications or materials that in our opinion will not alter the function of the product. Technical specification sheets that appear on www.zumtobel.us are the most recent version and supersede all other versions that exist in any other printed or electronic form.

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1/23/08

ZUMTOBEL

PANOS

Metal Halide
(1) T6-MH, 150W max.

Enclosed Recessed Downlight, Accessories 5"

4. ACCESSORIES

▼ Accessories

DECO DROP GLASS

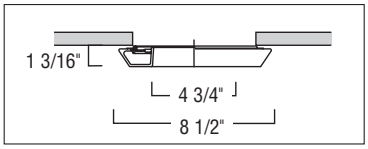
501-GR-AK	AKAMAR green drop glass
501-BL-AK	AKAMAR blue drop glass
501-WH-AK	AKAMAR white drop glass
502-GR-AD	ADHARA green drop glass
502-BL-AD	ADHARA blue drop glass
502-WH-AD	ADHARA white drop glass

DECO FLUSH-MOUNTED LENSES

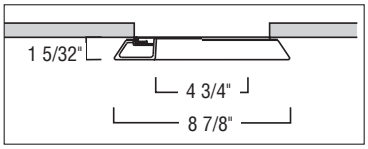
503-FC-LN	Flush-mounted glass lens, clear
504-FS-LN	Flush-mounted glass lens, UV

DECO DROP GLASS

AKAMAR drop glass



ADHARA drop glass



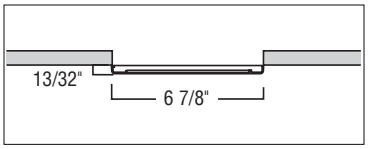
OTHER OPTIONS

▼ Options

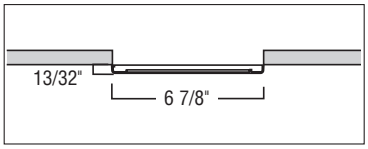
9930	Set of (2) 27" C-channel mounting bars
9952	Set of (2) 52" C-channel mounting bars
9954	Set of (2) 1-piece hanger bars w/ clips
9956	Set of (2) 28" 10 ga. 1-piece universal mounting bars

DECO FLUSH MOUNTED LENSES

Flush-mounted lens, clear



Flush-mounted lens, UV



3300 Route 9W • Highland, NY 12528-2630
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1/23/08

PAN-9A

ZUMTOBEL

Photometric Data

CHD5 70T6MH OD5810G8 SA (1) 70W T6 MH

5" OPEN DOWNLIGHT, SPECULAR REFLECTOR

PRORATED FROM ST5340

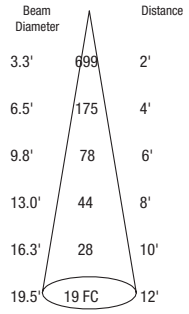
Total Luminaire Efficiency 73%

0% Uplight 100% Downlight

Spacing Criteria

Lateral Plane	0°	90°
	1.4	1.4

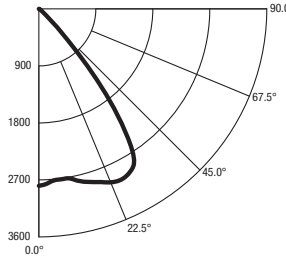
TOTAL LAMP LUMENS = 6600
INPUT WATTS = 77



Beam center footcandles shown in ''cone of light'' are initial, LLF = 1.0

For additional photometric data (for other wattages or finishes), please contact the Zumtobel Tech Center for assistance.

Candela Distribution



Vertical Angle	Horizontal Angle 0°	Zonal Lumens
0°	2795	
5°	2719	243.3
15°	2828	802.9
25°	2993	1372.5
35°	2408	1417.3
45°	387	375.5
55°	59	56.5
65°	21	21.9
75°	0	1.0
85°	0	0.0
90°	0	

Luminance Data in Candela / Sq. Meter

Angle in Vertical°	Average 0°	Average 45°	Average 90°
45°	32351	32351	32351
55°	6128	6128	6128
65°	2982	2982	2982
75°	0	0	0
85°	0	0	0

Coefficients of Utilization

Effective Floor Cavity Reflectance = 20%

pcc	0.8				0.7				0.5			0.3		
pw	0.7	0.5	0.3	0.1	0.7	0.5	0.3	0.1	0.5	0.3	0.1	0.5	0.3	0.1
0	87	87	87	87	85	85	85	85	81	81	81	78	78	78
1	82	80	78	77	81	79	77	75	76	74	73	73	72	71
2	78	74	71	68	76	73	70	67	70	68	66	68	66	65
3	73	68	64	61	72	67	64	61	65	62	60	64	61	59
4	69	63	59	55	68	62	58	55	61	57	54	59	56	54
5	65	58	54	50	64	58	53	50	56	53	50	55	52	49
6	61	54	49	46	60	54	49	46	52	48	45	51	48	45
7	58	50	46	42	57	50	45	42	49	45	42	48	44	42
8	55	47	42	39	54	46	42	39	46	41	38	45	41	38
9	51	44	39	36	51	43	39	36	43	38	36	42	38	35

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PAN-9B

ZUMTOBEL

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See attached Lighting Fixture Schedule

DELETED

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TRIPLES-H 126/5

recessed compact fluorescent downlight/wallwasher

Spec Sheet

COMPACT FLUORESCENT
1-364

FEATURES

Triples-H 126/5 is an efficient 5" aperture low brightness downlight, for use with one 26-watt, 4-pin, triple tube compact fluorescent lamp by GE, Sylvania or Philips. Triples-H 126/5 provides shielding angles of 38° parallel to and 40° perpendicular to the lamps. Recess depth is only 6".

One housing allows interchangeable use of downlight and wallwash reflectors, permitting housings to be installed first and reflectors to be installed or changed at any time.

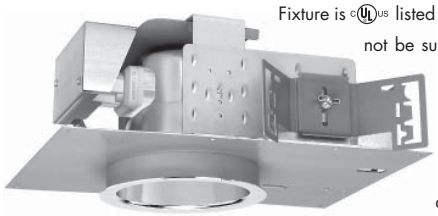
Triples-H 126/5 uses one 26-watt, 4-pin, triple tube lamp providing 1800 lumens (more than a 100-watt incandescent), a 10,000-hour life, a color rendering index (CRI) of 82, and color temperatures as warm as 2700°K (nearly duplicating the color qualities of incandescent).

Reflectors are available in clear, natural aluminum in three finishes: **EvenTone**, our standard clear finish, partially diffuse, anti-iridescent and gently luminous in appearance; **OptiTone**, specular and anti-iridescent, with minimum brightness and maximum efficiency; and **EasyTone**, diffuse and luminous. Additionally, reflectors are available in champagne gold, wheat, pewter, and bronze. Wallwash (120°) and double wallwash (2x120°) reflectors are also available.

Triples-H 126/5 includes a pair of mounting bars (¾" x 27" C channel). Specialty bars for wood joist and T-bar installations are available as accessories.

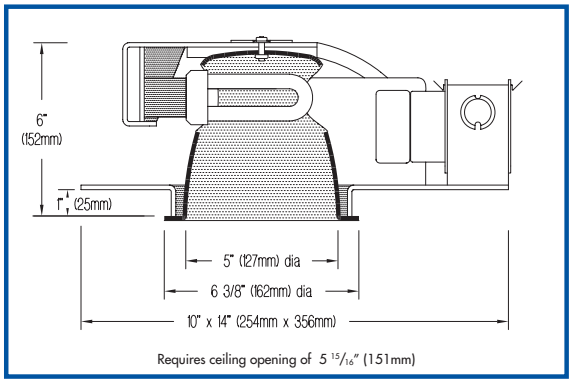
APPLICATIONS

Fixture is recommended for downlighting or wallwashing in offices, corridors, shops, banks, schools, hospitals and residences, as well as lobbies and public areas. The shallow recess depth allows mounting in constricted plenum situations.



Fixture is c UL us listed for Damp Location (may not be suitable for some outdoor environments). Fixture is prewired with high power factor Class P electronic ballast, suitable for use in a fire rated ceiling and approved for eight #12 wire 75°C branch circuit pull-through wiring. Removal of the reflector allows access to the ballast and junction box.

▶ We recommend the use of Sylvania Dulux® T/E (non-amalgam) lamps to virtually eliminate the possibility of reduced light output sometimes caused by a return air plenum or a nearby elevator, exterior door or air conditioning diffuser.



Requires ceiling opening of 5 15/16" (151mm)

PRODUCT CODE

For complete product code, list basic unit and select one item from each following box.

Basic Unit	TRPH 126/5

Reflector Type	
Downlight	no suffix
Wallwash	WW
Double Wallwash	DWW

Voltage			
120 volt service	120	277 volt service	277

Reflector and Flange Color	*Overlap*	*Flush*
EvenTone Clear	VOL	VFL
OptiTone Clear	COL	CFL
EasyTone Clear	ECOL	ECFL
Champagne Gold	GOL	GFL
Wheat	WHOL	WHFL
Pewter	POL	PFL
Bronze	ZOL	ZFL

Other reflector finishes are available on special order.

Standard reflector flange continues reflector finish. White painted flanges and custom painted flanges are available on special order. Add WF (white flange) or CCF (custom color flange).

OPTIONS

Specify by adding to the basic unit.

Dimmable 3-wire ballast; not for outdoor application	– DM
Emergency battery pack operates one lamp in event of power outage. Fixture footprint increases to 10 x 16 ¾" (254 x 425mm). Additional 2 ½" (63mm) is required to remove EM pack through aperture. Not for outdoor application	– EM
⅛" (3mm) thick **clear acrylic shield**, spring-mounted within reflector	– PS

▶ For combinations of the Options above, contact factory or Edison Price Lighting representative.

▶ A modified fixture suitable for 2" maximum ceiling thickness is available on special order. Contact factory.

▶ A modified fixture suitable for 347-volt service is available on special order. Contact factory.

▶ An install-from-below version of this fixture, suitable for installation outside North America, is also available. Contact factory.

▶ Decorative reflector rings are available on special order. Contact factory.

EDISON PRICE LIGHTING
41-50 22ND STREET, LIC NY 11101 TEL 718.685.0700 FAX 718.786.8530 www.epl.com

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FMS

Architect **Gensler**
Project **Portland International Jetport**

Date **26 October 2009**
Project No. **508667.00**

Type **FP**

TRIPLES-H 126/5

EDISON PRICE LIGHTING

PHOTOMETRIC REPORT

LTL *Luminaire Testing Laboratory Report No. 04507. Original test report furnished upon request.*

Luminaire ..... recessed compact fluorescent downlight with spun aluminum reflector
Lamp ..... Philips 26-watt triple-tube compact fluorescent, 4-pin, GX24q-3 base, 1800 lumens
Efficiency 46.4%
Spacing Criteria..... 0°- 1.3, 90°-1.4, 180°-1.4
Axis orientation..... 0° plane is parallel to lamps, opposite sockets

BALLAST INFORMATION

Voltage	*120*	*277*
Input Watts	28	28
Line Current (A)	.25	.11
Power Factor (%)	>98	>98
THD (%)	<10	<10
Min. Starting Temp* (°F)	0	0

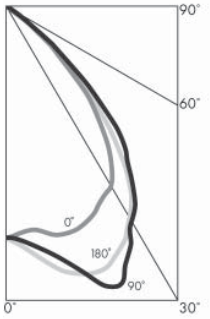
**Consult lamp manufacturers for specific temperatures.*

ZONAL LUMEN SUMMARY

Zone	*Lumens*	*% Lamp*	*% Fixture*
0 - 30°	413	22.9	49.4
0 - 40°	652	36.2	78.1
0 - 60°	834	46.3	99.9
0 - 90°	834	46.4	100.0
90 -180°	0	0.0	0.0
0 -180°	834	46.4	100.0

CANDLEPOWER DISTRIBUTION *(Candela)*

Vertical Angle	*Horizontal Angle*				
	0	*45*	*90*	*135*	*180*
0	439	439	439	439	439
5	442	448	456	458	460
15	468	506	511	534	507
25	434	457	523	496	479
35	363	369	409	387	372
45	201	205	219	205	178
55	17	16	15	16	10
65	0	0	0	0	0
75	0	0	0	0	0
85	0	0	0	0	0
95	0	0	0	0	0



LUMINANCE DATA *(Candela/m²)*

Vertical Angle	*Average 0° Longitude*	*Average 90° Longitude*	*Average 180° Longitude*
45	21357	21782	23269
55	2227	2096	1965
65	0	0	0
75	0	0	0
85	0	0	0

To convert cd/m² to footlamberts, multiply by 0.2919.

COEFFICIENTS OF UTILIZATION – ZONAL CAVITY METHOD

Effective Floor Cavity Reflectance 20%

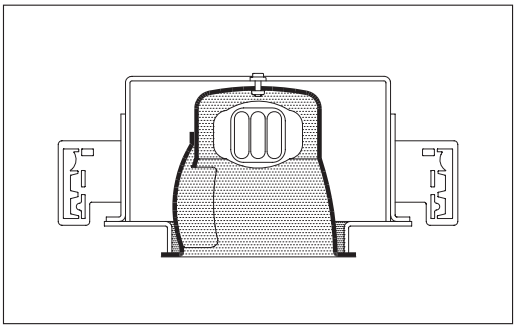
Ceiling Reflectance (%)	*80*				*70*				*50*			*30*			*10*			*0*
Wall Reflectance (%)	*70*	*50*	*30*	*10*	*70*	*50*	*30*	*10*	*50*	*30*	*10*	*50*	*30*	*10*	*50*	*30*	*10*	*0*
Room Cavity Ratio																		
0	55	55	55	55	54	54	54	54	51	51	51	49	49	49	47	47	47	46
1	52	51	50	49	51	50	49	48	48	47	46	46	46	45	45	44	44	43
2	50	47	45	43	49	46	45	43	45	43	42	43	42	41	42	41	40	39
3	47	44	41	39	46	43	41	39	42	40	38	40	39	37	39	38	37	36
4	44	40	37	35	43	40	37	35	39	36	35	38	36	34	37	35	34	33
5	41	37	34	32	40	36	34	32	36	33	31	35	33	31	34	32	31	30
6	39	34	31	29	38	34	31	29	33	30	29	32	30	28	32	30	28	27
7	36	31	28	26	36	31	28	26	30	28	26	30	27	26	29	27	25	25
8	34	29	25	23	33	28	25	23	28	25	23	27	25	23	27	25	23	22
9	31	26	23	21	31	26	23	21	25	22	20	25	22	20	24	22	20	20
10	29	24	21	18	28	24	20	18	23	20	18	23	20	18	22	20	18	18

TRIPLES-H 126/5 WW

WALLWASH INFORMATION

Distance From Ceiling (Feet)	*2'6" From Wall; 2'6" O.C.*		*3' From Wall; 3' O.C.*	
	Below Fixture	*Between Fixtures*	*Below Fixture*	*Between Fixtures*
1	10	8	7	5
2	13	12	9	8
3	15	14	10	9
4	14	14	11	10
5	12	12	10	10
6	9	10	8	8
7	8	8	7	7
8	6	6	6	6
9	5	5	5	5
10	4	4	4	4

All vertical footcandles are initial values with no contribution from ceiling or floor reflectances. Computation performed with at least five wallwashers.



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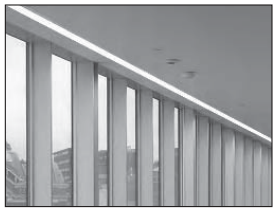
M100 Recessed Linear Fluorescent Asymmetrical Flanged Extrusion

se'lux®



Project: _____ **Type:** _____ **Qty.** _____

_____ – _____ – _____ – _____ – _____ – _____ – _____ –

Fixture Series | Lamp Type | Shielding | Mounting | Nominal Length | Finish | Voltage

MODIFIED TO 1T8 LAMPING

Options (refer to separate data sheets for ordering codes and details)

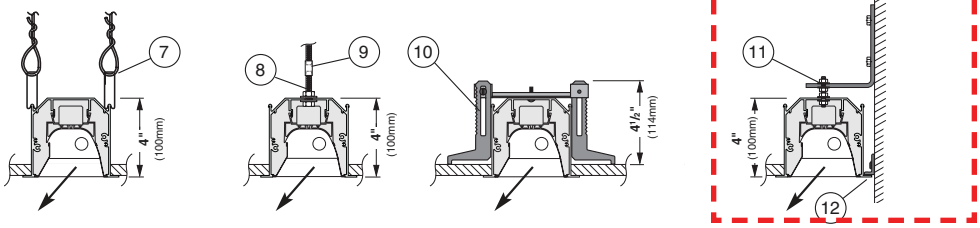
Fixture Series	Lamp Type	Shielding	Mounting	Nominal Length	Finish	Voltage	Options
M1RA1 M100 Recessed Asymmetrical Continuous Flange (Flanged Extrusion/ Flanged Endcaps) **M1RA2** M100 Recessed Asymmetrical Flush End (Flanged Extrusion/ Flangeless Endcaps)	**1T5** F28T5 **1T5HO** F54T5HO	**AMP** Asymmetric Silky Specular Louver **SD** Satine Lens	**SH** Suspension Clips **TS** 1" Studs (factory installed) **RC** Rotating Crossbars **PM** Perimeter Mount	**004** 4 foot **008** 8 foot **012** 12 foot For actual lengths see following page. For other lengths, configurations indicate nominal length rounded to the next highest foot. Factory will supply layout drawings. Individual fixtures cannot be field joined.	**WH** White **BK** Black **SV** Silver **SP** Specify RAL#	**120** **277** **347**	**TB** Lengths to Fit 2' Grid T-Bar Ceiling System[1] **(qty.)EM** Stand-by Battery Pack[2] (prefix quantity, i.e. - **5EM**) **FS** Single Fusing **DM** Dimming[2] (specify system) **DMA** Digital Addressable Dimming[2] **FW** Flex Whip (standard) **FW1** Flex Whip (dimming) **DL** Suitable for Damp Locations **CCEA** Chicago Plenum **Downlights** (See MR16 spec sheets, pp.98-99)

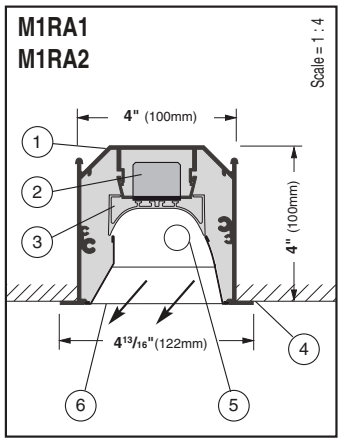
[1]T5 & T5HO lamps only, consult factory for other lamps. [2]Must be low profile ballasts (1½" W x 13/16" H); consult factory for details. [3]Consult factory for details.

Mounting Diagrams

Scale = 1 : 8

Suspension Clips (SH) | Pre-installed Rod (TS) | Rotating Crossbars (RC) | Perimeter Mount (PM)





1. Housing - Continuous, 6063-T5 extruded aluminum profile up to 16 feet long. Joined with Connector Plus Joining System for ease of installation and to assure a uniform appearance.

2. Ballast - Electronic, high power factor, class "P", type "A" sound rating. Specify 120v, 277v, or 347v. Ballast is factory pre-wired with leads to one end of fixture. Consult factory for ballast options.

3. Gear Tray - Extruded aluminum,with white painted finish. Gear tray installed as a complete electrical unit and is held in place with knurled dress nuts. It is fully accessible from below ceiling.

4. Flange - 1/2" (12mm) wide flange runs full lengths of both sides and is part of the main extruded body. Specify continuous flange (M1RA1) or flush end (M1RA2).

5. Lamps - As noted (by others). Other lamp lengths or wattages available, consult factory.

6. Shielding - Louvers offer excellent glare control in longitudinal, lateral, and all diagonal planes. High quality aluminum louvers and acrylic shielding allow true freedom of layout for contemporary modern spaces.

7. Spring steel suspension clips - Supplied two places, located nominally every 4 ft. Support wires Supplied and installed by others.

8. Pre-installed 1" 1/4-20 Stud - Attached to fixture every nominal 4 feet.

9. Coupling and Threaded Rod to Structure - Supplied and installed by others.

10. Rotating Crossbars - For inaccessible ceilings, adjustable for ceiling thicknesses from **1/4"** to **2".** Support required nominally every 4'.

11. Steel Wall Bracket and 1/4-20 rod supplied nominally every 4 ft. (Fasteners to wall and wall anchors by others)

12. Aluminum Wall Bracket - Secured to wall (fasteners and wall anchors by others) and runs entire length of fixture. Also supplied for width of fixtures when supplied with continuous flange. Allows for 1/8" gap between flange and wall to create shadow line allowing for unevenness of wall.

Interior Luminaire Finish - Standard interior colors are White (WH), Black (BK) and Silver SV). RAL colors (SP) are available, please specify RAL#.

TEL: (845) 691-7723
FAX: (845) 691-6749
www.selux.com/usa
M1RA1-01 (v5.0)

c UL us LISTED

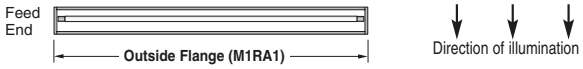
Union Made Affiliated with **IBEW** *Local 363*

M100 Recessed Linear Fluorescent Asymmetrical Flanged Extrusion

se'lux®

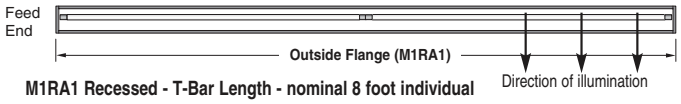
M1RA1 and M1RA2 Layout Dimensions

M1RA1/M1RA2 Recessed - nominal 4 foot individual

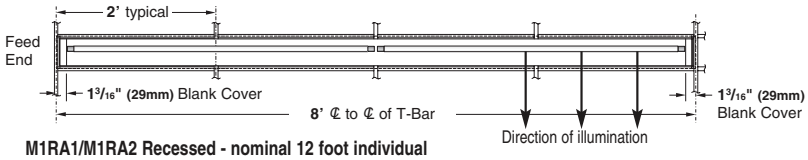


M1RA1 Recessed - T-Bar Length - nominal 4 foot individual

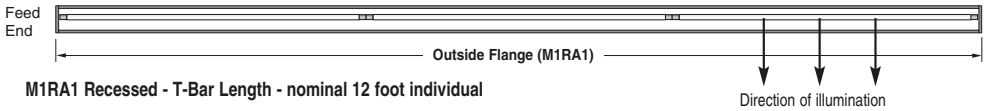
M1RA1/M1RA2 Recessed - nominal 8 foot individual



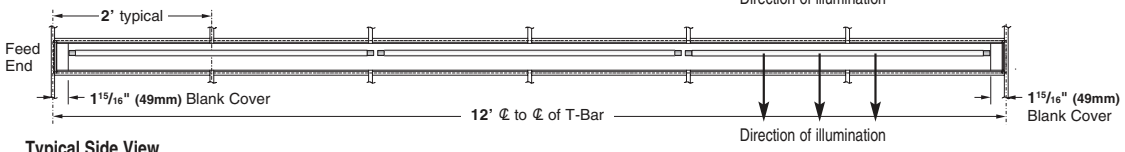
M1RA1 Recessed - T-Bar Length - nominal 8 foot individual



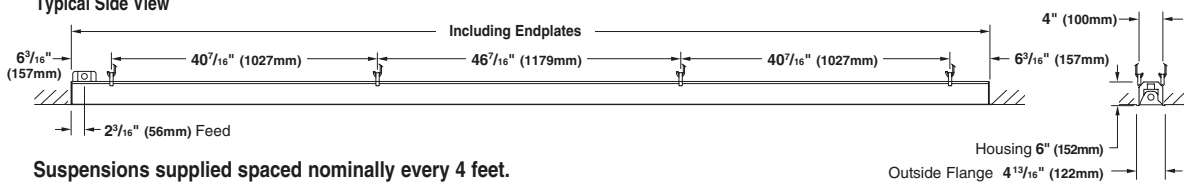
M1RA1/M1RA2 Recessed - nominal 12 foot individual



M1RA1 Recessed - T-Bar Length - nominal 12 foot individual



Typical Side View



Continuous Flange (M1RA1)

Flush End (M1RA2)

Suspensions supplied spaced nominally every 4 feet.
Fixture supplied with 7/8 knockout located 2 3/16" from end in top of fixture.

	T5 (1 or 2 lamp)				T8 (1 lamp)	
	M1RA1/M1RA2 Including Endplates	M1RA1 Outside Flange	M1RA1/M1RA2 - TB Including Endplates	M1RA1 - TB Outside Flange	M1RA1/M1RA2 Including Endplates	M1RA1 Outside Flange
4 foot individual	46.81" (1186mm)	47.58" (1209mm)	47.03" (1195mm)	47.91" (1216mm)	48.33" (1228mm)	49.20" (1250mm)
8 foot individual	93.21" (2365mm)	94.00" (2388mm)	95.03" (2414mm)	95.91" (2436mm)	96.37" (2448mm)	97.24" (2470mm)
12 foot individual	139.65" (3544mm)	140.41" (3567mm)	143.03" (3633mm)	143.91" (3655mm)	144.41" (3668mm)	145.28" (3690mm)

For other lengths, lamping, continuous runs or configurations please specify overall length (in feet), accessories desired and sketch/drawing of configuration. SELUX will detail project drawings upon order and supply submittal drawings for approval. Individual fixtures cannot be field joined. If you have any questions please contact SELUX customer service or applications engineering for assistance (1-800-SELUX-CS).

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PO Box 1060, 5 Lumen Lane / Highland, NY 12528
TEL: (845) 691-7723 / FAX: (845) 691-6749
E-mail: seluxus@selux.com / Web Site: www.selux.com/usa
M1RA1-02 (02/06)

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FMS

Architect **Gensler** Date **26 October 2009** Type **FQ**
Project **Portland International Jetport** Project No. **508667.00**

See attached Lighting Fixture Schedule

DELETED

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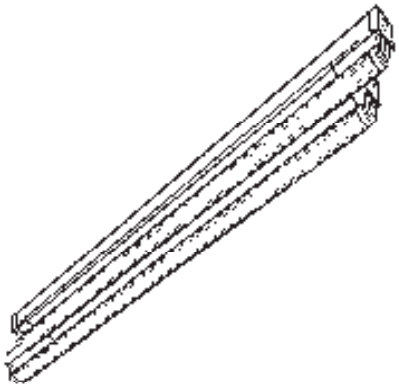
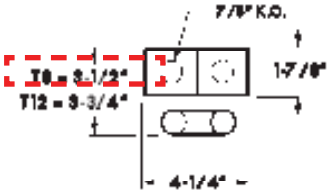
1 OR 2 LAMP **STAGGERED STRIP**

SERIES **74**

VOLTAGE TYPE JOB





SPECIFICATIONS

- HOUSING – 22 gauge die formed C.R.S. with welded end plates
- FINISH – White powder coating with multi-stage iron/phosphate prepared metal. 92% minimum average reflectance
- ELECTRICAL – Electronic ballast standard (where available), rated Class P
- LABELS – cULus listed as fluorescent luminaire suitable for dry or damp locations.
- MOUNTING – Surface or suspended

FEATURES

- 3" housing offset ensures uniform illumination in continuous row applications — ideal for cove lighting
- Factory mounted, pre-wired sockets cut installation time
- Welded end plates provide added strength
- One quarter-turn fastener secures wireway cover to housing
- Ballast secured by two captive bolts and nuts to ensure a tight, reliable fit for maximum heat dissipation and minimal ballast noise
- All parts painted after fabrication to facilitate installation, increase efficiency and inhibit corrosion

SUBMITTAL INFORMATION

For more options, accessories, and product details refer to Information Section

LAMP WATTAGE/TYPE
17 = 2', 17 watt T8
25 = 3', 25 watt T8
32 = 4', 32 watt T8
59 = 5', 59 watt T8, slimline
86 = 6', 86 watt T8, HO

ALUM = Aluminum fixture, painted after fabrication
EM7 = Emergency battery pack IB70A1 or equivalent

VOLTAGE
120 = 120V
277 = 277V

74-4-232-OPTIONS-EB2-120

LUMINAIRE SERIES

NOMINAL LENGTH
2 = 2 ft.
3 = 3 ft.
4 = 4 ft.
5 = 5 ft.
6 = 6 ft.

TOTAL LAMPS
1, 2 or 4

BALLAST TYPE (dependent on specified lamp type)
EB1 = 1 lamp electronic ballast
EB2 = 2 lamp electronic ballast
EB4 = 4 lamp electronic ballast
EBH2 = 2 lamp electronic ballast <10% THD

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See attached Lighting Fixture Schedule

74 SERIES | PHOTOMETRY INFORMATION

Williams Catalog #74-4-232-EB2-120
Test Report #6588.0, Dated 12/27/95

Lamp Type: F32T8/SPX35/RS
Lamp Quantity: 2

CANDLEPOWER DISTRIBUTION

VERT. ANG.	HORIZONTAL ANGLE 0	45	90	ZONAL LUMENS
0	1102.	1102.	1102.	
5	1104.	1107.	1112.	105.7
15	1109.	1140.	1170.	323.0
25	1004.	1062.	1140.	500.6
35	873.	1021.	1140.	636.1
45	724.	964.	1133.	731.6
55	542.	845.	1067.	743.4
65	353.	734.	1015.	712.0
75	145.	588.	753.	553.6
85	28.	371.	449.	313.6
90	3.	293.	388.	
95	0.	308.	456.	299.0
105	0.	325.	561.	320.9
115	0.	251.	445.	227.4
125	0.	144.	346.	147.6
135	0.	61.	221.	71.9
145	0.	22.	112.	25.3
155	0.	0.	17.	2.7
165	0.	0.	0.	.0
175	0.	0.	0.	.0
180	0.	0.	0.	

LUMEN SUMMARY

ZONE	LUMENS	% LAMP	% FIXTURE
0 - 30	930.	15.6	16.3
0 - 40	1566.	26.5	27.4
0 - 60	3041.	51.5	53.2
0 - 90	4620.	78.3	80.8
90 - 120	847.	14.4	14.8
90 - 130	995.	16.9	17.4
90 - 150	1092.	18.5	19.1
90 - 180	1095.	18.6	19.2
Total Luminaire			
0-180	5715.	96.9	100.0

TOTAL LUMINAIRE
OPTICAL EFFICIENCY – 96.9 %
SPACING CRITERIA: ACROSS– 1.6 ALONG– 1.3

ZONAL CAVITY COEFFICIENTS

EFFECTIVE FLOOR CAVITY REFL. = .20

CEILING	[illegible]			[illegible]			[illegible]		
WALL RCR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0	[illegible]	[illegible]	[illegible]	1.06	1.06	1.06	.97	.97	.97
1	100	.94	.90	.93	.90	.86	[illegible]	.79	.76
2	.90	[illegible]	.74	.85	.77	.71	.71	[illegible]	[illegible]
3	[illegible]	.70	[illegible]	.77	[illegible]	.60	[illegible]	[illegible]	[illegible]
4	.74	[illegible]	[illegible]	.70	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	.54	[illegible]	.64	[illegible]	.44	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.42	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	.54	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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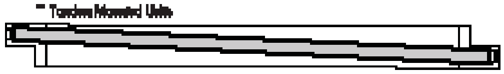
10	[illegible]	[illegible]	.24	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

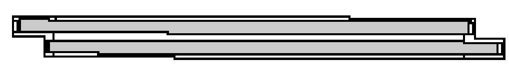
1 LAMP CROSS SECTION		
LAMPING	NOMINAL LENGTH	OVERALL LENGTH
1-17	21"	24"
1-25	33"	36"
1-32	45"	48"
2-25"	66"	69"
1-72SL	69"	72"
2-32"	90"	93"
1-59 or 1-96	93"	96"

" Tandem Mounted Units

2 LAMP CROSS SECTION		
LAMPING	NOMINAL LENGTH	OVERALL LENGTH
2-17	24"	27"
2-25	36"	39"
2-32	48"	51"
4-25"	72"	75"
4-32" or 2-59 or 2-96	96"	99"

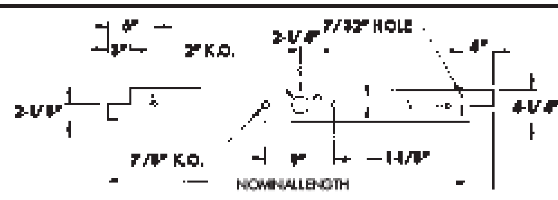
" Tandem Mounted Units





BACK VIEW

NOTE:
Center punching is in 4' & 8' units only



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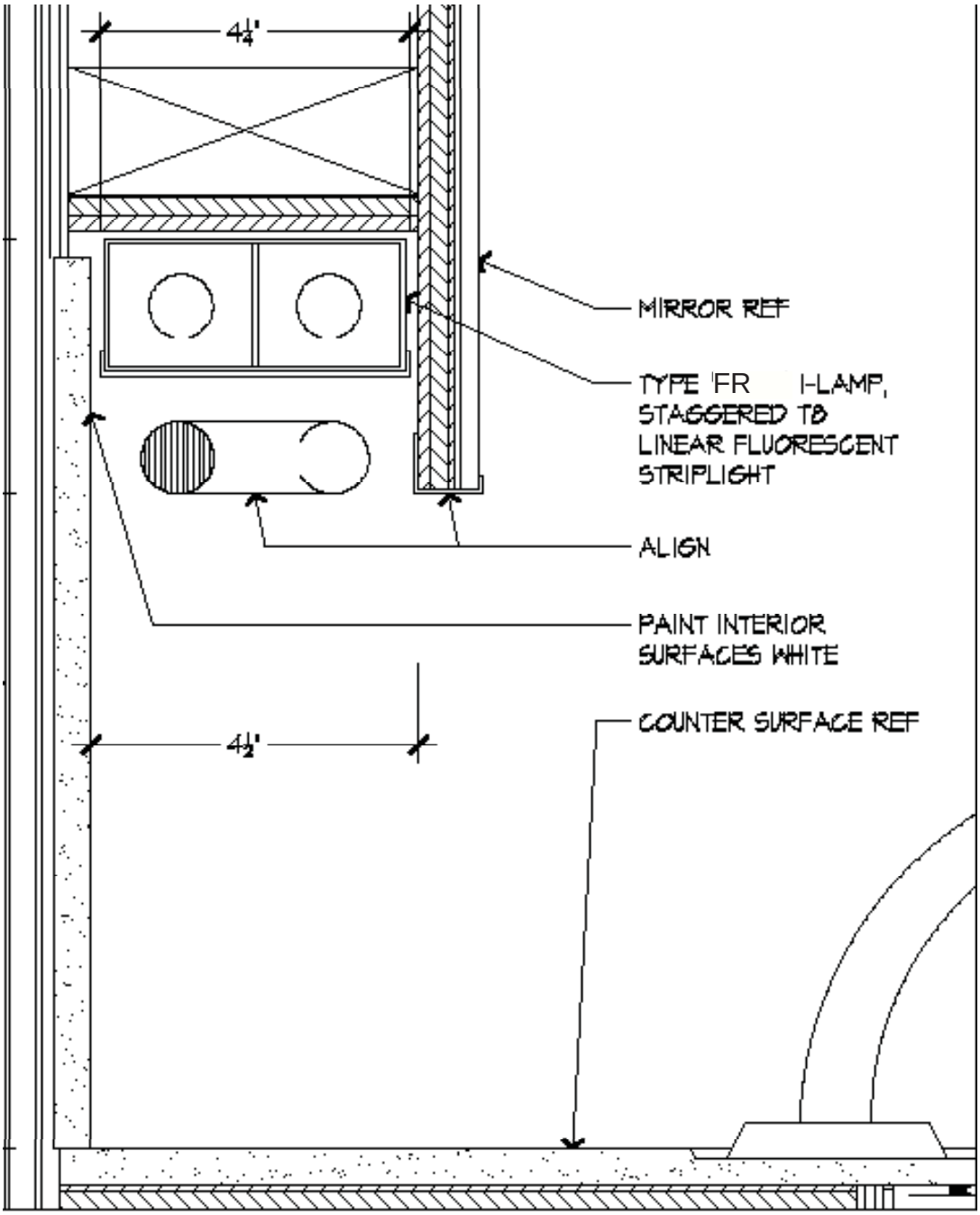

MOUNTING DETAIL
Scale: N.T.S

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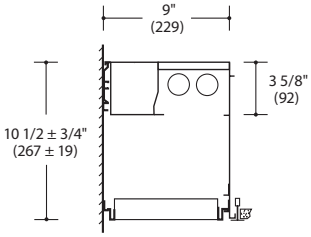
LITECONTROL

Type:
Project:

Wall/Slot®-II

85N
Recessed Perimeter

Specifications



baffle shown in flush **F**/position

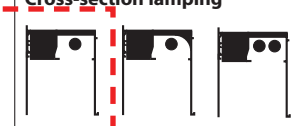
FIXTURE SUPPORT RAIL. Extruded white aluminum, wall-mounted rail provides continuous support and true alignment of fixtures and components. Rail is designed to provide a reveal at the wall to compensate for irregularities in wall construction. Galvanized splines are included for continuous alignment. A hook-and-lock system provides quick installation and horizontal adjustment.
FIXTURE HOUSING. Components are manufactured using computer-controlled dies to assure precise tolerance. Housing is with an 18-gauge steel integrated rear support channel having captive leveling screws to provide field adjustment.
FIXTURE REFLECTOR SHIELDS. Die-formed 24-gauge steel having a continuous channel at ceiling juncture with locking and splining clips for attaching to ceiling trims. Shields are designed to provide 1 1/2" vertical adjustment.
LAMPING. Available in one- and two-lamp T8.
BALLAST. Electronic Ballast (**ELB**), high power factor, thermally protected Class P, Sound Rated A, less than 10% THD, manufactured by a UL Listed manufacturer, as available, determined by Litecontrol. Ballasts with a voltage range of 120 to 277 will be used when fixture configuration and ballast availability allow. The minimum number of ballasts will be used.
CEILING TYPE. Compatible with most types of ceiling systems, including grid and plaster. Fixture system must be installed prior to installation of ceiling. Finish of wall should extend 11" above finished ceiling height. See Wall/Slot-II Pre-Installation Manual for specific ceiling type details.
CERTIFICATION. Fixture and electrical components shall be UL and/or CUL Listed and shall bear the I.B.E.W., A.F. of L. label.
Note: Litecontrol reserves the right to change specifications without notice for product development and improvement.

Ordering guide

Product, lamping, & length

85N -	1	4	T8 -
Series	Lamp Count	Nominal Length(ft)	Lamp Type
85N	**1, 2 →**	**2**	**T8**
	1, 2 →	**3**	
	1, 2 →	**4**	
	2, 4 →	**6**	
	2, 4 →	**8**	
	see **notes**		

Cross-section lamping



Options

S/	BW -	CWM -	G -	ELB -	EF -	120
Shielding Position	Diffuser	Finish	Ceiling Type	Ballast	Other options	Volts
S/	**BW**	**CWM** (Matte White) is standard	**G**	**ELB** is standard	**EF**	**120**
R/	**PBSS**		**CT**		**F**	**277**
F/	**PAT.12(XA)**		**CZ**	**DA-ELB**	**PR**	
	FP		**DP**	**HEL/ELB**	**TW**	
see **Shielding position**	see **Diffusers**		see **Ceiling type**	**ECO/ELB**	**DS**	
				see **Ballast options**	**SDS**	
					see **Other options**	

notes:
Lamp Count = total number of lamps in the fixture
Tandem Wiring not available for one-lamp cross-section fixtures
For Ordering guide information in shaded areas, choose selection by reading ACROSS the shaded areas for correct specifications.

85N14T8-S/BW-CWM-G-ELB-EF-120 is a typical catalog number for a 1-lamp (1 lamp in cross-section), 4-foot long T8 fixture with blade baffle shielding at top, Matte White finish, for mounting in a lay-in ceiling, electronic ballast, emergency fluorescent ballast, 120 volts.

Questions to Ask
1. 120 or 277 volt? **2.** Row information, including desired fixture lengths?
3. Diffuser type? **4.** Tandem wiring? **5.** Ceiling type? **6.** Other options?

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Shielding position

–/ Open*. No shielding is used at the ceiling opening.
S/ Shielding at Top. A baffle or lens diffuser may be used just below the lamp (S/position) to shield lamps from view while maintaining a clean, floating appearance.
R/ Regressed. Baffle or lens diffuser is positioned above ceiling line, to shield the lamp and fixture from view. Baffle regressed 1"; lens 1 3/4". **PR** one-lamp version only.
F/ Flush. Baffle is positioned flush with the ceiling to complete the ceiling plane. Len regressed 3/4". **PR** one-lamp version only.

* There is no designation required for open shielding position.

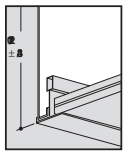
Diffusers

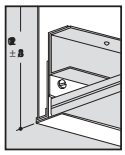
BW Blade Baffle. S/position: White, 3/4" high x 3/4" OC, 20-gauge steel. Linear shielding is 45°. R/ or F/positions: White, 1 1/2" high x 1 1/2" OC, 20-gauge steel. Linear shielding is 45°.
PBSS Parabolic Baffle. R/ or F/position: semi-specular anodized aluminum, 1.4" high x 2" OC. Linear shielding is 40°.
PAT. 12 (XA) Lens. Diagonal 3/16" conical prisms, .100" thick extruded acrylic.
FP Lens. White acrylic diffuser, .100" thick.

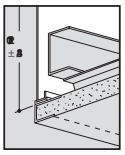
Note: Leave both **Shielding position** and **Diffuser** choice blank for **OPEN - no shielding** option.

Ceiling type


G Lay-in


CT Concealed Tee


CZ Concealed Zee


DP Drywall/Plaster

Specify the applicable ceiling trim.
Detailed fixture shield information is available from your sales representative.

Ballast options

Specify in place of **ELB**, contact factory for availability:
DA/ELB Advance Mark VII Dimming Ballast.
HEL/ELB Osram Sylvania Helios Dimming Ballast.
ECO/ELB Lutron ECO-10 Dimming Ballast.

Other options

EF Emergency Fluorescent Ballast. Battery-powered ballast from a UL Listed manufacturer will operate one T8 lamp for 1 1/2 hours.
F Fuse. Slow or fast blow, determined by Litecontrol.
PR Parabolic Reflector. Specular aluminum reflector for additional downward light projection. Only available with one-lamp fixtures.
TW Tandem Wiring. For two-lamp cross-section fixtures wired to switch in-line lamps separately, providing two levels of light.
DS Double Shields. Specify when a corridor intersects a row of Wall/Slot. Not intended for use as row fixtures in ceilings.
SDS Special Depth Shield. Standard fixture height is 10 1/2". A lower height shield is available for installations where obstructions occur. Contact factory for details.

System connectors

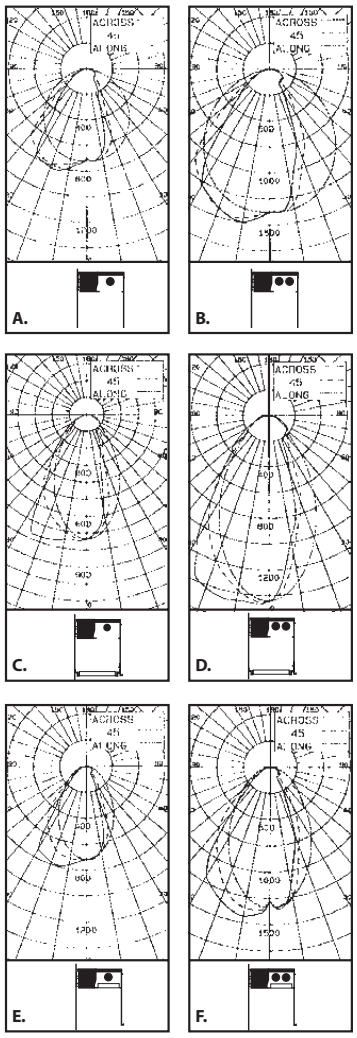
Catalog Number

Series -	Connector -	Finish	Description (Minimum-Maximum along wall in parenthesis)
85N	**EC**	**CWM**	End Cap
85N	**SE**	**CWM**	Straight Extension (2"-12")
85N	**IC**	**CWM**	Inside Corner - 90° (11"-21")
85N	**OC**	**CWM**	Outside Corner - 90° (2"-11")
85N	**ASE**	**CWM**	Angular Straight Extension - 135° (2"-11")
85N	**AIC**	**CWM**	Angular Inside Corner - 135° (6"-15")
85N	**AOC**	**CWM**	Angular Outside Corner - 135° (2"-11")
85N	**AEC**	**CWM**	Angular End Cap

85N-AOC-CWM is a typical catalog number for an angular outside corner connector.
Corners, extensions, and end caps, when added to fixtures, permit continuous wall-to-wall installation.
Finish: CWM (Matte White).
Mitered baffles are supplied for corners when Regressed or Flush baffles are specified.
Lengths are field cut.

note: A technical sheet with additional details, illustrations, and photometric data is available online for Wall/Slot-II.

Photometric data



A. 85N14T8 50% wall reflectance
Litecontrol Certified Test Report #16011002

B. 85N24T8 50% wall reflectance
Litecontrol Certified Test Report #16021002

C. 85N14T8-F/BW 50% wall reflectance
Litecontrol Certified Test Report #16211302

D. 85N24T8-F/BW 50% wall reflectance
Litecontrol Certified Test Report #16221302

E. 85N14T8-S/BW 50% wall reflectance
Litecontrol Certified Test Report #16111302

F. 85N24T8-S/BW 50% wall reflectance
Litecontrol Certified Test Report #16121302

For complete photometric information, see website.

Click on **Quick Find** **85n**
litecontrol.com

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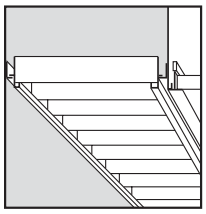
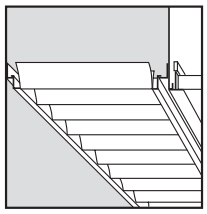
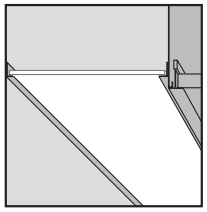
SHIELDING TYPES



BW Blade Baffle



PBSS Parabolic Baffle



Lens or Diffuser
(various types available)

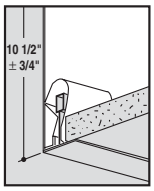
BW Blade Baffles. S/ position: White, 3/4" high x 3/4" OC, 20-gauge steel. Linear shielding is 45°.
R/ or F/ positions: White, 1 1/2" high x 1 1/2" OC, 20-gauge steel. Linear shielding is 45°.
PBSS Parabolic Baffles. R/ or F/ position: semi-specular anodized aluminum, 1.4" high x 2" OC. Linear shielding is 40°.
PAT. 12 (XA) Lens. Diagonal 3/16" conical prisms, .100" thick extruded acrylic.
FP Lens. White acrylic diffuser, .100" thick.

BALLAST OPTIONS

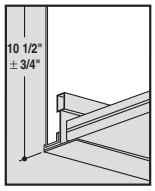
Specify in place of **ELB**, contact factory for availability:

ELB10 Electronic ballast, same specification as "Ordering Guide", except less than 10% THD.
MKV/ELB Advance Mark V electronic ballast.
DA-ELB Advance Mark VII dimming ballast.
HEL/ELB Motorola Helios dimming ballast.
ECO/ELB Lutron ECO-10 dimming ballast.

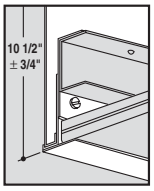
CEILING TYPE



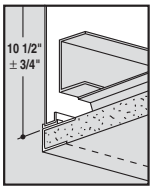
G Lay-in



CT Concealed Tee



CZ Concealed Zee

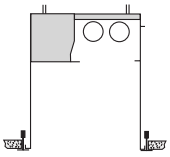


DP Drywall/Plaster

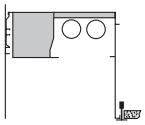
Specify the applicable ceiling trim. Detailed fixture shield information is available from your sales representative.

OTHER OPTIONS

DS Double Shields
Specify when a corridor intersects a row of Wall/Slot. Specify **DS** in OTHER OPTIONS column. Not intended for use as row fixtures in ceilings.



SDS Special Depth Shield
Standard fixture height is 10 1/2". A lower height shield is available for installations where obstructions occur. Specify **SDS** in OTHER OPTIONS column and contact factory.



OTHER ELECTRICAL OPTIONS

EF Emergency fluorescent ballast. Battery-powered ballast from a UL Listed manufacturer will operate one T8 lamp in a 3', 4' or 8' fixture for 1 1/2 hours.
F Fuse. Slow or fast blow, determined by Litecontrol.
TW Tandem Wiring. For two-lamp cross-section fixtures wired to switch in-line lamps separately, providing two levels of light.

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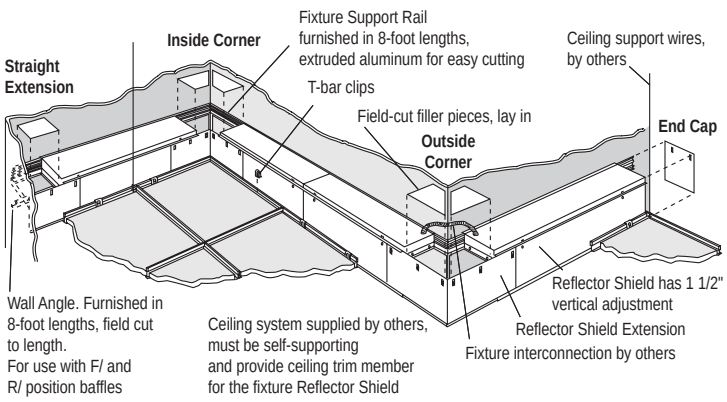
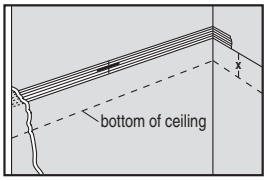
PLANNING FOR INSTALLATION

PRE-INSTALLATION NOTES: Finish of wall should extend 11" above ceiling. Continuous Fixture Support Rail is provided for ease of installation. Locate bottom of rail **X** dimension from bottom of ceiling, *see table below.*

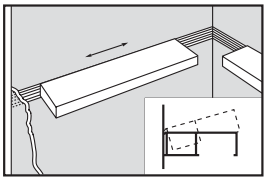
Ceiling construction must be supported independently of the lighting system.

Ceiling	**X** Dimension
Lay-in Grid T-Bar **Concealed T-bar** **Concealed Z-bar**	7 1/8"
Tegular Grid T-Bar	7 1/8" + Tile Regression
Drywall/Plaster	7 1/8" + Ceiling Thickness

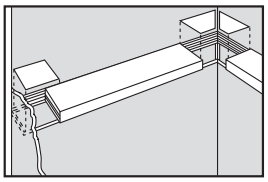




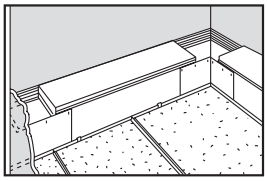
1. Install Fixture Support Rails on walls.



2. Hook fixtures on rail and slide into position.

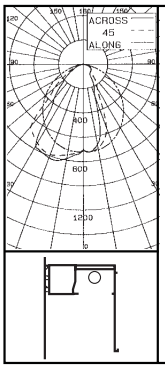


3. Install extensions and corners.



4. Attach Reflector Shields to fixtures and components.

PHOTOMETRIC DATA: *No Shielding*



CANDLEPOWER SUMMARY

ANGLE	0	45	90	135	180	OUTPUT LUMENS
90	0	0	0	1	0	
85	6	7	16	14	13	14
80	21	25	39	29	25	
75	37	44	83	42	38	54
70	56	68	145	56	51	
65	77	106	207	67	63	109
60	108	153	270	73	75	
55	152	215	334	78	81	173
50	198	303	396	82	84	
45	270	405	456	85	85	227
40	365	661	509	123	88	
35	480	707	560	186	90	282
30	772	745	604	229	138	
25	796	776	642	340	209	268
20	815	786	674	556	267	
15	817	776	698	648	527	196
10	786	754	713	698	670	
5	746	735	720	716	719	69
0	703	703	703	703	703	

85N14T8 50% wall reflectance
Litecontrol Certified Test Report #16011002

RCC	80				70				50			30			10			0
RW	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
RCR																		
0	.57	.57	.57	.57	.56	.56	.56	.56	.53	.53	.53	.51	.51	.51	.49	.49	.49	.48
1	.53	.51	.50	.48	.52	.50	.49	.48	.48	.47	.46	.47	.46	.45	.45	.44	.43	.42
2	.49	.46	.44	.41	.48	.45	.43	.41	.44	.42	.40	.42	.41	.39	.41	.39	.38	.37
3	.46	.42	.38	.36	.45	.41	.38	.36	.40	.37	.35	.38	.36	.34	.37	.35	.34	.33
4	.42	.38	.34	.31	.42	.37	.34	.31	.36	.33	.31	.35	.32	.30	.34	.32	.30	.29
5	.39	.34	.30	.27	.38	.33	.30	.27	.32	.29	.27	.32	.29	.27	.31	.28	.26	.26
6	.37	.31	.27	.24	.36	.30	.27	.24	.30	.27	.24	.29	.26	.24	.28	.26	.24	.23
7	.34	.28	.24	.22	.33	.28	.24	.22	.27	.24	.22	.26	.23	.21	.26	.23	.21	.20
8	.32	.26	.22	.19	.31	.25	.22	.19	.25	.21	.19	.24	.21	.19	.23	.21	.19	.18
9	.29	.23	.20	.17	.29	.23	.19	.17	.22	.19	.17	.22	.19	.17	.21	.19	.17	.16
10	.27	.21	.18	.15	.27	.21	.18	.15	.20	.17	.15	.20	.17	.15	.20	.17	.15	.14

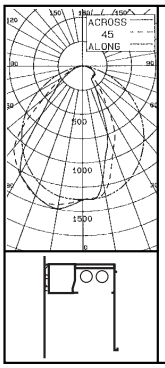
Floor Cavity Reflectance .20

ZONAL LUMEN SUMMARY

ZONE	LUMENS	% LAMP	% LUMINAIRE
180-90°	0	0.0	0.0
90-0°	1388	47.87	100
180-0°	1388	47.87	100

LUMINANCE SUMMARY (fL)

ANGLE	0°	45°	90°	135°	180°
45°	402	602	675	126	126
55°	278	393	610	142	149
65°	192	263	514	167	156
75°	150	178	335	171	155
85°	73	88	190	167	152



CANDLEPOWER SUMMARY

ANGLE	0	45	90	135	180	OUTPUT LUMENS
90	1	2	1	4	5	
85	13	15	30	26	25	27
80	38	44	74	51	47	
75	68	78	157	79	71	99
70	103	122	276	106	97	
65	143	185	395	125	120	199
60	195	275	519	136	140	
55	274	367	641	143	152	312
50	355	524	757	147	155	
45	474	839	870	146	158	423
40	650	1090	972	205	158	
35	1058	1196	1067	346	155	508
30	1278	1282	1152	536	247	
25	1348	1358	1226	781	410	494
20	1415	1419	1287	912	730	
15	1467	1458	1333	1115	926	363
10	1491	1450	1363	1311	1184	
5	1441	1415	1374	1365	1375	132
0	1378	1378	1378	1378	1378	

85N24T8 50% wall reflectance
Litecontrol Certified Test Report #16021002

RCC	80				70				50			30			10			0
RW	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
RCR																		
0	.52	.52	.52	.52	.51	.51	.51	.51	.49	.49	.49	.47	.47	.47	.45	.45	.45	.44
1	.49	.47	.46	.44	.48	.46	.45	.44	.44	.43	.42	.43	.42	.41	.41	.41	.40	.39
2	.45	.43	.40	.38	.44	.42	.39	.38	.40	.38	.37	.39	.37	.36	.38	.36	.35	.34
3	.42	.38	.35	.33	.41	.38	.35	.33	.36	.34	.32	.35	.33	.32	.34	.33	.31	.30
4	.39	.35	.31	.29	.38	.34	.31	.29	.33	.30	.28	.32	.30	.28	.31	.29	.28	.27
5	.36	.31	.28	.25	.35	.31	.28	.25	.30	.27	.25	.29	.27	.25	.28	.26	.24	.24
6	.34	.28	.25	.23	.33	.28	.25	.22	.27	.24	.22	.27	.24	.22	.26	.24	.22	.21
7	.31	.26	.23	.20	.31	.26	.22	.20	.25	.22	.20	.24	.22	.20	.24	.21	.20	.19
8	.29	.24	.20	.18	.28	.23	.20	.18	.23	.20	.18	.22	.19	.17	.22	.19	.17	.17
9	.27	.21	.18	.16	.26	.21	.18	.16	.21	.18	.16	.20	.17	.16	.20	.17	.15	.15
10	.25	.20	.16	.14	.25	.19	.16	.14	.19	.16	.14	.19	.16	.14	.18	.16	.14	.13

Floor Cavity Reflectance .20

ZONAL LUMEN SUMMARY

ZONE	LUMENS	% LAMP	% LUMINAIRE
180-90°	0	0.0	0.0
90-0°	2554	44.04	100
180-0°	2554	44.04	100

LUMINANCE SUMMARY (fL)

ANGLE	0°	45°	90°	135°	180°
45°	705	1248	1289	218	235
55°	503	672	1170	262	279
65°	356	459	980	311	298
75°	275	318	636	320	289
85°	156	178	360	314	300

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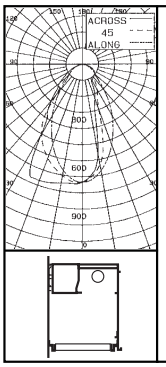
PHOTOMETRIC DATA: *F/ Position Shielding (Flush)*



CANDLEPOWER SUMMARY

ANGLE	0	45	90	135	180	OUTPUT LUMENS
90	0	0	0	1	0	
85	6	6	8	11	12	11
80	18	17	19	22	29	
75	28	29	30	34	43	35
70	50	42	43	48	57	
65	73	56	56	62	70	61
60	99	72	71	77	83	
55	135	90	89	91	91	87
50	182	122	108	103	98	
45	211	175	138	112	99	117
40	298	252	207	118	103	
35	375	416	287	139	110	164
30	506	500	368	180	115	
25	761	566	451	220	161	196
20	767	621	530	295	224	
15	761	664	606	494	290	163
10	748	703	670	631	565	
5	743	731	716	698	685	68
0	731	731	731	731	731	

85N14T8-F/BW 50% wall reflectance
Litecontrol Certified Test Report #16211302

RCC	80				70				50			30			10			0
RW	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
RCR																		
0	.37	.37	.37	.37	.36	.36	.36	.36	.34	.34	.34	.33	.33	.33	.32	.32	.32	.31
1	.35	.33	.33	.32	.34	.33	.32	.31	.32	.31	.30	.30	.30	.29	.29	.29	.28	.28
2	.32	.30	.29	.27	.32	.30	.28	.27	.29	.27	.26	.28	.27	.26	.27	.26	.25	.25
3	.30	.28	.26	.24	.29	.27	.25	.24	.26	.25	.24	.25	.24	.23	.25	.24	.23	.22
4	.28	.25	.23	.21	.28	.25	.23	.21	.24	.22	.21	.23	.22	.21	.23	.22	.20	.20
5	.26	.23	.21	.19	.26	.23	.20	.19	.22	.20	.19	.21	.20	.19	.21	.20	.18	.18
6	.25	.21	.19	.17	.24	.21	.19	.17	.20	.18	.17	.20	.18	.17	.19	.18	.17	.16
7	.23	.20	.17	.16	.23	.19	.17	.16	.19	.17	.16	.18	.17	.15	.18	.17	.15	.15
8	.22	.18	.16	.14	.21	.18	.16	.14	.17	.15	.14	.17	.15	.14	.17	.15	.14	.13
9	.20	.17	.14	.13	.20	.16	.14	.13	.16	.14	.13	.16	.14	.13	.15	.14	.13	.12
10	.19	.15	.13	.12	.19	.15	.13	.12	.15	.13	.12	.15	.13	.11	.14	.13	.11	.11

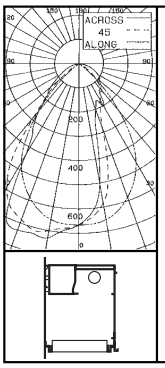
Floor Cavity Reflectance .20

ZONAL LUMEN SUMMARY

ZONE	LUMENS	% LAMP	% LUMINAIRE
180-90°	0	0.0	0.0
90-0°	897	30.95	100
180-0°	897	30.95	100

LUMINANCE SUMMARY (fL)

ANGLE	0°	45°	90°	135°	180°
45°	389	323	255	206	182
55°	308	205	201	208	208
65°	224	172	173	191	217
75°	140	145	152	173	216
85°	85	91	117	161	186



CANDLEPOWER SUMMARY

ANGLE	0	45	90	135	180	OUTPUT LUMENS
90	0	0	0	0	0	
85	2	0	1	1	6	2
80	15	1	1	1	25	
75	29	1	2	2	40	8
70	47	3	2	3	55	
65	65	5	3	6	72	23
60	85	14	5	21	90	
55	113	47	13	51	104	54
50	151	106	53	82	107	
45	180	184	145	109	128	117
40	252	285	257	147	136	
35	329	474	375	148	150	189
30	432	589	469	174	203	
25	700	656	535	209	167	213
20	730	684	586	283	201	
15	724	711	626	467	261	163
10	730	699	652	584	503	
5	690	681	663	635	618	63
0	665	665	665	665	665	

85N14T8-F/PBSS 50% wall reflectance
Litecontrol Certified Test Report #16211342

RCC	80				70				50			30			10			0
RW	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
RCR																		
0	.34	.34	.34	.34	.33	.33	.33	.33	.32	.32	.32	.30	.30	.30	.29	.29	.29	.29
1	.32	.31	.31	.30	.32	.31	.30	.29	.30	.29	.29	.29	.28	.28	.28	.27	.27	.26
2	.30	.29	.28	.27	.30	.28	.27	.26	.27	.26	.26	.27	.26	.25	.26	.25	.25	.24
3	.29	.27	.25	.24	.28	.26	.25	.24	.25	.24	.23	.25	.24	.23	.24	.23	.22	.22
4	.27	.24	.23	.21	.26	.24	.23	.21	.24	.22	.21	.23	.22	.21	.22	.21	.21	.20
5	.25	.23	.21	.19	.25	.22	.20	.19	.22	.20	.19	.21	.20	.19	.21	.20	.19	.18
6	.24	.21	.19	.18	.23	.21	.19	.18	.20	.19	.17	.20	.18	.17	.19	.18	.17	.17
7	.22	.19	.17	.16	.22	.19	.17	.16	.19	.17	.16	.18	.17	.16	.18	.17	.16	.15
8	.21	.18	.16	.15	.21	.18	.16	.14	.17	.16	.14	.17	.15	.14	.17	.15	.14	.14
9	.19	.16	.14	.13	.19	.16	.14	.13	.16	.14	.13	.16	.14	.13	.15	.14	.13	.12
10	.18	.15	.13	.12	.18	.15	.13	.12	.15	.13	.12	.14	.13	.12	.14	.13	.12	.11

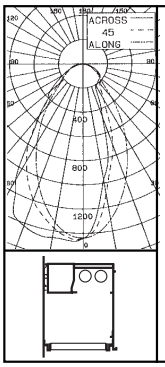
Floor Cavity Reflectance .20

ZONAL LUMEN SUMMARY

ZONE	LUMENS	% LAMP	% LUMINAIRE
180-90°	0	0.0	0.0
90-0°	827	28.53	100
180-0°	827	28.53	100

LUMINANCE SUMMARY (fL)

ANGLE	0°	45°	90°	135°	180°
45°	333	339	266	201	237
55°	256	107	30	116	237
65°	200	15	10	20	222
75°	146	7	8	11	202
85°	26	1	12	13	97



CANDLEPOWER SUMMARY

ANGLE	0	45	90	135	180	OUTPUT LUMENS
90	0	0	1	1	1	
85	11	11	14	17	22	18
80	32	32	35	37	52	
75	53	53	56	64	79	65
70	95	79	82	90	105	
65	140	105	105	116	132	116
60	189	137	135	144	158	
55	253	172	168	173	173	164
50	337	230	205	196	183	
45	386	337	266	211	185	221
40	535	527	400	223	196	
35	727	730	557	267	206	319
30	1093	909	718	359	214	
25	1344	1054	881	521	314	376
20	1416	1185	1040	736	477	
15	1452	1285	1189	887	806	317
10	1452	1369	1316	1109	978	
5	1458	1433	1406	1349	1269	131
0	1440	1440	1440	1440	1440	

85N24T8-F/BW 50% wall reflectance
Litecontrol Certified Test Report #16221302

RCC	80				70				50			30			10			0
RW	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
RCR																		
0	.35	.35	.35	.35	.35	.35	.35	.35	.33	.33	.33	.32	.32	.32	.30	.30	.30	.30
1	.33	.32	.31	.30	.32	.32	.31	.30	.30	.30	.29	.29	.29	.28	.28	.28	.27	.27
2	.31	.29	.28	.26	.30	.29	.27	.26	.28	.26	.25	.27	.26	.25	.26	.25	.24	.24
3	.29	.26	.25	.23	.28	.26	.24	.23	.25	.24	.23	.25	.23	.22	.24	.23	.22	.21
4	.27	.24	.22	.21	.26	.24	.22	.20	.23	.22	.20	.23	.21	.20	.22	.21	.20	.19
5	.25	.22	.20	.18	.25	.22	.20	.18	.21	.19	.18	.21	.19	.18	.20	.19	.18	.17
6	.24	.20	.18	.17	.23	.20	.18	.17	.20	.18	.16	.19	.18	.16	.19	.17	.16	.16
7	.22	.19	.17	.15	.22	.19	.17	.15	.18	.16	.15	.18	.16	.15	.17	.16	.15	.14
8	.21	.17	.15	.14	.20	.17	.15	.14	.17	.15	.14	.16	.15	.13	.16	.15	.13	.13
9	.19	.16	.14	.12	.19	.16	.14	.12	.15	.14	.12	.15	.13	.12	.15	.13	.12	.12
10	.18	.15	.13	.11	.18	.15	.13	.11	.14	.12	.11	.14	.12	.11	.14	.12	.11	.11

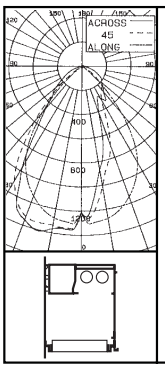
Floor Cavity Reflectance .20

ZONAL LUMEN SUMMARY

ZONE	LUMENS	% LAMP	% LUMINAIRE
180-90°	0	0.0	0.0
90-0°	1722	29.71	100
180-0°	1722	29.71	100

LUMINANCE SUMMARY (fL)

ANGLE	0°	45°	90°	135°	180°
45°	712	621	489	390	342
55°	576	390	382	393	394
65°	432	325	324	358	406
75°	268	268	280	320	397
85°	168	168	208	248	325



CANDLEPOWER SUMMARY

ANGLE	0	45	90	135	180	OUTPUT LUMENS
90	1	1	1	0	1	
85	3	0	1	1	10	3
80	27	1	1	1	47	
75	53	1	1	3	74	14
70	90	6	5	6	105	
65	123	6	6	11	137	43
60	163	24	9	42	173	
55	213	90	25	100	197	102
50	282	200	103	162	205	
45	335	360	281	230	243	226
40	465	607	503	248	273	
35	644	873	733	266	341	369
30	973	1097	914	325	300	
25	1260	1239	1044	468	294	404
20	1352	1323	1144	690	401	
15	1406	1339	1224	832	678	313
10	1364	1334	1274	1004	865	
5	1352	1343	1294	1206	1117	118
0	1202	1202	1202	1202	1202	

85N24T8-F/PBSS 50% wall reflectance
Litecontrol Certified Test Report #16221342

RCC	80				70				50			30			10			0
RW	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
RCR																		
0	.33	.33	.33	.33	.32	.32	.32	.32	.30	.30	.30	.29	.29	.29	.28	.28	.28	.27
1	.31	.30	.29	.29	.30	.30	.29	.28	.28	.28	.27	.27	.27	.27	.26	.26	.26	.25
2	.29	.28	.26	.25	.29	.27	.26	.25	.26	.25	.25	.25	.25	.24	.25	.24	.24	.23
3	.27	.25	.24	.23	.27	.25	.24	.23	.24	.23	.22	.24	.23	.22	.23	.22	.22	.21
4	.26	.23	.22	.20	.25	.23	.22	.20	.23	.21	.20	.22	.21	.20	.21	.20	.20	.19
5	.24	.22	.20	.18	.24	.21	.20	.18	.21	.19	.18	.20	.19	.18	.20	.19	.18	.17
6	.23	.20	.18	.17	.22	.20	.18	.17	.19	.18	.17	.19	.18	.17	.19	.17	.16	.16
7	.21	.18	.17	.15	.21	.18	.17	.15	.18	.16	.15	.18	.16	.15	.17	.16	.15	.15
8	.20	.17	.15	.14	.20	.17	.15	.14	.16	.15	.14	.16	.15	.14	.16	.15	.14	.13
9	.19	.16	.14	.12	.18	.15	.14	.12	.15	.14	.12	.15	.13	.12	.15	.13	.12	.12
10	.17	.14	.13	.11	.17	.14	.13	.11	.14	.12	.11	.14	.12	.11	.14	.12	.11	.11

Floor Cavity Reflectance .20

ZONAL LUMEN SUMMARY

ZONE	LUMENS	% LAMP	% LUMINAIRE
180-90°	0	0.0	0.0
90-0°	1587	27.37	100
180-0°	1587	27.37	100

LUMINANCE SUMMARY (fL)

ANGLE	0°	45°	90°	135°	180°
45°	619	665	517	424	449
55°	485	204	57	228	449
65°	380	19	18	35	422
75°	268	4	7	17	374
85°	52	0	12	12	152

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100 HAWKS AVENUE HANSON MA 02341 781 294 0100 FAX 781 293 2849 info@litecontrol.com www.litecontrol.com

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See attached Lighting Fixture Schedule

DELETED

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WideLite®

A2 1000
Aktra II Floodlight
Bulletin No. A2 1000-011808

Type:
Job:
Catalog Number:

____ - ____ - ____ - ____ - ____ - ____

SERIES	REFLECTOR	VOLTAGE	MOUNTING	OPTIONS (FACTORY INSTALLED)	FINISH
	See Page 2			See Page 3	

*Note: X and Y components of order sequence to be manually entered in part number **after** Option / Accessory is selected.*
Certain configurations or combinations of options and/or accessories may not be compatible.

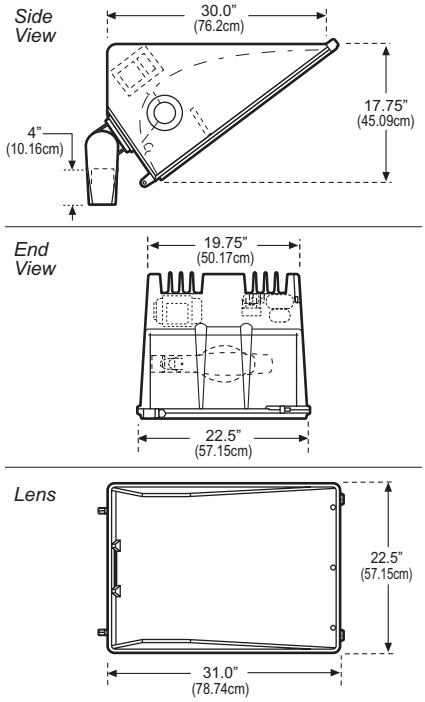
ACCESSORIES (SHIPPED SEPARATELY) See Pages 4 and 5

Approvals:

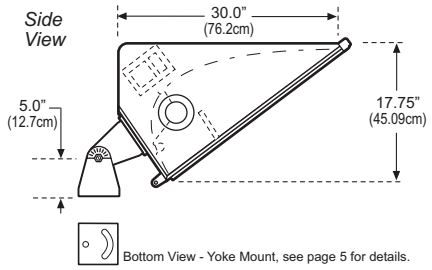
Date:

Overall Dimensions *For Reference Only*

M - Mastfitter Mount



Y - Yoke Mount



Bottom View - Yoke Mount, see page 5 for details.

Specifications

Housing
The Aktra II 1000 floodlight features a cast aluminum alloy housing with integral heat dissipating fins and heavy-duty hinges. Standard unit constructed to IP54.

Reflector
Patented Aktra® reflector system. High purity anodized aluminum reflectors assure maximum efficiency. A secondary internal reflector element reflects high angle rays back into the beam to achieve high beam utilization. Meets IES definition of cutoff distribution.

Lamp Access
Hinged lens frame allows convenient lamp access.

Lens
Clear tempered glass lens is secured to cast aluminum door frame by 10 retaining clips and sealed with a gasket.

Socket
Pre-wired grip-type mogul base socket, 4KV rated for MH, 5KV for HPS. Glass end of the lamp is held in precise photometric alignment and protected from breakage by a Stabilux™ socket.

Ballast
High power factor ballast with reliable starting down to -29°C (-20°F) for Metal Halide lamps, -34°C (-30°F) for Pulse Start Metal Halide lamps, and -40°C (-40°F) for High Pressure Sodium. Ballast has Class H, 180°C (356°F) rated insulation. Crest factor does not exceed 1.8. Capacitor and HPS ignitor are separated from the ballast core and coil to maximize life by minimizing heat.

Aiming
Cutoff distribution achieved at 62.5° (2 times mounting height). Aiming above 63° provides semi-cutoff and non-cutoff distribution.

Mounting
Fixture may be specified with a cast aluminum mastfitter, suitable for mounting to a 2-3/8" O.D. vertical tenon; or formed plate steel yoke. Yoke mount allows mounting directly to any flat surface.

Finish
Standard finish shall be dark bronze UltraClad™ polyester powder coating, 2.5 mil nominal thickness, electrostatically applied and oven cured. All components shall be thoroughly cleaned by a 5 stage pre-treatment process including iron phosphate bath and non-chromic acid etching stages, ensuring optimum performance characteristics. Other colors may be specified.

Listings
UL/cUL Listed luminaire, UL 1598, suitable for Wet Locations. The quality systems of this facility have been registered by UL to the ISO 9001 Series Standards.

Warranty / Terms and Conditions
Standard 5 Year Limited Warranty
Wide-Lite's current Warranty may be found at www.wide-lite.com (keyword: warranty) as well as Wide-Lite's current Standard Terms and Conditions of Sale (keyword: terms).
All sales of items in this catalogue shall be subject to Wide-Lite's Standard Terms and Conditions of Sale current at the time of shipment. If you do not have a copy of Wide-Lite's Warranty and Standard Terms, please contact the factory for same prior to ordering.

Hg Some luminaires use fluorescent or high intesity discharge (HID) lamps that contain small amounts of mercury. Such lamps are labeled "Contain Mercury' and/or with the symbol 'Hg'. Lamps that contain mercury must be disposed of in accordance with local requirements. Information regarding lamp recycle and disposal can be found at ***www.lamprecycle.org.***

ISO 9001 Certified

www.wide-lite.com
CATALOG KEYWORD: A2 1000

WIDE-LITE UL REGISTERED FIRM ISO 9001 A5211

Wide-Lite
a GENLYTE company
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(512) 392-5821 • Fax (512) 753-1122

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FMS

Architect **Gensler**
Project **Portland International Jetport**
Date **26 October 2009**
Project No. **508667.00**
Type **FV**

Fisher Marantz Stone Partners in Architectural Lighting Design 22 West 19th Street New York, NY 10011

WideLite®

A2 1000
Aktra II Floodlight
Bulletin No. A2 1000-011808

Type:
Job:

Series (1)

Metal Halide
- ❒ A2M-1000

Pulse Start
- ❒ A2P-1000 (2)

High Pressure Sodium
- ❒ A2S-1000

Reflector
- ❒ A
- ❒ C
- ❒ D

Voltage
- ❒ 120
- ❒ 208
- ❒ 240
- ❒ 277
- ❒ 480
- ❒ QV (3)

Mounting
- ❒ M = Mastfitter
- ❒ Y = Yoke Mount

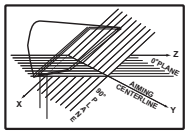
(1) Mogul Base EP39 T25 Lamp provided by others.
(2) For acceptable performance, note position orientation specific nature of Pulse Start lamps. Consult factory.
(3) Allows field selection of 120/208/240/277 voltage. *(No 480V).* Certain options may require voltage selection as well.

Distribution Guide & Ballast Data (1)

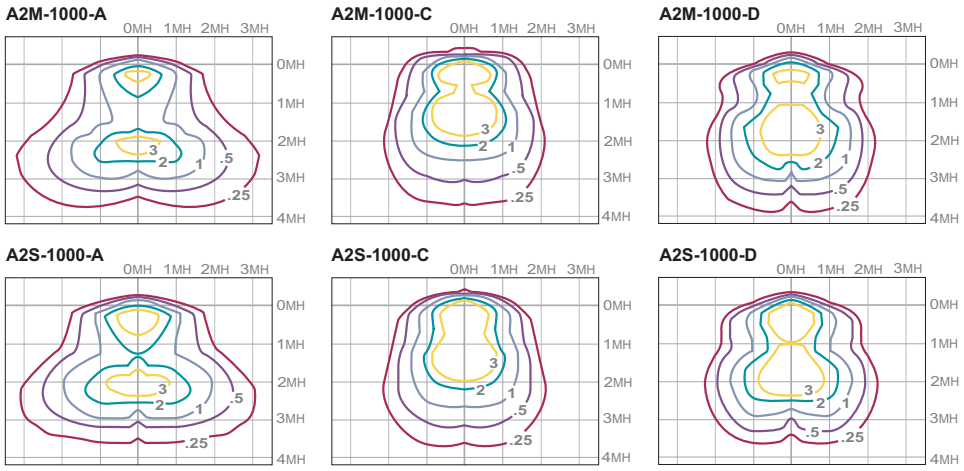
Source Type(2)	Catalog Number	Reflector Type	Lamp(3) Envelope	Field Angle Based on 10%	Beam Angle Based on 50%	.ies File Name	Ballast Type(4)	ANSI Code	Line Current 120 / 208 / 240 / 277 / 480	Line Watts
MH	A2M-1000	A	BT37	129H x 22V	75H x 8V	a2m100a.ies	CWA	M47 / H36	9.2 / 5.6 / 4.7 / 4.1 / 2.4	1080
	A2M-1000	C	BT37	103H x 90V	62H x 27V	a2m100c.ies	CWA	M47 / H36	9.2 / 5.6 / 4.7 / 4.1 / 2.4	1080
	A2M-1000	D	BT37	80H x 28V	53H x 14V	a2m100d.ies	CWA	M47 / H36	9.2 / 5.6 / 4.7 / 4.1 / 2.4	1080
PS	A2P-1000	A	BT37	129H x22V	75H x 8V	a2p100a.ies	CWA	M141	9.0 / 5.2 / 4.5 / 3.9 / 2.4	1080
	A2P-1000	C	BT37	103H x 90V	62H x 27V	a2p100c.ies	CWA	M141	9.0 / 5.2 / 4.5 / 3.9 / 2.4	1080
	A2P-1000	D	BT37	80H x 28V	53H x 14V	a2p100d.ies	CWA	M141	9.0 / 5.2 / 4.5 / 3.9 / 2.4	1080
HPS	A2S-1000	A	E25	117H x 20V	62H x 7V	a2s100a.ies	CWA	S52	9.5 / 5.5 / 4.8 / 4.2 / 2.5	1100
	A2S-1000	C	E25	100H x 89V	60H x 28V	a2s100c.ies	CWA	S52	9.5 / 5.5 / 4.8 / 4.2 / 2.5	1100
	A2S-1000	D	E25	90H x 72V	63H x 14V	a2s100d.ies	CWA	S52	9.5 / 5.5 / 4.8 / 4.2 / 2.5	1100

(1) The Aktra II 1000 accommodates a variety of other wattages and lamps. Consult factory.
(2) MH = Metal Halide, PS = Pulse Start Metal Halide, HPS = High Pressure Sodium.
(3) Horizontal clear lamps recommended for optimum photometric performance.
(4) CWA = Constant Wattage Autotransformer.

Distribution Patterns(1) and EPA data



EPA
Effective Projected Area in Ft.²
3.4



1) Photometric data calculated at 50' mounting height.

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CATALOG KEYWORD: A2 1000

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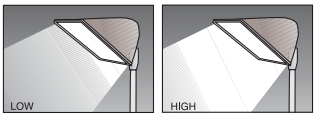
Issued for Permit

WideLite®

A2 1000
Aktra II Floodlight
Bulletin No. A2 1000-011808

Type:
Job:

Options (Factory Installed)

❒ **BL** = Bi-Level® (Requires 5-wire) *Note: Suitable for HPS in any aiming position. Consult factory when specifying dimming with Metal Halide.*	Bi-Level provides high/low level of lamp output with 50% power consumption. Zero crossover network avoids strobing and lamp dropout. 
❒ **CSR** = Hot Quartz Restrike ❒ **LQ** = Hot/Cold Quartz Restrike ❒ **LQ1** = Separately Wired (120V) Quartz Restrike (Requires 5-wire) *Note: Standard 150 watt (120V) double contact bayonet base socket. Combined Quartz wattage may not exceed HID lamp wattage.* *LQ1 requires an Interlock (by others) to ensure HID and Quartz source are not operated at once.*	CSR - Quartz restrike using a current sensing relay; extinguishes auxiliary lamp when main arc strikes. LQ - Provides LiteMatic operation for fixtures with 120V or multi-tap ballasts. LQ1 - Separately wired, externally controlled emergency lighting from a separate power source. **LiteMatic Operation**  **Normal Start:** Main and Quartz lamps both energized. **Main Lamp Reaches Approximately 40% of Rated Output:** Quartz lamp automatically extinguishes (combined lamp currents never exceed that of main lamp at 100% output). **When Arc Extinguished:** Auxiliary quartz lamp automatically energized when power is restored. **Main Lamp Reaches 40% of Rated Output:** Quartz lamp automatically extinguishes
❒ **F1** = Single Fuse (120V/277V) ❒ **F2** = Double Fuse (208V/240V/480V) *Note: If ordering QV ballast, voltage must be specified.*	Consists of 1 or 2 fuse holders and 1 or 2 KTK 30 amp fuses. 
❒ **TLR** = Photocontrol Receptacle	Photocontrol twistlock receptacle only (Photocontrol by others).
❒ **50 HZ** = 50 Hz Ballast Operation *(Consult Factory)*	Specified for applications (outside the United States) where 50 Hertz operation is standard.

Finish

❒ **TDB** = Textured Dark Bronze (Standard)

❒ **TGR** = Textured Gray

❒ **TBK** = Textured Black

❒ **TGN** = Textured Green

❒ **TWHT** = Textured White

❒ **TSA** = Textured Satin Aluminum

❒ **RAL(*)** = Special Tiger DryLac® Powder coat finish; (*) Specify RAL color number from RAL color chart *(Consult factory for assistance in color selection.)*

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WideLite®

A2 1000
Aktra II Floodlight
Bulletin No. A2 1000-011808

Type:
Job:

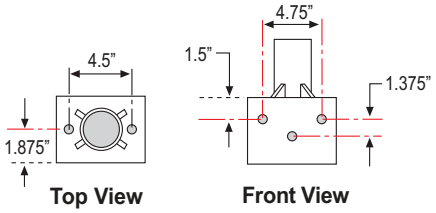
Accessories (field installed - shipped separately)

❒ **F1 Kit** = Single Fuse Kit (120V/277V)

❒ **F2 Kit** = Double Fuse Kit (208V/240V/480V)

Consists of 1 or 2 fuse holders and 1 or 2 KTK 30 amp fuses.

❒ **PX-1-TL** = Heavy duty Cross-arm Bracket

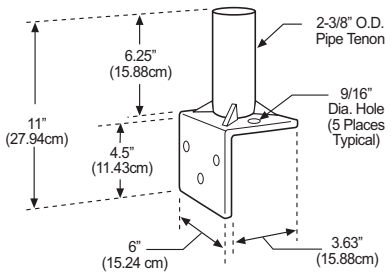


Steel angle bracket with 2" pipe stub. Four gussets provide additional mounting stability.

"L" base.

Hot dipped galvanized.

For installing floodlights on wooden or steel cross-arms.

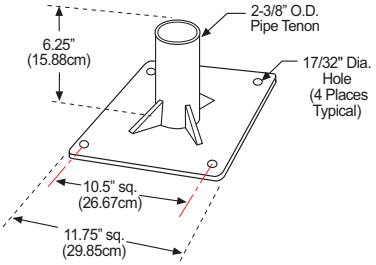


❒ **FB1-TL** = Flat Base Mount

Steel construction, with 2" pipe stub and four gussets for heavy-duty support.

Hot dipped galvanized.

For installing floodlight to flat horizontal surfaces.

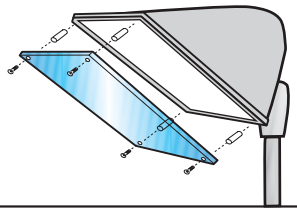


❒ **AL-10-A2** = Auxiliary Polymer Lens

Provides additional protection of the glass lens. Useful life is limited by UV discoloration from sunlight, mercury or metal halide lamps.

Auxiliary lens for Aktra II Series floodlights.

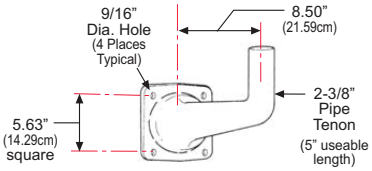
1/4" thick impact-resistant polymer lens, furnished with mounting hardware and standoffs.



❒ **WB-1** = Wall Bracket

Cast aluminum wall bracket for vertical surfaces only. Designed to permit mounting of floodlights on flat vertical surfaces.

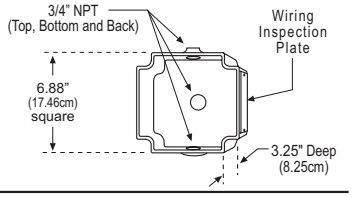
Use in conjunction with WB-5 for surface mounted wiring.



❒ **WB-5** = Wiring Box for WB-1 and surface mounted conduit feed

Used in conjunction with WB-1 for surface mounted wiring. Tapped top, back and bottom for 3/4" conduit or pipe.

Gasket provided for sealing surface wiring box to WB-1, vertical wall mounting bracket.



ISO 9001 Certified

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CATALOG KEYWORD: A2 1000

WIDE-LITE UL REGISTERED FIRM ISO 9001 A5211

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AKTRA®

Specifications and dimensions are subject to change without notice.

Issued for Permit

WideLite®

A2 1000
Aktra II Floodlight
Bulletin No. A2 1000-011808

Type:
Job:

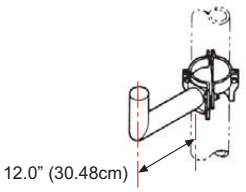
Accessories (field installed - shipped separately)

❒ **PM-1-HD** = 1-Light Heavy Duty Pole Mounting Kit

Suitable for wood poles 6.0" to 12.0" O.D.
Galvanized steel.

Heavy Duty Wood Pole Mounting kit includes one U-18 arm for mounting a single light to wood pole.

Shipping wt. 15 lbs (6.80 kg)

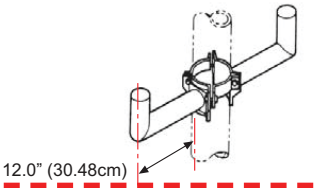


❒ **PM-2-HD** = 2-Light Heavy Duty Pole Mounting Kit

Suitable for wood poles 6.0" to 12.0" O.D.
Galvanized steel.

Heavy Duty Wood Pole Mounting kit includes two U-18 arms for mounting two lights to wood pole.

Shipping wt. 20 lbs (9.07 kg)

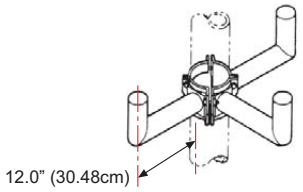


❒ **PM-3-HD** = 3-Light Heavy Duty Pole Mounting Kit

Suitable for wood poles 6.0" to 12.0" O.D.
Galvanized steel.

Heavy Duty Wood Pole Mounting kit includes three U-18 arms for mounting three lights to wood pole.

Shipping wt. 26 lbs (11.79 kg)

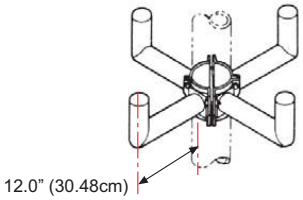


❒ **PM-4-HD** = 4-Light Heavy Duty Pole Mounting Kit

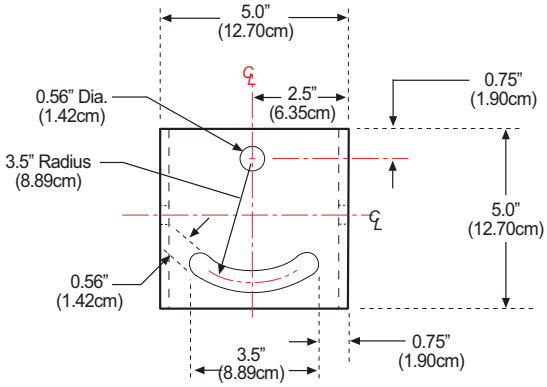
Suitable for wood poles 6.0" to 12.0" O.D.
Galvanized steel.

Heavy Duty Wood Pole Mounting kit includes four U-18 arm for mounting four lights to wood pole.

Shipping wt. 31 lbs (14.06 kg)



Bottom View
Yoke Mount



Direction of Major Light Path

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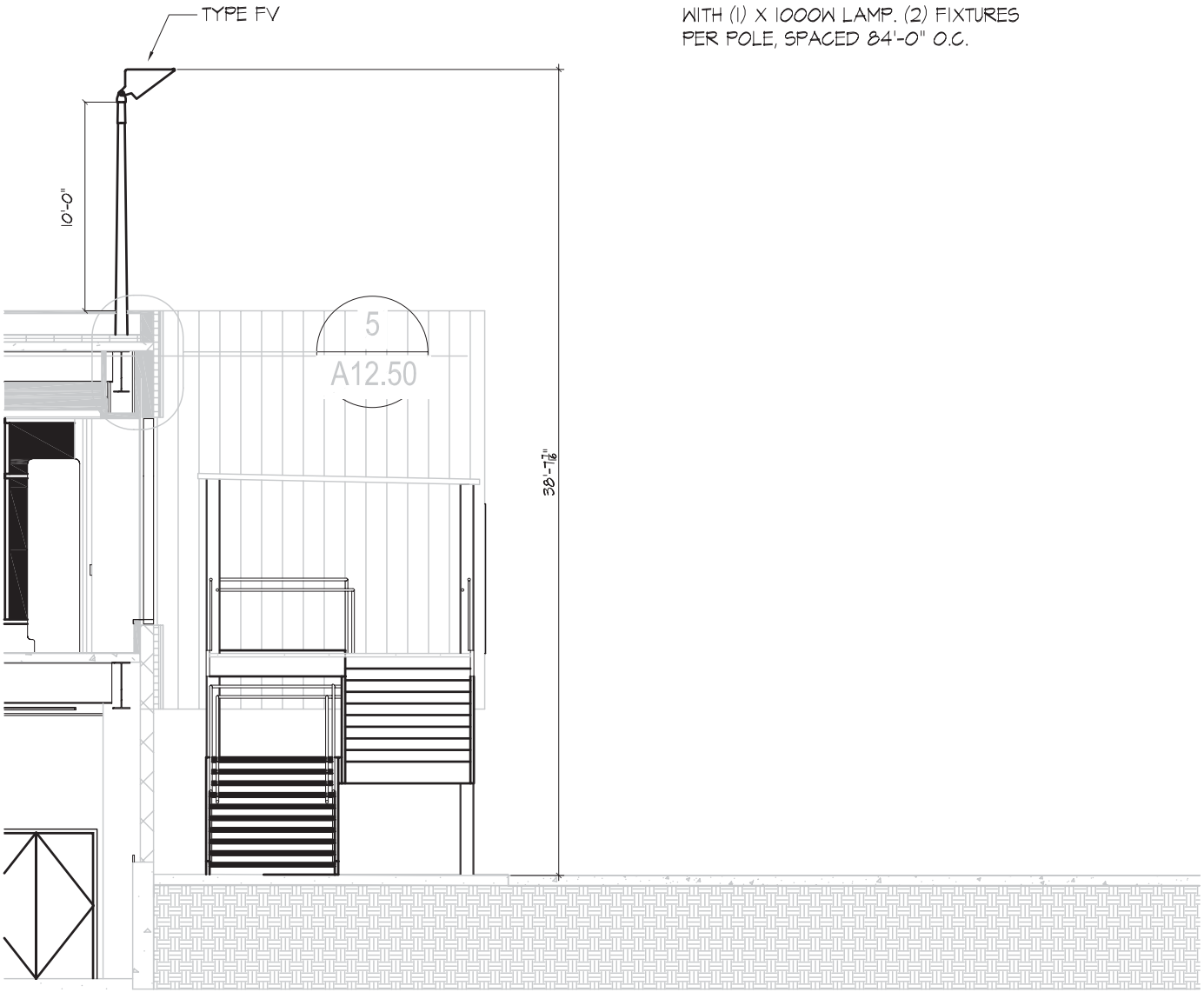
METAL HALIDE FORWARD THROW ASYMETRIC DISTRIBUTION FLOODLIGHT WITH (1) X 1000W LAMP. (2) FIXTURES PER POLE, SPACED 84'-0" O.C.



MOUNTING DETAIL SECTION
Scale: N.T.S

Issued for Permit

Wide-Lite®

A2 1000
Aktra II Floodlight
Bulletin No. A2 1000-011808

Type:
Job:
Catalog Number:

____ - ____ - ____ - ____ - ____ - ____

SERIES	REFLECTOR	VOLTAGE	MOUNTING	OPTIONS (FACTORY INSTALLED)	FINISH
				See Page 3	

See Page 2

*Note: X and Y components of order sequence to be manually entered in part number **after** Option / Accessory is selected.*

Certain configurations or combinations of options and/or accessories may not be compatible.

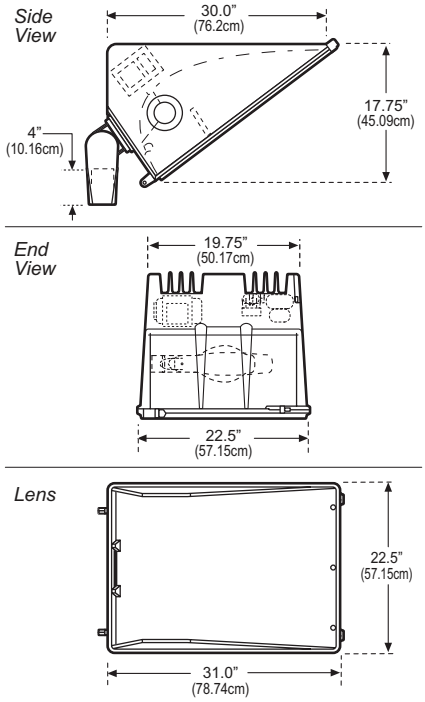
ACCESSORIES (SHIPPED SEPARATELY)
See Pages 4 and 5

Approvals:

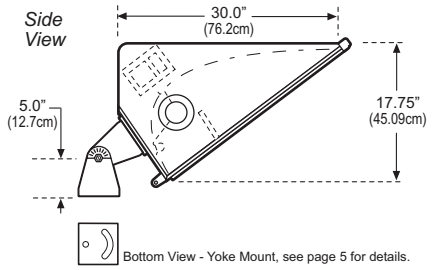
Date:

Overall Dimensions *For Reference Only*

M - Mastfitter Mount



Y - Yoke Mount



Bottom View - Yoke Mount, see page 5 for details.

Specifications

Housing
The Aktra II 1000 floodlight features a cast aluminum alloy housing with integral heat dissipating fins and heavy-duty hinges. Standard unit constructed to IP54.

Reflector
Patented Aktra® reflector system. High purity anodized aluminum reflectors assure maximum efficiency. A secondary internal reflector element reflects high angle rays back into the beam to achieve high beam utilization. Meets IES definition of cutoff distribution.

Lamp Access
Hinged lens frame allows convenient lamp access.

Lens
Clear tempered glass lens is secured to cast aluminum door frame by 10 retaining clips and sealed with a gasket.

Socket
Pre-wired grip-type mogul base socket, 4KV rated for MH, 5KV for HPS. Glass end of the lamp is held in precise photometric alignment and protected from breakage by a Stabilux™ socket.

Ballast
High power factor ballast with reliable starting down to -29°C (-20°F) for Metal Halide lamps, -34°C (-30°F) for Pulse Start Metal Halide lamps, and -40°C (-40°F) for High Pressure Sodium. Ballast has Class H, 180°C (356°F) rated insulation. Crest factor does not exceed 1.8. Capacitor and HPS ignitor are separated from the ballast core and coil to maximize life by minimizing heat.

Aiming
Cutoff distribution achieved at 62.5° (2 times mounting height). Aiming above 63° provides semi-cutoff and non-cutoff distribution.

Mounting
Fixture may be specified with a cast aluminum mastfitter, suitable for mounting to a 2-3/8" O.D. vertical tenon; or formed plate steel yoke. Yoke mount allows mounting directly to any flat surface.

Finish
Standard finish shall be dark bronze UltraClad™ polyester powder coating, 2.5 mil nominal thickness, electrostatically applied and oven cured. All components shall be thoroughly cleaned by a 5 stage pre-treatment process including iron phosphate bath and non-chromic acid etching stages, ensuring optimum performance characteristics. Other colors may be specified.

Listings
UL/cUL Listed luminaire, UL 1598, suitable for Wet Locations. The quality systems of this facility have been registered by UL to the ISO 9001 Series Standards.

Warranty / Terms and Conditions
Standard 5 Year Limited Warranty
Wide-Lite's current Warranty may be found at www.wide-lite.com (keyword: warranty) as well as Wide-Lite's current Standard Terms and Conditions of Sale (keyword: terms).

All sales of items in this catalogue shall be subject to Wide-Lite's Standard Terms and Conditions of Sale current at the time of shipment. If you do not have a copy of Wide-Lite's Warranty and Standard Terms, please contact the factory for same prior to ordering.

(Hg) Some luminaires use fluorescent or high intesity discharge (HID) lamps that contain small amounts of mercury. Such lamps are labeled "Contain Mercury' and/or with the symbol 'Hg'. Lamps that contain mercury must be disposed of in accordance with local requirements. Information regarding lamp recycle and disposal can be found at ***www.lamprecycle.org.***

ISO 9001 Certified

www.wide-lite.com
CATALOG KEYWORD: A2 1000

WIDE-LITE UL REGISTERED FIRM ISO 9001 A5211

Wide-Lite
a GENLYTE company
P.O. Box 606 • San Marcos TX 78667-0606
(512) 392-5821 • Fax (512) 753-1122

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Specifications and dimensions are subject to change without notice.

Issued for Permit

FMS

Architect **Gensler**
Project **Portland International Jetport**

Date **26 October 2009**
Project No. **508667.00**

Type **FV-1**
1 of 6

Wide-Lite®

A2 1000
Aktra II Floodlight
Bulletin No. A2 1000-011808

Type:

Job:

Series (1)

Metal Halide
- ❒ A2M-1000

Pulse Start
- ❒ A2P-1000 (2)

High Pressure Sodium
- ❒ A2S-1000

Reflector
- ❒ A
- ❒ C
- ❒ D

Voltage
- ❒ 120
- ❒ 208
- ❒ 240
- ❒ 277
- ❒ 480
- ❒ QV (3)

Mounting
- ❒ M = Mastfitter
- ❒ Y = Yoke Mount

(1) Mogul Base EP39 T25 Lamp provided by others.

(2) For acceptable performance, note position orientation specific nature of Pulse Start lamps. Consult factory.

(3) Allows field selection of 120/208/240/277 voltage. *(No 480V).* Certain options may require voltage selection as well.

Distribution Guide & Ballast Data (1)

Source Type(2)	Catalog Number	Reflector Type	Lamp(3) Envelope	Field Angle Based on 10%	Beam Angle Based on 50%	.ies File Name	Ballast Type(4)	ANSI Code	Line Current 120 / 208 / 240 / 277 / 480	Line Watts
MH	A2M-1000	A	BT37	129H x 22V	75H x 8V	a2m100a.ies	CWA	M47 / H36	9.2 / 5.6 / 4.7 / 4.1 / 2.4	1080
	A2M-1000	C	BT37	103H x 90V	62H x 27V	a2m100c.ies	CWA	M47 / H36	9.2 / 5.6 / 4.7 / 4.1 / 2.4	1080
	A2M-1000	D	BT37	80H x 28V	53H x 14V	a2m100d.ies	CWA	M47 / H36	9.2 / 5.6 / 4.7 / 4.1 / 2.4	1080
PS	A2P-1000	A	BT37	129H x22V	75H x 8V	a2p100a.ies	CWA	M141	9.0 / 5.2 / 4.5 / 3.9 / 2.4	1080
	A2P-1000	C	BT37	103H x 90V	62H x 27V	a2p100c.ies	CWA	M141	9.0 / 5.2 / 4.5 / 3.9 / 2.4	1080
	A2P-1000	D	BT37	80H x 28V	53H x 14V	a2p100d.ies	CWA	M141	9.0 / 5.2 / 4.5 / 3.9 / 2.4	1080
HPS	A2S-1000	A	E25	117H x 20V	62H x 7V	a2s100a.ies	CWA	S52	9.5 / 5.5 / 4.8 / 4.2 / 2.5	1100
	A2S-1000	C	E25	100H x 89V	60H x 28V	a2s100c.ies	CWA	S52	9.5 / 5.5 / 4.8 / 4.2 / 2.5	1100
	A2S-1000	D	E25	90H x 72V	63H x 14V	a2s100d.ies	CWA	S52	9.5 / 5.5 / 4.8 / 4.2 / 2.5	1100

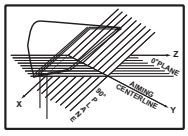
(1) The Aktra II 1000 accommodates a variety of other wattages and lamps. Consult factory.

(2) MH = Metal Halide, PS = Pulse Start Metal Halide, HPS = High Pressure Sodium.

(3) Horizontal clear lamps recommended for optimum photometric performance.

(4) CWA = Constant Wattage Autotransformer.

Distribution Patterns(1) and EPA data

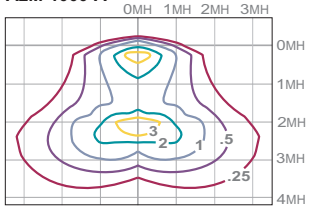


EPA

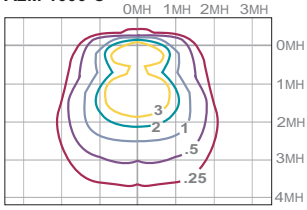
Effective Projected Area in Ft.²

3.4

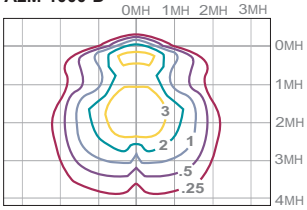
A2M-1000-A



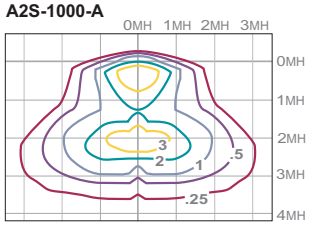
A2M-1000-C



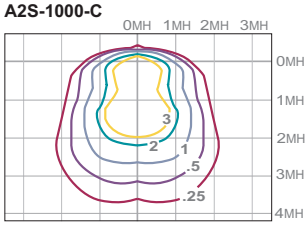
A2M-1000-D



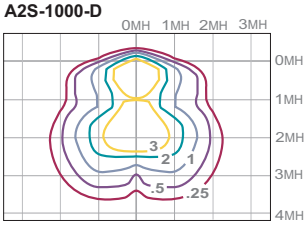
A2S-1000-A



A2S-1000-C



A2S-1000-D



1) Photometric data calculated at 50' mounting height.

ISO 9001 Certified

www.wide-lite.com

CATALOG KEYWORD: A2 1000

WIDE-LITE REGISTERED FIRM ISO 9001 A5211

Wide-Lite
a GENLYTE company
P.O. Box 606 • San Marcos TX 78667-0606
(512) 392-5821 • Fax (512) 753-1122

AKTRA®

Specifications and dimensions are subject to change without notice.

Issued for Permit

FMS

Architect **Gensler**

Project **Portland International Jetport**

Date **26 October 2009**

Project No. **508667.00**

Type **FV-1**

WideLite®

A2 1000
Aktra II Floodlight
Bulletin No. A2 1000-011808

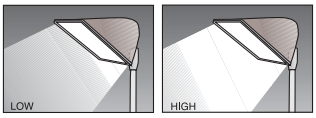
Type:
Job:

Options (Factory Installed)

❒ **BL** = Bi-Level®
(Requires 5-wire)

Note: Suitable for HPS in any aiming position. Consult factory when specifying dimming with Metal Halide.

Bi-Level provides high/low level of lamp output with 50% power consumption. Zero crossover network avoids strobing and lamp dropout.



❒ **CSR** = Hot Quartz Restrike

❒ **LQ** = Hot/Cold Quartz Restrike

❒ **LQ1** = Separately Wired (120V) Quartz Restrike
(Requires 5-wire)

Note: Standard 150 watt (120V) double contact bayonet base socket. Combined Quartz wattage may not exceed HID lamp wattage.

LQ1 requires an Interlock (by others) to ensure HID and Quartz source are not operated at once.

CSR - Quartz restrike using a current sensing relay; extinguishes auxiliary lamp when main arc strikes.

LQ - Provides LiteMatic operation for fixtures with 120V or multi-tap ballasts.

LQ1 - Separately wired, externally controlled emergency lighting from a separate power source.

LiteMatic Operation

Normal Start: Main and Quartz lamps both energized.

Main Lamp Reaches Approximately 40% of Rated Output: Quartz lamp automatically extinguishes (combined lamp currents never exceed that of main lamp at 100% output).

When Arc Extinguished: Auxiliary quartz lamp automatically energized when power is restored.

Main Lamp Reaches 40% of Rated Output: Quartz lamp automatically extinguishes

❒ **F1** = Single Fuse (120V/277V)

❒ **F2** = Double Fuse (208V/240V/480V)

Note: If ordering QV ballast, voltage must be specified.

Consists of 1 or 2 fuse holders and 1 or 2 KTK 30 amp fuses.

❒ **TLR** = Photocontrol Receptacle

Photocontrol twistlock receptacle only (Photocontrol by others).

❒ **50 HZ** = 50 Hz Ballast Operation
(Consult Factory)

Specified for applications (outside the United States) where 50 Hertz operation is standard.

Finish

❒ **TDB** = Textured Dark Bronze (Standard)

❒ **TGR** = Textured Gray

❒ **TBK** = Textured Black

❒ **TGN** = Textured Green

❒ **TWHT** = Textured White

❒ **TSA** = Textured Satin Aluminum

❒ **RAL(*)** = Special Tiger DryLac® Powder coat finish; (*) Specify RAL color number from RAL color chart *(Consult factory for assistance in color selection.)*

ISO 9001 Certified

www.wide-lite.com
CATALOG KEYWORD: A2 1000

WIDE-LITE UL REGISTERED FIRM ISO 9001 A5211

Wide-Lite
a GENLYTE company
P.O. Box 606 • San Marcos TX 78667-0606
(512) 392-5821 • Fax (512) 753-1122

Specifications and dimensions are subject to change without notice.

AKTRA®

Issued for Permit

WideLite®

A2 1000
Aktra II Floodlight
Bulletin No. A2 1000-011808

Type:
Job:

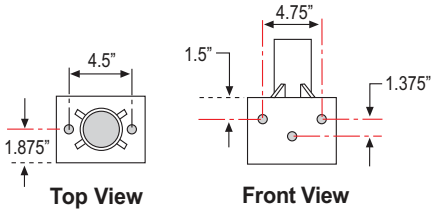
Accessories (field installed - shipped separately)

❒ **F1 Kit** = Single Fuse Kit (120V/277V)

❒ **F2 Kit** = Double Fuse Kit (208V/240V/480V)

Consists of 1 or 2 fuse holders and 1 or 2 KTK 30 amp fuses.

❒ **PX-1-TL** = Heavy duty Cross-arm Bracket

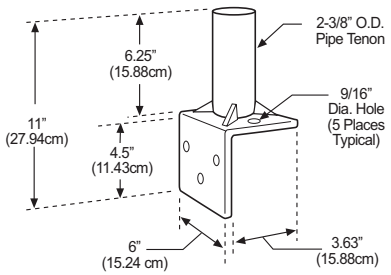


Steel angle bracket with 2" pipe stub. Four gussets provide additional mounting stability.

"L" base.

Hot dipped galvanized.

For installing floodlights on wooden or steel cross-arms.

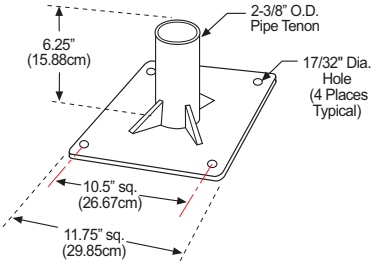


❒ **FB1-TL** = Flat Base Mount

Steel construction, with 2" pipe stub and four gussets for heavy-duty support.

Hot dipped galvanized.

For installing floodlight to flat horizontal surfaces.

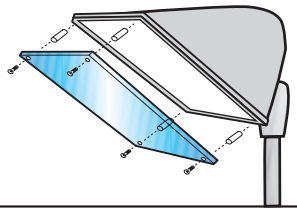


❒ **AL-10-A2** = Auxiliary Polymer Lens

Provides additional protection of the glass lens. Useful life is limited by UV discoloration from sunlight, mercury or metal halide lamps.

Auxiliary lens for Aktra II Series floodlights.

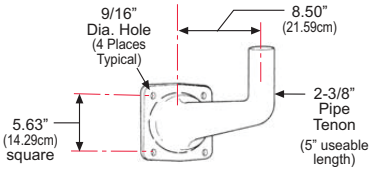
1/4" thick impact-resistant polymer lens, furnished with mounting hardware and standoffs.



❒ **WB-1** = Wall Bracket

Cast aluminum wall bracket for vertical surfaces only. Designed to permit mounting of floodlights on flat vertical surfaces.

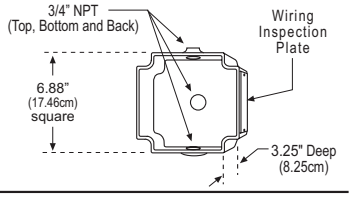
Use in conjunction with WB-5 for surface mounted wiring.



❒ **WB-5** = Wiring Box for WB-1 and surface mounted conduit feed

Used in conjunction with WB-1 for surface mounted wiring. Tapped top, back and bottom for 3/4" conduit or pipe.

Gasket provided for sealing surface wiring box to WB-1, vertical wall mounting bracket.



ISO 9001 Certified

www.wide-lite.com

CATALOG KEYWORD: A2 1000

WIDE-LITE UL REGISTERED FIRM ISO 9001 A5211

Wide-Lite
a GENLYTE company
P.O. Box 606 • San Marcos TX 78667-0606
(512) 392-5821 • Fax (512) 753-1122

AKTRA®

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Issued for Permit

FMS

Architect **Gensler**
Project **Portland International Jetport**

Date **26 October 2009**
Project No. **508667.00**

Type **FV-1**
4 of 6

WideLite®

A2 1000
Aktra II Floodlight
Bulletin No. A2 1000-011808

Type:
Job:

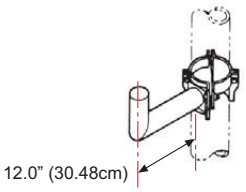
Accessories (field installed - shipped separately)

❒ **PM-1-HD** = 1-Light Heavy Duty Pole Mounting Kit

Suitable for wood poles 6.0" to 12.0" O.D.
Galvanized steel.

Heavy Duty Wood Pole Mounting kit includes one U-18 arm for mounting a single light to wood pole.

Shipping wt. 15 lbs (6.80 kg)

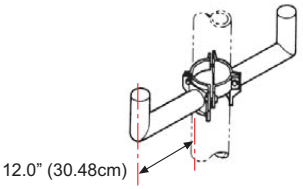


❒ **PM-2-HD** = 2-Light Heavy Duty Pole Mounting Kit

Suitable for wood poles 6.0" to 12.0" O.D.
Galvanized steel.

Heavy Duty Wood Pole Mounting kit includes two U-18 arms for mounting two lights to wood pole.

Shipping wt. 20 lbs (9.07 kg)

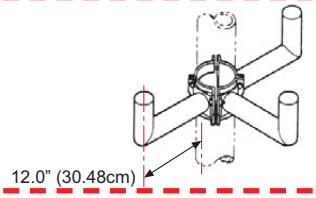


❒ **PM-3-HD** = 3-Light Heavy Duty Pole Mounting Kit

Suitable for wood poles 6.0" to 12.0" O.D.
Galvanized steel.

Heavy Duty Wood Pole Mounting kit includes three U-18 arms for mounting three lights to wood pole.

Shipping wt. 26 lbs (11.79 kg)

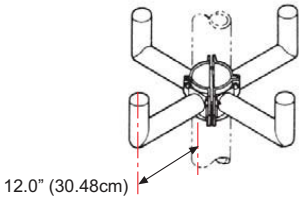


❒ **PM-4-HD** = 4-Light Heavy Duty Pole Mounting Kit

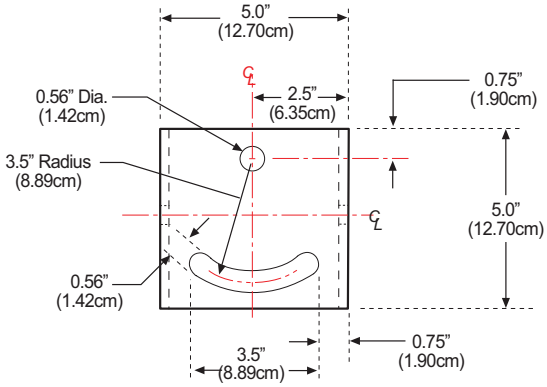
Suitable for wood poles 6.0" to 12.0" O.D.
Galvanized steel.

Heavy Duty Wood Pole Mounting kit includes four U-18 arm for mounting four lights to wood pole.

Shipping wt. 31 lbs (14.06 kg)



Bottom View
Yoke Mount



Direction of Major Light Path

ISO 9001 Certified

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CATALOG KEYWORD: A2 1000

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Date **26 October 2009**
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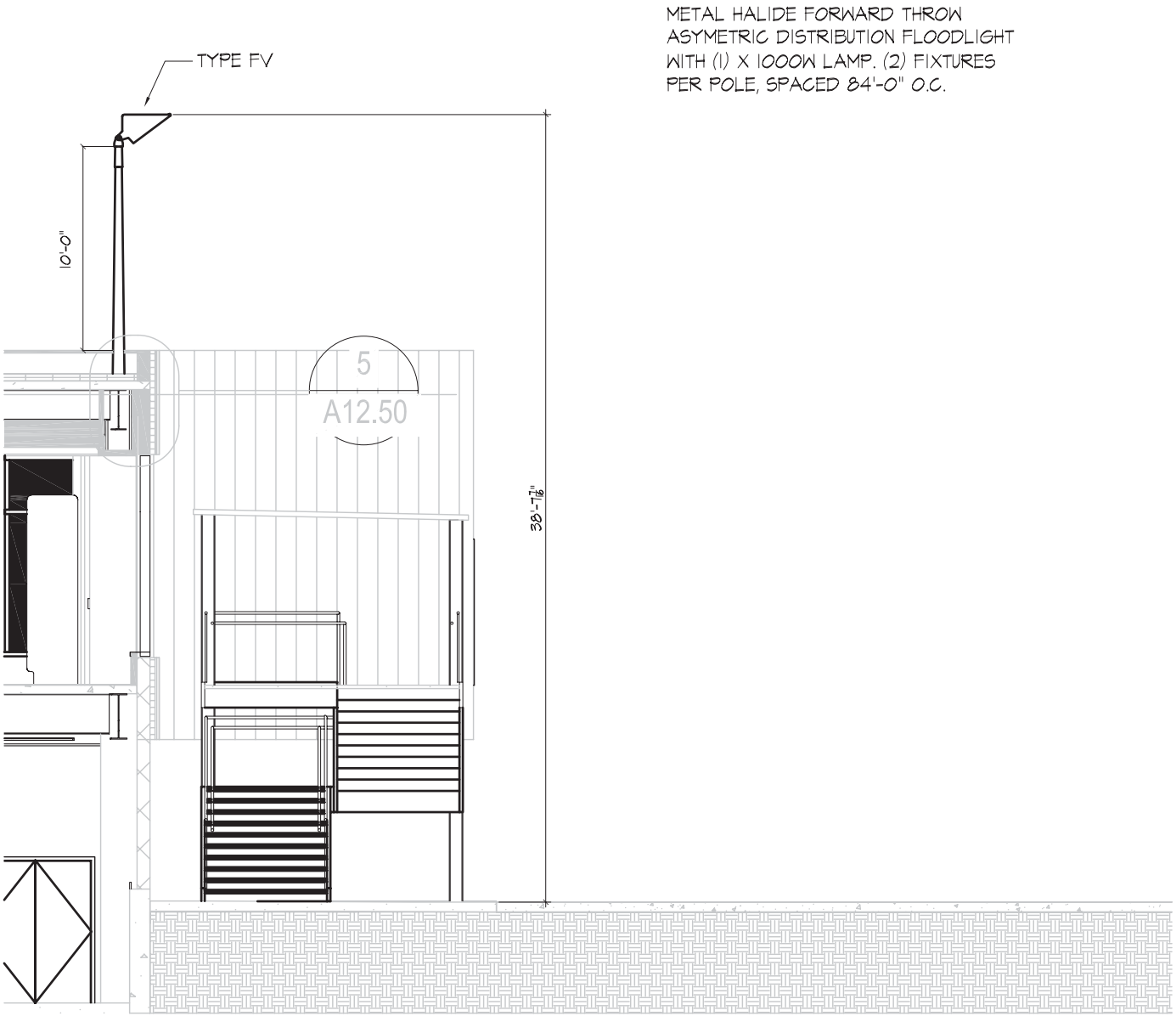
Type **FV-1**
5 of 6

See attached Lighting Fixture Schedule



MOUNTING DETAIL SECTION
Scale: N.T.S

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Architect **Gensler**
Project **Portland International Jetport**

Date **26 October 2009**
Project No. **508667.00**

Type **FV-1**
6 of 6

Fisher Marantz Stone Partners in Architectural Lighting Design 22 West 19th Street New York, NY 10011

DELETED

Spec Sheet

COMPACT FLUORESCENT 1-370

TRIPLES-H 126/6

recessed compact fluorescent downlight/wallwasher

FEATURES

Triples-H 126/6 is an efficient 6" aperture low brightness downlight, for use with one 26-watt, 4-pin, triple tube compact fluorescent lamp by GE, Sylvania or Philips. Triples-H 126/6 provides shielding angles of 40° parallel to and 40° perpendicular to the lamps. Recess depth is only 6 ½".

One housing allows interchangeable use of downlight and wallwash reflectors, permitting housings to be installed first and reflectors to be installed or changed at any time.

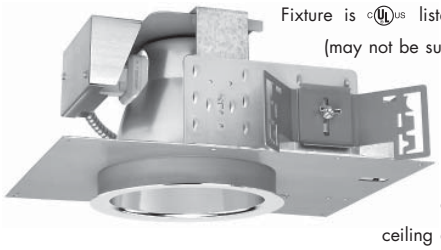
Triples-H 126/6 uses one 26-watt, 4-pin, triple tube lamp providing 1800 lumens (more than a 100-watt incandescent), a 10,000-hour life, a color rendering index (CRI) of 82, and color temperatures as warm as 2700°K (nearly duplicating the color qualities of incandescent).

Reflectors are available in clear, natural aluminum in three finishes: **EvenTone**, our standard clear finish, partially diffuse, anti-iridescent and gently luminous in appearance; **OptiTone**, specular and anti-iridescent, with minimum brightness and maximum efficiency; and **EasyTone**, diffuse and luminous. Additionally, reflectors are available in champagne gold, wheat, pewter, and bronze. Wallwash (120°) and double wallwash (2x120°) reflectors are also available.

Triples-H 126/6 includes a pair of mounting bars (¾" x 27" C channel). Specialty bars for wood joist and T-bar installations are available as accessories.

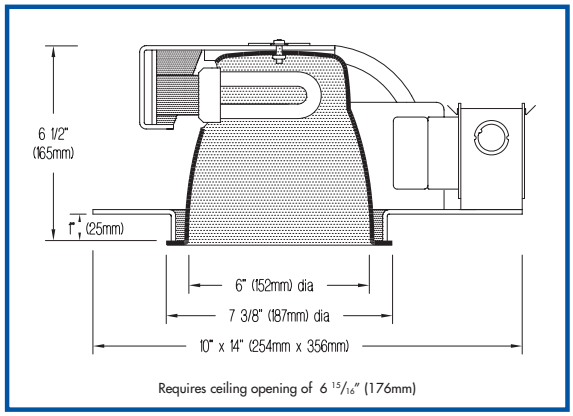
APPLICATIONS

Fixture is recommended for downlighting or wallwashing in offices, corridors, shops, banks, schools, hospitals and airports, as well as lobbies and public areas. The shallow recess depth allows mounting in constricted plenum situations.



Fixture is c UL us listed for Damp Location (may not be suitable for some outdoor environments). Fixture is prewired with high power factor Class P electronic ballast, suitable for use in a fire rated ceiling and approved for eight #12 wire 75°C branch circuit pull-through wiring. Removal of the reflector allows access to the ballast and junction box.

▶ We recommend the use of Sylvania Dulux® T/E (non-amalgam) lamps to virtually eliminate the possibility of reduced light output sometimes caused by a return air plenum or a nearby elevator, exterior door or air conditioning diffuser.



Requires ceiling opening of 6 15/16" (176mm)

PRODUCT CODE

For complete product code, list basic unit and select one item from each following box.

Basic Unit	TRPH 126/6

Reflector Type

Downlight	no suffix
Wallwash	WW
Double Wallwash	DWW

Voltage

120 volt service	120	277 volt service	277

Reflector and Flange Color	*Overlap*	*Flush*
EvenTone Clear	VOL	VFL
OptiTone Clear	COL	CFL
EasyTone Clear	ECOL	ECFL
Champagne Gold	GOL	GFL
Wheat	WHOL	WHFL
Pewter	POL	PFL
Bronze	ZOL	ZFL

Other reflector finishes are available on special order.

Standard reflector flange continues reflector finish. White painted flanges and custom painted flanges are available on special order. Add WF (white flange) or CCF (custom color flange).

OPTIONS

Specify by adding to the basic unit.

Dimmable 3-wire ballast; not for outdoor application ..... – DM

Emergency battery pack operates one lamp in event of power outage. Fixture footprint increases to 10 x 16 ¾" (254 x 425mm). Additional 1 ¼" (32mm) is required to remove EM pack through aperture. Not for outdoor application ..... – EM

⅛" (3mm) thick **clear acrylic shield**, spring-mounted within reflector ..... – PS

▶ For combinations of the Options above, contact factory or Edison Price Lighting representative.

▶ A modified fixture suitable for 2" maximum ceiling thickness is available on special order. Contact factory.

▶ A modified fixture suitable for 347-volt service is available on special order. Contact factory.

▶ An install-from-below version of this fixture, suitable for installation outside North America, is also available. Contact factory.

▶ Decorative reflector rings are available on special order. Contact factory.

EDISON PRICE LIGHTING

41-50 22ND STREET, LIC NY 11101 TEL 718.685.0700 FAX 718.786.8530 www.epl.com

11-07

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FMS

Architect **Gensler**
Project **Portland International Jetport**

Date **26 October 2009**
Project No. **508667.00**

Type **FX**

Fisher Marantz Stone Partners in Architectural Lighting Design 22 West 19th Street New York, NY 10011

TRIPLES-H 126/6

EDISON PRICE LIGHTING

PHOTOMETRIC REPORT

LTL *Luminaire Testing Laboratory Report No. 05265. Original test report furnished upon request.*

Luminaire ..... recessed compact fluorescent downlight with spun aluminum reflector
Lamp ..... Philips 26-watt triple-tube compact fluorescent, 4-pin, GX24q-3 base, 1800 lumens
Efficiency 59.4%
Spacing Criteria.... 0°- 1.3, 90°-1.5, 180°-1.5
Axis orientation.... 0° plane is parallel to lamps, opposite sockets

BALLAST INFORMATION

Voltage	*120*	*277*
Input Watts	28	28
Line Current (A)	.25	.11
Power Factor (%)	>98	>98
THD (%)	<10	<10
Min. Starting Temp* (°F)	0	0

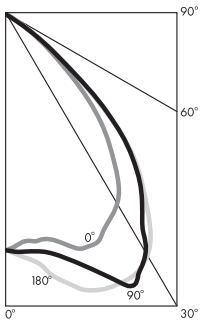
**Consult lamp manufacturers for specific temperatures.*

ZONAL LUMEN SUMMARY

Zone	*Lumens*	*% Lamp*	*% Fixture*
0 - 30°	509	28.3	47.6
0 - 40°	822	45.7	76.9
0 - 60°	1069	59.4	100.0
0 - 90°	1069	59.4	100.0
90 -180°	0	0.0	0.0
0 -180°	1069	59.4	100.0

CANDLEPOWER DISTRIBUTION *(Candela)*

Vertical Angle	*Horizontal Angle*				
	0.0	*45.0*	*90.0*	*135.0*	*180.0*
0	531	531	531	531	531
5	516	528	539	552	552
15	542	567	577	629	639
25	530	599	677	661	654
35	424	462	531	520	557
45	241	281	334	316	329
55	5	6	8	7	8
65	0	0	0	0	0
75	0	0	0	0	0
85	0	0	0	0	0
90	0	0	0	0	0



LUMINANCE DATA *(Candela/m²)*

Vertical Angle	*Average 0° Longitude*	*Average 90° Longitude*	*Average 180° Longitude*
45	18683	21784	25895
55	478	573	765
65	0	0	0
75	0	0	0
85	0	0	0

To convert cd/m² to footlamberts, multiply by 0.2919.

COEFFICIENTS OF UTILIZATION – ZONAL CAVITY METHOD

Effective Floor Cavity Reflectance 20%

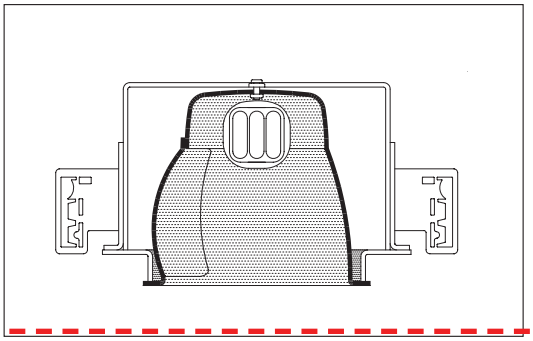
Ceiling Reflectance (%)	*80*				*70*				*50*			*30*			*10*			*0*
Wall Reflectance (%)	*70*	*50*	*30*	*10*	*70*	*50*	*30*	*10*	*50*	*30*	*10*	*50*	*30*	*10*	*50*	*30*	*10*	*0*
Room Cavity Ratio																		
0	71	71	71	71	69	69	69	69	66	66	66	63	63	63	61	61	61	59
1	67	65	64	62	66	64	63	61	62	61	60	60	59	58	57	57	56	55
2	64	61	58	56	62	59	57	55	58	56	54	56	54	53	54	53	52	51
3	60	56	53	50	59	55	52	50	53	51	49	52	50	48	51	49	47	46
4	56	51	48	45	55	51	47	45	49	46	44	48	46	44	47	45	43	42
5	53	47	43	40	52	47	43	40	46	42	40	44	42	40	44	41	39	38
6	50	44	40	37	49	43	39	37	42	39	36	41	38	36	41	38	36	35
7	46	40	36	33	45	40	36	33	39	35	33	38	35	33	37	34	32	31
8	43	36	32	29	42	36	32	29	35	32	29	35	31	29	34	31	29	28
9	40	33	29	26	39	33	29	26	32	28	26	31	28	26	31	28	26	25
10	37	30	26	23	36	30	26	23	29	25	23	29	25	23	28	25	23	22

TRIPLES-H 126/6 WW

WALLWASH INFORMATION

Distance From Ceiling (Feet)	*2'6" From Wall; 2'6" O.C.*		*3' From Wall; 3' O.C.*	
	Below Fixture	*Between Fixtures*	*Below Fixture*	*Between Fixtures*
1	8	7	5	4
2	11	10	7	7
3	15	15	9	9
4	16	16	11	11
5	14	14	11	11
6	12	12	10	10
7	10	9	9	9
8	8	7	7	7
9	6	6	6	6
10	5	5	5	5

All vertical footcandles are initial values with no contribution from ceiling or floor reflectances. Computation performed with at least five wallwashers.



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DELETED

See attached Lighting Fixture Schedule

DELETED

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COLOR KINETICS

PHILIPS

COLORBLAZE 48

The ColorBlaze® 48 fixture washes large areas with far-reaching, rich, saturated colors and color-changing lighting effects. The streamlined, four-foot black metal housing provides a simple yet powerful solution for large-area scenery and wash lighting for theaters, TV and video studios, concerts, events, casinos, and exhibits. On-board power supplies and addressing capabilities eliminate the need for dedicated support equipment and simplifies specification and installation. The auto-switching power supplies work around the world.

Designed in a rugged extruded aluminum housing, each fixture features attached mounting brackets with two, 1/2-inch (13 mm) mounting holes for use with Cheeseborough clamps or pipe clamps. Locking knobs located on the mounting brackets allow for 180° rotational adjustment and locking without the use of special tools. Optional mounting brackets are available for T-handle mount applications. The housing is equipped to support spread lenses, louvers, and other attachments. A single 3-wire, 18AWG 6-foot (1.8 m) UL/cUL rated cord with IEC and flying leads is supplied. (Consult distribution for cord sets listed for PSE or CE).

Each ColorBlaze 48 fixture has eight individual circuit board assemblies, each with 18 high-intensity LEDs. This makes it sequentially controllable in 6-inch increments by a Color Kinetics DMX controller or a third-party DMX512 controller. Each circuit board is pre-addressed for Light# 1-8/DMX# 1-24. Data can be daisy-chained from fixture to fixture with an RJ-45 data cable or an XLR-5 data cable.

For protection from overheating, ColorBlaze 48 has been designed with a temperature monitoring feature. If operating temperatures rise to an unsafe level, a compensation circuit is triggered and ColorBlaze 48 operation is interrupted causing the lights to turn dull red. After 30 minutes the lights will auto-cycle and return to full intensity.

COLORBLAZE 48 SPECIFICATIONS

COLOR RANGE	16.7 million (24 bit) additive RGB colors; continuously variable intensity output range
SOURCE	High intensity power light emitting diodes (LEDs)
BEAM ANGLE	10°
HOUSING	Extruded aluminum with black finish
POWER CONNECTOR	IEC 15A (max) with C13 plug, UL/cUL rated 2-pole, 3-wire, grounded, 15A, flying leads
DATA CONNECTORS	RJ-45 or XLR-5
LISTINGS	UL/cUL, CE, PSE

COMMUNICATION SPECIFICATIONS

DATA INTERFACE	DMX512
CONTROL	Color Kinetics' line of DMX controllers or other DMX512 (RS-485) controllers

ELECTRICAL SPECIFICATIONS

POWER REQUIREMENT	100-240VAC
POWER CONSUMPTION	280W, 2.5A nominal at full intensity (full RGB)

ENVIRONMENTAL SPECIFICATIONS

TEMPERATURE RANGE	-40°F to 122°F (-40°C to 50°C) operating temperature 14°F to 122°F (-10°C to 50°C) starting temperature

CHROMACORE® BY COLOR KINETICS

OPTIBIN® BY COLOR KINETICS

DRY

PSE CE cULus LISTED

ITEM#116-000016-00

BR0116 Rev 07

LED SOURCE LIFE

In traditional lamp sources, lifetime is defined as the point at which 50% of the lamps fail. This is also termed Mean Time Between Failure [MTBF]. LEDs are semiconductor devices and have a much longer MTBF than conventional sources. However, MTBF is not the only consideration in determining useful life. Color Kinetics uses the concept of useful light output for rating source lifetimes. Like traditional sources, LED output degrades over time (lumen depreciation) and this is the metric for SSL lifetime.

LED lumen depreciation is affected by numerous environmental conditions such as ambient temperature, humidity and ventilation. Lumen depreciation is also affected by means of control, thermal management, current levels, and a host of other electrical design considerations. Color Kinetics systems are expertly engineered to optimize LED life when used under normal operating conditions. Lumen depreciation information is based on LED manufacturers' source life data as well as other third party testing. Low temperatures and controlled effects have a beneficial effect on lumen depreciation. Overall system lifetime could vary substantially based on usage and the environment in which the system is installed.

Temperature and effects will affect lifetime. Color Kinetics rates product lifetime using lumen depreciation to 50% of original light output. When the fixture is running at room temperature using a color wash effect, the range of lifetime is in the range of 80,000-100,000 hours. This is LED manufacturers' test data. High output is defined as any LED device that is 1/2 watt or above. For more detailed information on source life, please see www.colorkinetics.com/lifetime.

OPTIBIN®

There are inherent variations in the fabrication processes of all semiconductor materials. For LEDs, this variance results in differences in the color and intensity of light output as well as electrical characteristics. Due to these differences, LED manufacturers sort production into "bins," but insuring the availability of a single bin is very difficult. To minimize this issue and achieve optimal color consistency in its products, Color Kinetics has developed and uses a proprietary technology called Optibin. Optibin is an advanced production binning optimization process that minimizes the effects of LED variance for the best possible output uniformity in the final product. Color Kinetics Optibin technology gives the most consistent control of color and intensity from product to product.

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TEL 888 FULL RGB • TEL 617 423 9999 • FAX 617 423 9998 • INFO@COLORKINETICS.COM • WWW.COLORKINETICS.COM

COLORBLAZE 48

PHOTOMETRIC PERFORMANCE

Photometric data is based on test results from an independent testing lab.

SOURCE SPECIFICATIONS

Optics:	Clear polycarbonate
Source:	144 LEDs (48 Red, 48 Green, 48 Blue)
Beam Angle:	10° (at 50% of peak illuminance)
Distribution:	Symmetric direct illumination
CCT:	Adjustable 1,000 – 10,000K
CRI:	Not measurable (CIE 13.3-1995)

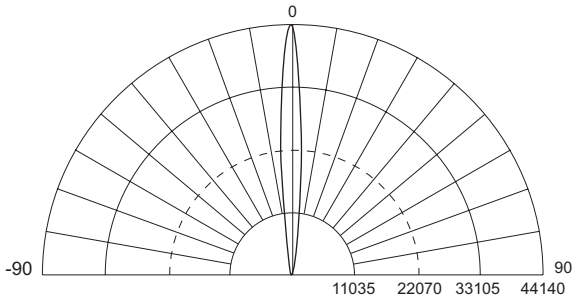
ILLUMINANCE DISTRIBUTION

7.9 / 85.0	10.7 / 115.2	11.9 / 128.1	11.4 / 122.7	9.6 / 103.3	6.9 / 74.3	6.0′/2.0m
15.3 / 164.7	25.3 / 272.3	29.3 / 315.4	27.6 / 297.1	19.1 / 205.6	10.0 / 107.6	
52.8 / 568.3	99.1 / 1066.7	107.0 / 1151.7	109.0 / 1173.3	68.0 / 732.0	18.0 / 193.8	3.0′/1.0m
59.0 / 635.1	144.0 / 1550.0	183.0 / 1969.8	183.0 / 1969.8	140.0 / 1507.0	54.6 / 587.7	
23.4 / 251.9	82.5 / 888.0	127.0 / 1367.0	125.0 / 1345.5	112.0 / 1205.6	57.3 / 616.8	
10.1 / 108.7	25.5 / 274.5	38.9 / 418.7	40.5 / 435.9	35.4 / 381.0	19.6 / 211.0	0.0′/0.0m

3.0′/1.0m 0′/0m 3.0′/1.0m

Units:	Footcandles (top)/Lux (bottom) 10.8 lux = 1 fc
Measured on:	All, reflectance model 80/50/20%
Distance from surface:	Bottom of grid, 3′ (1.0 m) from surface, light at a 45° angle off horizontal

CANDLE POWER DISTRIBUTION



Measured on:	White
Beam center:	44140 cd
Thin dashed line:	Indicates 50% of peak
Multipliers:	0.33 Red, 0.50 Green, 0.18 Blue

ILLUMINANCE

COLOR	3′ / 1m	6′ / 2m	9′ / 3m	15′ / 5m
WHITE	2162.0 / 23271.8	675.0 / 7265.7	253.0 / 2723.3	127.0 / 1367.0
RED	721.2 / 7763.5	225.2 / 2423.8	84.4 / 908.5	42.4 / 456.0
GREEN	1070.2 / 11519.5	334.1 / 3596.5	125.2 / 1348.0	62.9 / 676.7
BLUE	393.5 / 4235.5	122.9 / 1322.4	46.0 / 495.6	23.1 / 248.8

Measured in Footcandles (top)/Lux (bottom) on axis.
Measured on: All, reflectance 0.

LIGHT OUTPUT

COLOR	TOTAL OUTPUT (lumens)	POWER (Watts)	EFFICACY (Lm/W)
WHITE	2282	240.0	9.5
RED	761.3	84.0	9.1
GREEN	1129.6	84.0	13.4
BLUE	415.3	84.0	4.9

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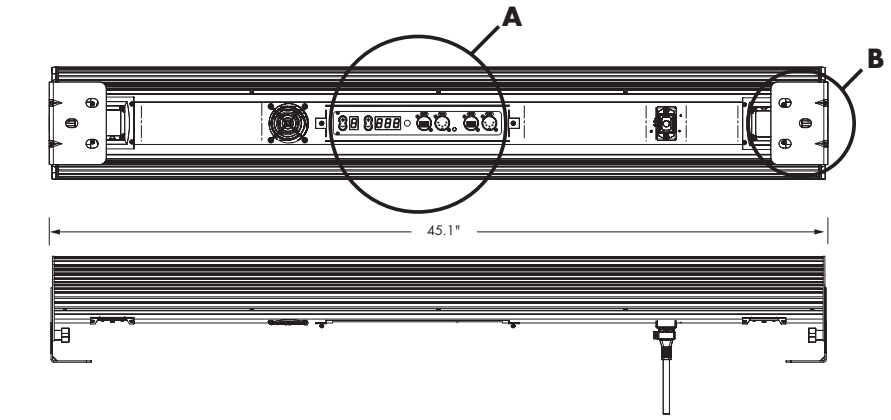
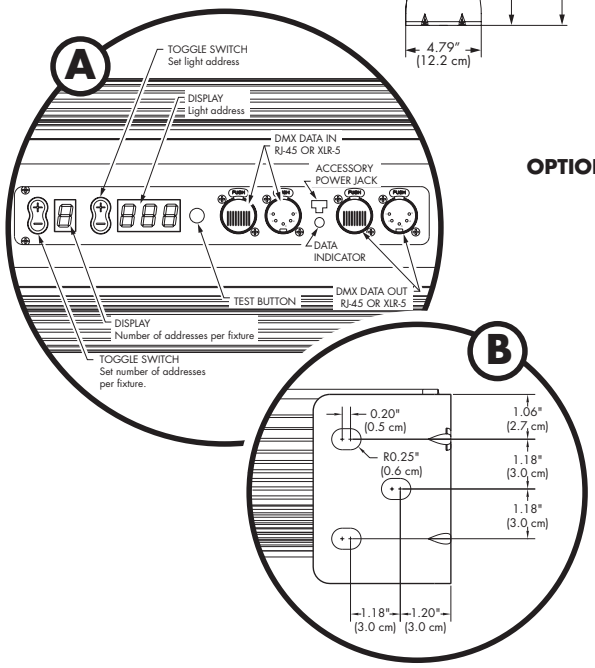
COLORBLAZE 48

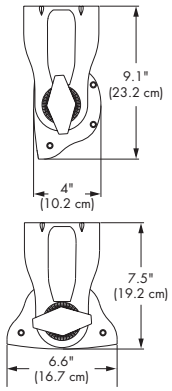
PHYSICAL DIMENSIONS





OPTIONAL MOUNTING BRACKET

FOR T-HANDLE MOUNING



COLORBLAZE 48 ITEM# 116-000016-00	
WEIGHT (APPROX)	40.0 lb (18.1 kg)
POWER CABLE	IEC 15A (max) with C13 plug
POWER REQUIREMENT	100-240VAC (280W)

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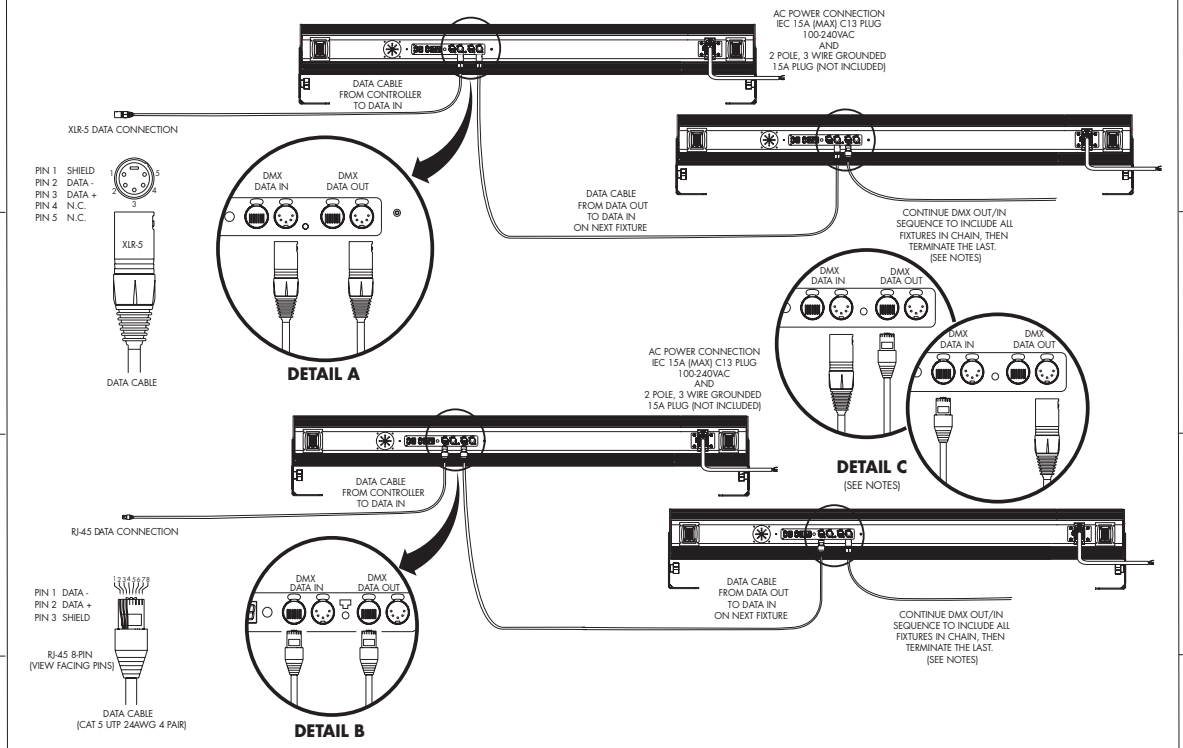
COLORBLAZE 48

FUNCTIONAL FLOW DIAGRAM



NOTES:

1. PLACE TERMINATOR IN DMX DATA OUT PORT OF THE LAST FIXTURE IN A CHAIN.
2. MAXIMUM DMX DATA RUN FROM DMX SOURCE TO LAST FIXTURE IN CHAIN IS 1000 FEET (OR 300 m).
3. DMX DATA CHAINS NEED NOT BE CONNECTOR SPECIFIC, FOR EXAMPLE: XLR-5 INPUT WITH RJ-45 OUTPUT AND VICE VERSA. SEE DETAIL C.
4. THE ACCESSORY POWER JACK IS FOR USE WITH COLOR KINETICS PRODUCTS ONLY.

For complete installation instructions and safety precautions, refer to the ColorBlaze 48/72 User Guide and wiring diagrams located at www.colorkinetics.com/support.

Additional Items	
Power Plug	2 Pole, 3 Wire, Grounded, 15A Power Plug
Controller	Color Kinetics DMX controller or DMX512 compatible controller
Data Cables	RJ-45 or XLR-5 data cables

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Date: _____ Type: _____

Firm Name: _____

Project: _____

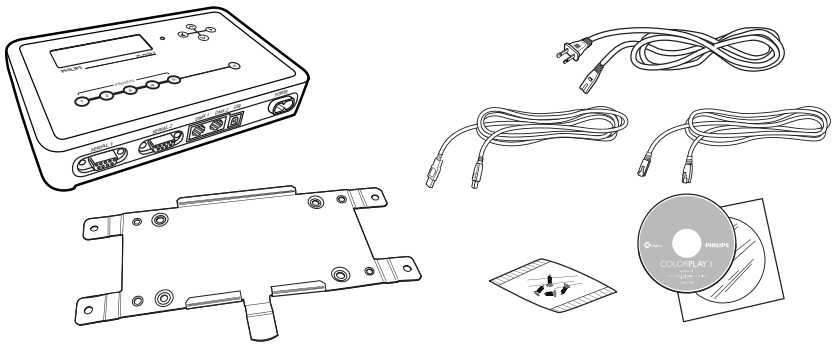
iPlayer 3

A compact DMX control solution with advanced light show authoring features

iPlayer® 3 controller is a compact yet powerful show storage and playback device capable of delivering light shows to installations with up to 340 unique light addresses. Packaged with ColorPlay® 3 light show authoring software, iPlayer 3 is designed to add new levels of sophistication and flexibility to your lighting installations while eliminating the need for expensive lighting boards and technical programming expertise.

- Easy to use — With factory preset shows, custom show-authoring capabilities, an intuitive LCD interface, removable SD card storage, and onboard light addressing features, iPlayer 3 enables you to spend more time on the creative aspects of lighting design and less time on setup.
- Packaged with ColorPlay 3 light show authoring software — ColorPlay 3 gives you the flexibility to create and manage light shows using fully customizable effects, multi-track editing, timeline layering, and transition styles.
- Designed for use with the optional Controller Keypad — Controller Keypad is a wall-mounted user interface providing instant pushbutton playback of up to eight light shows.
- Supports the optional AuxBox expansion device — AuxBox automatically triggers up to eight iPlayer 3 light shows using any remote triggering device with a dry-contact closure. Via the AuxBox, you can trigger light shows by motion sensors, 3rd party control or sensor systems, and more.
- Control two DMX universes — iPlayer 3 has two DMX output ports, each controlling a DMX512 universe of 170 unique light addresses.
- Automate show playback — Set alarms to automatically trigger show playback based on a specific date, day of the week, weekdays, weekends, or an astronomical event, such as sunrise or sunset.

For detailed product information, please refer to the iPlayer 3 Product Guide at:
www.colorkinetics.com/ls/controllers/iplayer3/



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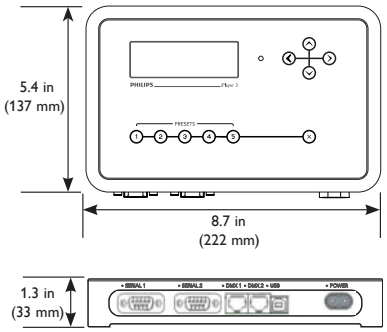
Specifications

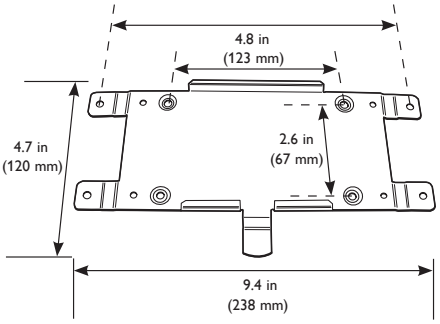
Due to continuous improvements and innovations, specifications may change without notice

Item	Specification	Details
Electrical	Input Voltage	100 – 240 VAC, 50 – 60 Hz, 5 W
Control	Computer Interface	USB 2.0
	External / Auxiliary Interface	Two DMX512 RJ45 ports Two RS-232 9-pin serial ports
	Data Storage	Removable Secure Digital Card drive (256 MB Card included.)
Physical	Dimensions *(Width x Depth x Height)*	8.2 x 5.4 x 1.3 in (209 x 137 x 33 mm)
	Weight	1.2 lb (0.54 kg)
	Housing	Polycarbonate
	Operating Temperature	14° – 104° F (-10° – 40° C)
	Humidity	0 – 95%, non-condensing
Certification and Safety	Certification	UL / cUL, FCC Class B, CE
	Environment	Dry Location, IP20



Software Requirements

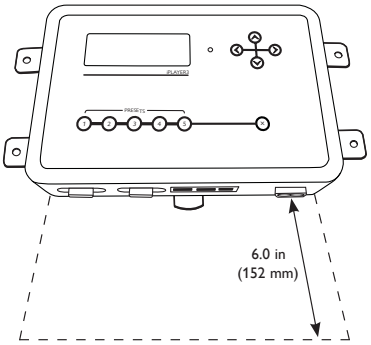
System Requirements	Specification	PC	Mac
OS		Windows® 2000 / XP / Vista	Mac OS 10.4 or greater
Hardware	CD Drive	CD-ROM or DVD drive	CD-ROM or DVD drive
	Memory	512 MB RAM	512 MB RAM
	Disk space	60 MB free disk space	60 MB free disk space



iPlayer 3 and Accessories

Item	Type	Item Number	Philips 12NC
iPlayer 3	North America Power Cord	103-000019-00	910403327101
iPlayer 3	Europe Power Cord	103-000019-01	910503700392
Controller Keypad	DB-9 Serial	103-000020-00	910503700223
AuxBox	DB-9 Serial	103-000021-00	910503700224

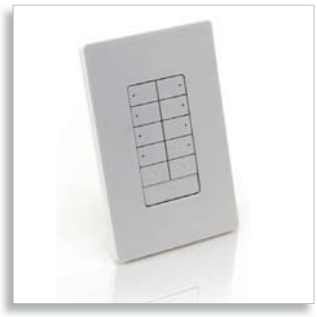
Use Item Number when ordering in North America.



For detailed product information, please refer to the iPlayer 3 Product Guide at: www.colorkinetics.com/ls/controllers/iplayer3/

Philips Solid-State Lighting Solutions, Inc.
3 Burlington Woods Drive
Burlington, Massachusetts 01803 USA
Tel 888.Full.RGB
Tel 617.423.9999
Fax 617.423.9998
www.colorkinetics.com

See attached Lighting Fixture Schedule



Date: _____ Type: _____

Firm Name: _____

Project: _____

Controller Keypad

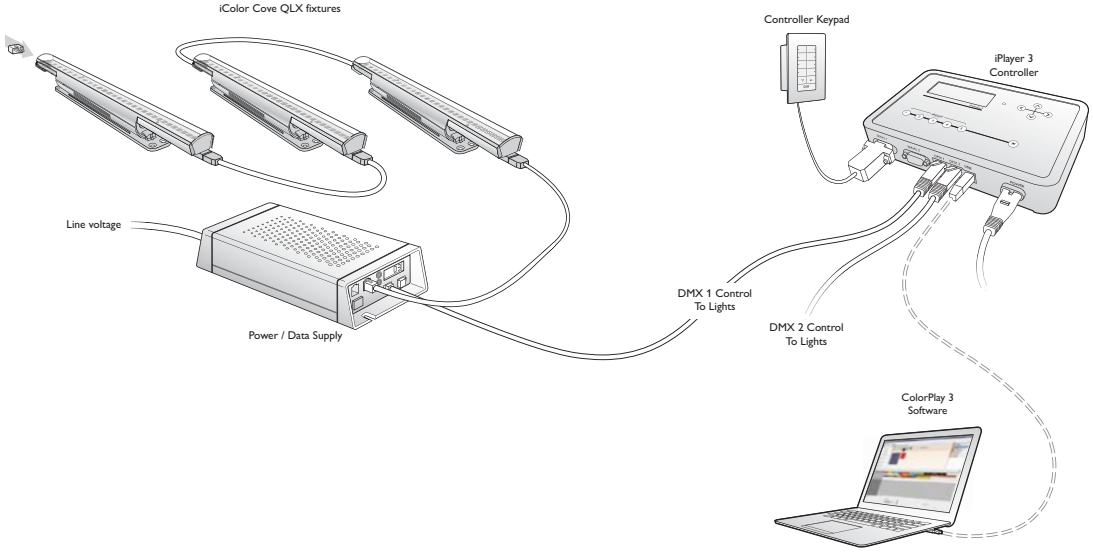
Convenient push-button control for iPlayer 3 light shows

Controller Keypad is a convenient and elegant user interface to iPlayer 3®, a compact DMX lighting controller that stores and plays back custom ColorPlay 3 light shows. iPlayer 3 and Controller Keypad integrate to provide push-button playback of up to eight shows per keypad.

- Full set of lighting controls — Each keypad instantly and conveniently triggers up to eight iPlayer 3 light shows. Onboard indicator lamps identify the current show. Dimmer controls adjust the brightness of light fixtures during playback, and a master OFF switch turns all show lights off.
- Simple installation — Mounts in a standard US single-gang wall box. Uses a single serial cable to connect with iPlayer 3.
- Standard support for two Controller Keypads within a single installation — Standard configuration allows you to easily install two keypads in a single iPlayer 3 installation, for control of up to 16 shows. With advanced instructions, you can install up to eight keypads in a single installation, for control of up to 64 total shows.
- Compact design with sleek Decora® style faceplate — Compact design uses wall space efficiently. Industry standard Decora style faceplate hides mounting hardware for a clean look that blends with a variety of architectural styles.

For detailed product information, please refer to the Controller Keypad Product Guide at www.colorkinetics.com/ls/controllers/iplayer3/.

Typical iPlayer 3 Installation with Controller Keypad



PHILIPS

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Specifications

Due to continuous improvements and innovations, specifications may change without notice

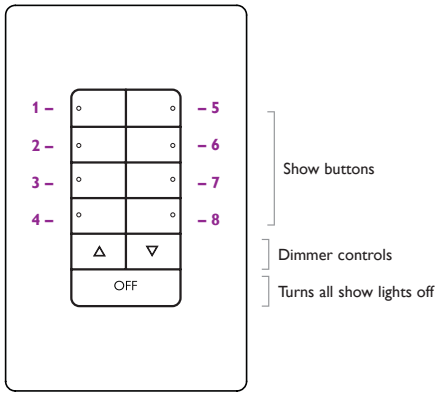
Item	Specification	Details
Control	Serial	+5 VDC @ 50 mA, from iPlayer 3 Controller
Physical	Dimensions *(Height x Width x Depth)*	4.7 x 2.9 x .93 in (119 x 74 x 24 mm)
	Weight	3 oz (85 g)
	Housing	Medium matte white plastic Decora® style faceplate Mounts in single-gang wall box
	Operating Temperature	14° F – 104° F (-10° C – 40° C)
	Humidity	0 – 95%, non-condensing
	Connector / Cable	Serial cable, 20 ft (6.1 m) included Length of up to 50 ft (15.2 m) supported
	Environment	Indoor, Dry

Controller Keypad and Accessories

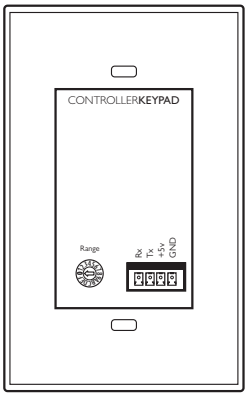
Item	Item Number	Philips 12NC
Controller Keypad	103-000020-00	910503700223
iPlayer 3 Controller (N. America Power Cord)	103-000019-00	910403327101
iPlayer 3 Controller (Europe Power Cord)	103-000019-01	910503700392

Use Item Number when ordering in North America.

Front



Back

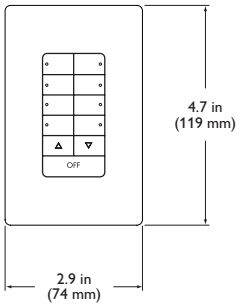


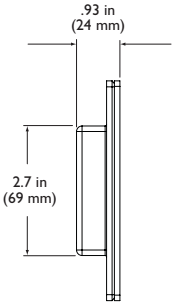
Controller Keypad is part of a complete system that includes:

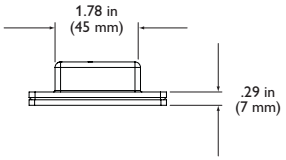
- iPlayer 3 (including ColorPlay 3) for configuring the keypad and for assigning shows to each keypad trigger.
- The provided 20 ft (6.1 m) serial cable, or a custom serial cable of no longer than 50 ft (15.2 m).

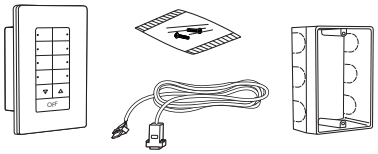
For detailed product information, please refer to the Controller Keypad Product Guide at: www.colorkinetics.com/ls/controllers/iplayer3/

Dimensions









Included in the box

Controller Keypad
20 ft (6.1 m) serial cable
Standard single-gang wall box for use outside of North America
(2) self-threading flat-head countersunk M2.5 screws
Decora® style faceplate

Philips Solid-State Lighting Solutions, Inc.
3 Burlington Woods Drive
Burlington, Massachusetts 01803 USA
Tel 888.Full.RGB
Tel 617.423.9999
Fax 617.423.9998
www.colorkinetics.com

DAS-000016-01 R01 10-08

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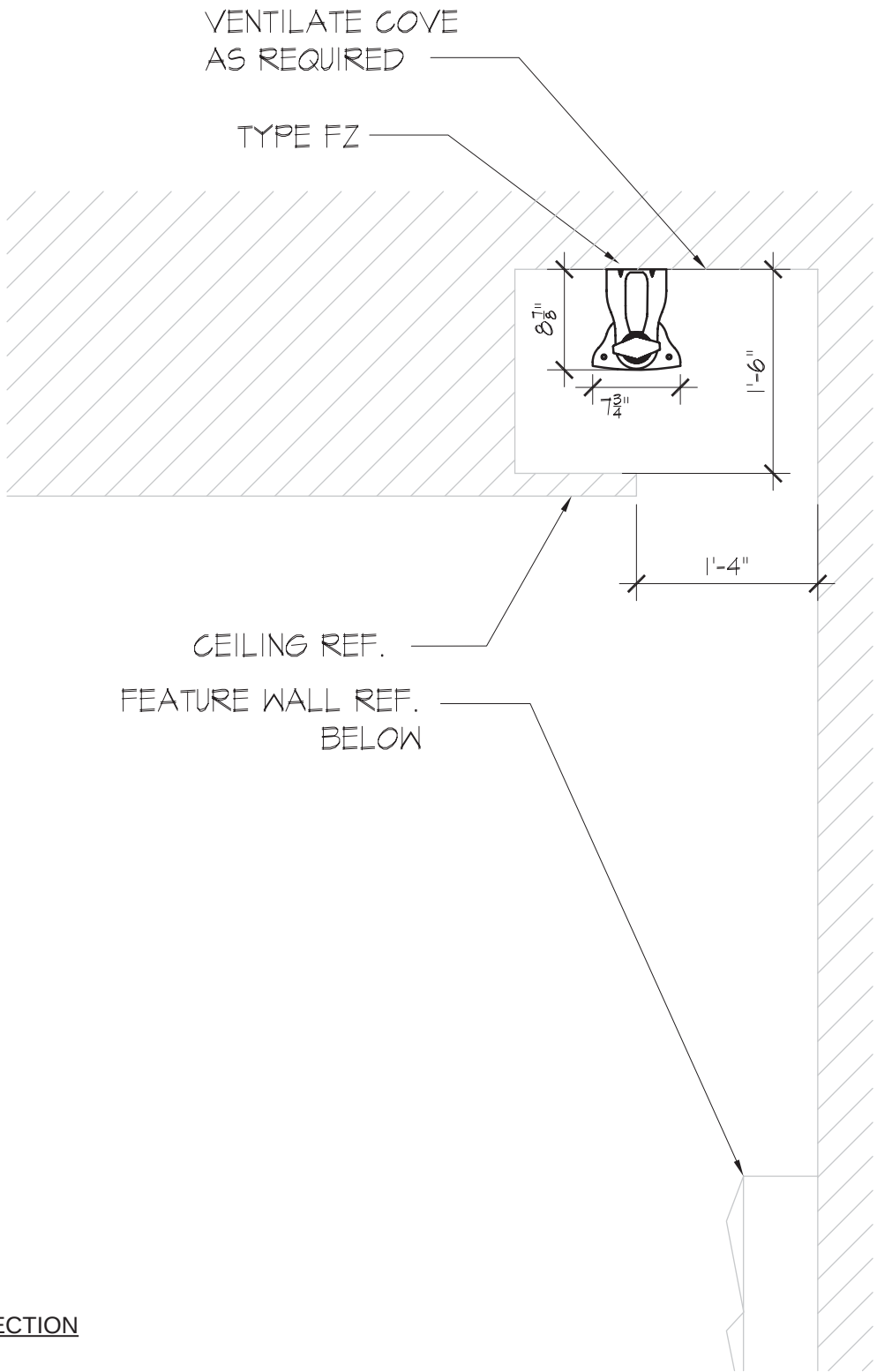
See attached Lighting Fixture Schedule



MOUNTING DETAIL SECTION
Scale: N.T.S

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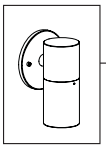


CATSKILL™

PAR20 Halogen

PROJECT:	
TYPE:	
CATALOG NUMBER:	
LAMP(S):	
NOTES:	

CATALOG NUMBER LOGIC

	CK									
Example	**CK**	**-**	**PAR20**	**-**	**47**	**-**	**BZP**	**-**	**10**	**-**	**11**

Series

CK - Catskill Series™

Source

PAR20 - PAR20 Halogen (50W)

Lamp

0 - By Others

47 - 50 PAR20/H/NSP9(50W) 9° N Spot
49 - 50 PAR20/H/FL30(50W) 30° N Flood

Finish

Aluminum

Powder Coat Color	Satin	Wrinkle
Bronze	**BZP**	**BZW**
Black	**BLP**	**BLW**
White (Gloss)	**WHP**	**WHW**
Aluminum	**SAP**	—
Verde	—	**VER**

Also available in Premium Finishes See submittal SUB-1439-00 for Premium Finishes

Lens Type

9 - Clear (Standard)
10 - Spread*
13 - Rectilinear*

Shielding

11 - Honeycomb Baffle*

* Accomodates up to 2 Lens/Shielding media

LAMP DATA

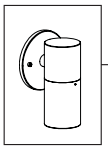
BK No.	Lamp Watts	Description	Rated Life	Center Beam Candlepower	Beam Angle	Beam Type
47	50	50PAR20/H/SP10	3,000	6,000	10°	Narrow Spot
49	50	50PAR20/H/FL25	3,000	1,500	25°	Flood

B-K LIGHTING

40429 Brickyard Drive • Madera, CA 93636 • USA
559.438.5800 • FAX 559.438.5900
www.bklighting.com • info@bklighting.com

SUBMITTAL DATE 07-14-08

DRAWING NUMBER SUB-1185-00

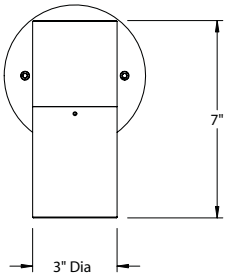


CATSKILL™

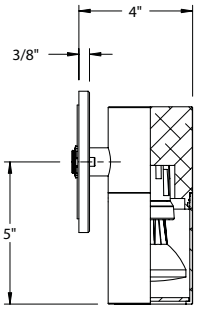
PAR20 Halogen

PROJECT:	
TYPE:	

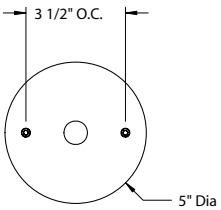
FRONT VIEW



SIDE VIEW



CANOPY DETAIL



SPECIFICATIONS

GreenSource Initiative™
Metal and packaging components are made from recycled materials. Manufactured using renewable solar energy, produced onsite. Returnable to manufacturer at end of life to ensure cradle-to-cradle handling. Packaging contains no chlorofluorocarbons (CFC's). RoHS compliant.

Body
Fully machined from solid, copper-free aluminum. Unibody design provides enclosed, water-proof wireway and heat sink to maximize lamp life. High temperature, silicone 'O' Ring provides water-tight seal.

Cap
Machined from copper-free aluminum. Flush mounted lens. Accommodates up to (2) lens or louver media.

Canopy
5" dia. Machined from copper-free aluminum. Includes Universal Mounting Ring. For use with 4" recessed octagon box (by others).

Lens
Shock resistant, tempered, clear glass lens is factory adhered to fixture cap and provides hermetically sealed optical compartment.

Lamp
For use with 50 watt maximum, PAR20 line voltage halogen lamp.

Socket
Specification grade ceramic body lamp holder. Medium base, nickel-plated copper alloy lamp grip and screw shell. Corrosion resistant coil spring under center contact.

Wiring
Teflon® coated wire, 18AWG, 600V, 250° C rated and certified to UL 1659 standard. Leads extend 6" beyond canopy.

Hardware
Tamper-resistant, stainless steel hardware. Mounting screws are additionally black oxided.

Finish
StarGuard® (Pat. Pend.), a 15 stage chromate-free process cleans and conversion coats aluminum components prior to application of Class 'A' TGIC polyester powder coating. RoHS compliant.

Warranty
5 year limited warranty.

Listings
ARL and CSA listed to UL 1598 standard. Suitable for use in wet locations.

**Teflon is a registered trademark of DuPont Corporation.*

B-K LIGHTING
40429 Brickyard Drive • Madera, CA 93636 • USA
559.438.5800 • FAX 559.438.5900
www.bklighting.com • info@bklighting.com

SUBMITTAL DATE	DRAWING NUMBER
07-14-08	SUB-1185-00

Wall luminaires with cutoff optics

Type:
BEGA Product:
Project:
Voltage:
Color:
Options:
Modified:

Housing: Constructed of copper free die-cast aluminum alloy. The housing uses stainless steel inserts for enclosure attachment. Mounts over a standard 3½" or 4" octagonal wiring box.

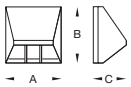
Enclosure: Tempered, etched glass lens. One piece die-cast, copper free, louvered, aluminum face plate secured to the housing with four captive socket head, stainless steel screws. Semi specular, anodized aluminum internal reflector. Fully gasketed for water tight operation using a silicone rubber gasket.

Electrical: Compact fluorescent: Lampholder: 26 W, 32 W, and 42 W multiwatt socket GX24q-3, GX24q-4 rotary lock lampholder rated 75 W, 600 V. Ballasts are internal and electronic universal voltage (120 V through 277 V).

Finish: Available in five standard BEGA colors: Black (BLK), White (WHT), Bronze (BRZ), Silver (SLV), Eurocoat™ (URO). To specify, add appropriate suffix to catalog number. Custom colors supplied on special order.

U.L. listed, suitable for wet locations.
Protection class IP 65.

Options:
FSC Fusing
EMPK Integral emergency battery pack
SMC Surface conduit entry



	Lamp	Lumen	A	B	C
2240P	1 42W CF triple-4p	3200	11	11	5⅞

BEGA-US 1000 BEGA Way, Carpinteria, CA 93013 (805) 684-0533 FAX (805) 566-9474 www.bega-us.com

Issued for Permit

4 Lighting Power Density Calculation

PORTLAND INTERNATIONAL JETPORT
Lighting Power Density Calculation (LPD)
Gensler
Issued for Permit Set
26 October 2009

Room Description	Room #	Room (Sq.Ft.)	Fixture Type	Wattage/ Fixture Type	Fixture Qty.	Total Fixture Watts	Total Design Watts (Per space)	Design LPD (W/Sq.Ft)	Total ASHRAE 2004 Watts*	ASHRAE 2004 LPD (W/Sq.Ft)	Excess Watts (Deficit)
LEVEL 2											
CHECK-IN-TICKET HALL	1510	16,511	**FA**	46 W	4	184 W					
			FB*	250 W	5	1,250 W					
			FC	136 W	35	4,760 W					
			FF	30 W	61	1,830 W					
			FG	125 W	4	500 W					
			FL	45 W	101	4,545 W					
			FZ*	280 W	15	4,200 W	17,269 W	1.0	33,022 W	1.0	15,753
CHECK-IN-COUNTERS		15,189	**FF**	30 W	1	30 W					
			FP	30 W	102	3,060 W					
			FQ*	8 WLF	173 LF	1,384 W	4,474 W	0.3	37,973 W	1.5	33,499
RESTROOMS	1513	317	**FF**	30 W	5	150 W					
			FP	30 W	3	90 W					
			FR	8 WLF	9 LF	68 W					
			FS	8 WLF	17 LF	132 W					
			FX	30 W	2	60 W					
	1515	73	**FF**	30 W	1	30 W					
			FP	30 W	1	30 W					
	1516	364	**FF**	30 W	6	180 W					
			FP	30 W	3	90 W					
			FR	8 WLF	13 LF	100 W					
			FS	8 WLF	17 LF	136 W					
			FX	30 W	2	60 W	1126 W	1.5	679 W	0.9	(447)
ESCALATORS/ STAIRS #2, #3		1,067	**FA**	46 W	10	460 W					
			FG	125 W	10	1,250 W	1710 W	1.6	640 W	0.6	(1,070)

PORTLAND INTERNATIONAL JETPORT
Lighting Power Density Calculation (LPD)
Gensler
Issued for Permit Set
26 October 2009

Room Description	Room #	Room (Sq.Ft.)	Fixture Type	Wattage/ Fixture Type	Fixture Qty.	Total Fixture Watts	Total Design Watts (Per space)	Design LPD (W/Sq.Ft)	Total ASHRAE 2004 Watts*	ASHRAE 2004 LPD (W/Sq.Ft)	Excess Watts (Deficit)
LEVEL 3											
CONCOURSE	2500	10,546	**FF**	30 W	41	1,230 W					
			FB*	250 W	16	4,000 W					
			FA	46 W	13	598 W					
			FG	125 W	13	1,625 W	7,453 W	0.7	16,874 W	0.6	9,421
HOLDROOM		44,018	**FC**	136 W	51	6,936 W					
			FF	30 W	103	3,090 W	10,026 W	0.2	26,411 W	0.6	16,385
CORRIDOR		2,287	**FF-1**	30 W	27	810 W					
			FF-2	30 W	7	210 W					
			FF-3	30 W	1	30 W	240 W	0.1	1,372 W	0.6	1,132
RESTROOMS	2507	579	**FF**	30 W	6	180 W					
			FP	30 W	5	150 W					
			FX	30 W	1	30 W					
			FS	8 WLF	30	240 W					
			FR	8 WLF	18.5	148 W					
	2510	4,461	**FF**	30 W	5	150 W					
			FP	30 W	4	120 W					
			FX	30 W	1	30 W					
			FS	8 WLF	23	184 W					
			FR	8 WLF	12	96 W					
	2512	57	**FF**	30 W	1	30 W					
			FP	30 W	1	30 W	1,388 W	0.3	4,587 W	0.9	3,199
FOOD COURT	2516	2,577	**FD***	66 W	10	660 W					
			FD-1	96 W	7	672 W					
			FD-2*	177 W	5	885 W					
			FF	30 W	9	270 W	2,487 W	1.0	6,185 W	1.4	3,698
CONCESSIONS		6,256	**FD***	66 W	20	1,320 W					
			FD-1	96 W	9	864 W					
			FD-2*	177 W	5	885 W					
			FF	30 W	9	270 W	3,339 W	0.5	15,014 W	1.4	11,675
FIXED LINK	2526	714	**FF**	30 W	10	300 W	300 W	0.4	428 W	0.6	128

PORTLAND INTERNATIONAL JETPORT
Lighting Power Density Calculation (LPD)
Gensler
Issued for Permit Set
26 October 2009

Room Description	Room #	Room (Sq.Ft.)	Fixture Type	Wattage/ Fixture Type	Fixture Qty.	Total Fixture Watts	Total Design Watts (Per space)	Design LPD (W/Sq.Ft)	Total ASHRAE 2004 Watts*	ASHRAE 2004 LPD (W/Sq.Ft)	Excess Watts (Deficit)
LEVEL 4											
SECURITY-SECURITY QUEUE	3503	4,396	**FA**	46 W	32	1,472 W					
			FH*	242 W	4	968 W					
			FB*	250 W	24	6,000 W	8,440 W	1.9	10,990 W	1.5	2,550
CIRCULATION PUBLIC-CIRCULATION	3500	13,518	**FA**	46 W	38	1,748 W					
			FB*	250 W	7	1,750 W					
			FF	30 W	15	450 W					
			FH*	242 W	2	484 W	4,432 W	0.3	21,629 W	0.6	17,197
SECURITY SCREENING CHECK POINT	3504	6,072	**FB***	250 W	4	1,000 W					
			FC	136 W	66	8,976 W	9,976 W	1.6	9,715 W	0.6	(261)
PUBLIC-SECURE CIRCULATION	3505	6,667	**FA**	46 W	56	2,576 W					
			FB*	250 W	2	500 W					
			FH*	242 W	5	1,210 W	13,262 W	2.0	10,667 W	0.6	(2,595)
CIRCULATION PUBLIC-BY-PASS LANE	3513	545	**FA**	46 W	6	276 W					
ESCALATORS/ STAIRS #5, #6		598	**FA**	46 W	9	414 W					
			FG	125 W	10	1,250 W	1,940 W	1.7	686 W	0.6	(1,254)
TOTAL		**136,811**					**87,862 W**		**196,870 W**		**109,008**

PORTLAND INTERNATIONAL JETPORT
Lighting Power Density Calculation (LPD)
Gensler
Issued for Permit Set
26 October 2009

Room Description	Room #	Room (Sq.Ft.)	Fixture Type	Wattage/ Fixture Type	Fixture Qty.	Total Fixture Watts	Total Design Watts (Per space)	Design LPD (W/Sq.Ft)	Total ASHRAE 2004 Watts*	ASHRAE 2004 LPD (W/Sq.Ft)	Excess Watts (Deficit)
EXTERIOR											
CANOPY		3,138	**FK**	45 W	12	540 W					
			FJ	59 W	15	885 W					
DROP-OFF		24,125	**FM**	45 W	143	6,435 W					
			FAB**	50 W	2	100 W	7,960 W	0.3	33,979 W	1.25	26,019
APRON**		20,000	**FAC**	45 W	6	270 W					
			FV	2160 W	17	36,720 W					
			FV-1	3240 W	1	3,240 W	40,230 W		n/a		
TOTAL		**47,263**					**7,960 W**		**33,979 W**	**1.25**	**26,019 W**

*- Allowance up to 1.0W/sq ft max. according to 1308.6.2.3. (1) (Decorative lighting)
**- Exempt

Portland International Jetport (PWM)

Portland, Maine

Appendix C: Geotechnical Report

GEOTECHNICAL DATA REPORT
PROPOSED TERMINAL EXPANSION
PORTLAND INTERNATIONAL JETPORT
PORTLAND, MAINE

by

Haley & Aldrich, Inc.
Portland, Maine

for

Gensler
New York, New York

File No. 35024-001
13 October 2008

HALEY&
ALDRICH

Haley & Aldrich
75 Washington Avenue
Suite 203
Portland, ME 04101-2617

Tel: 207.482.4600
Fax: 207.775.7666
HaleyAldrich.com

HALEY&
ALDRICH

13 October 2008
File No. 35024-001

Gensler
48 Wall St, Suite 900
New York, NY 10005

Attention: William Hooper, AIA
Project Manager

Subject: Geotechnical Data Report
Proposed Terminal Expansion
Portland International Jetport
Portland, Maine

Dear Bill:

This data report presents the results of the subsurface exploration program conducted in support of the subject project in Portland, Maine.

This work was undertaken by Haley & Aldrich, Inc. (Haley & Aldrich) at your request in accordance with our proposal dated 15 May 2008, our Agreement Amendments No. 1 and 2 dated 13 August 2008 and 9 September 2008, respectively, and subsequent authorization by Gensler.

This report has been prepared for use by the design team during design development and contract document preparation phases of the project. It is our intent that this report be included in the contract documents or as a reference to the contract document package for use by the prospective bidding contractors. A geotechnical engineering report will be issued separately outlining foundation support and other geotechnical recommendations.

ELEVATION DATUM

Elevations referenced herein are in feet and reference the National Geodetic Vertical Datum of 1929 (NGVD 29).

EXISTING SITE CONDITIONS

The project site (referred to hereinafter as the "site,") is located at the Portland International Jetport ("the jetport"), as shown on the Project Locus, Figure 1. The southern portion of the site (to the west of the existing terminal building) currently consists of a landscaped area with grass, bushes and trees. The northwestern portion of the site is mostly forested (tall trees and shrubs) and contains some low-lying wet areas. The remainder of the site is comprised of the existing access roads and short-term and long-term parking areas for the jetport. The topographic data provided by OEST

Associates, Inc. (OEST) indicates that the existing ground surface of the site generally slopes downward from north to south and varies from approximately El. 85 in the northwestern portion of the site to approximately El. 59.5 near the southeastern corner of the site, as shown in the site and Subsurface Exploration Location Plan, Figure 2.

PROPOSED SITE DEVELOPMENT

The principal improvements for the project include the following:

- Terminal Building Expansion – 2- to 3-story (including partial basement), 125,000 gross square foot (sf) addition located at the western end of the existing terminal building. The lowest level floor slab is proposed to be constructed at El. 62 in the northern portion of the expansion, El. 56 in the southeast portion of the expansion and El. 57.5 in the southwest portion of the expansion. An L-shaped baggage tunnel will be constructed along the eastern side of the proposed building with a floor slab level at El. 54. An approximately 4,300 sf basement level is proposed at the westernmost corner of the building, with a floor slab level at El. 41.
- Over-Roadway Connection (Sky bridge) – two-story structure (one enclosed story) between the terminal expansion and the new parking garage currently under construction. The sky bridge will cover the new access road near the entrance to the terminal expansion; proposed grades will vary between El. 61 and El. 63 in the covered area.
- Terminal Roadway – An approximately 900-ft long roadway aligned with the northern edge of the terminal building expansion. Portions of the excavation necessary for the construction of the terminal roadway will be supported by an approximately 600-ft long permanent retaining wall with maximum height of 9 ft.
- Parking lots – New parking lots will be constructed along the west side of the site, within the limits of the existing western parking lot and in the current wooded area to the northwest of the existing western parking lot.

The project also includes a renovation of approximately 50,000 square feet of the existing terminal. However, it is our understanding that the renovation will not include any new foundations or underground construction.

Additional details on the proposed construction, including a description of column-grid spacing and loads for the structures and required cut and fill thickness for construction of building and pavement areas, will be included in the geotechnical design report.

SUBSURFACE EXPLORATION PROGRAM

Haley & Aldrich performed a geotechnical subsurface exploration program for the subject project that included seven test borings during the preliminary exploration phase (HA08-series borings; Phase 1A), 14 additional borings in the final exploration phase (HA08-100 series borings; Phase 1B), and six borings in the supplemental exploration phase (HA08-200 series borings). Ground surface elevations shown on the boring logs are approximate and were estimated to the nearest 0.5 ft using topographic information

provided by OEST. The approximate boring locations are provided on Figure 2 and were determined by taping from existing site features.

Borings were previously conducted at the jetport for the last expansion of the terminal (B93-series test borings) and for the parking garages (B-series test borings). Locations of relevant borings are shown on Figure 2 based on interpretation of the locations shown on the site plans. Additional details of the subsurface explorations are presented below.

HA08-Series, HA08-100 Series and HA08-200-Series Test Borings

The borings were drilled by Maine Test Borings, Inc. of Brewer, Maine. Borings HA08-1 through HA08-7 were drilled between 16 and 19 June 2008 using a Mobile B47 trailer-mounted drill rig, borings HA08-101 through HA08-114 were drilled between 11 and 15 August 2008 using a Mobile B53 truck-mounted drill rig, and borings HA08-201 through HA08-206 were drilled on 24 and 25 September 2008 using a Mobile B47 ATV-mounted drill rig. The borings were advanced to depths ranging from 12.0 to 25.6 ft below ground surface (BGS) using 3-in. or 4-in. ID steel casing and/or 2.5-in. ID hollow-stem augers. Soil samples were generally collected continuously or at nominal 5-ft intervals by driving a 24-in. long, 1-3/8 in. ID split-spoon sampler with a 140-lb hammer dropped from a height of 30 in. A donut hammer was used for the HA08-series test borings, and a safety hammer was used for the HA08-100 and HA08-200 series test borings. The hammers were lifted/dropped using a spool-and-winch system for all of the borings. The number of hammer blows required to advance the sampler for each 6-in. interval was recorded and is provided on the test boring logs. The Standard Penetration Test (SPT) N-value is the total number of hammer blows required to advance the sampler through the middle 12 in. of the 24-in. sampling interval. Each test boring within the structure footprints (HA08-1 through HA08-7, HA08-101 through HA08-106 and HA08-204 through HA08-206) was advanced either to practicable refusal on bedrock or was cored up to 12.4 ft into bedrock. Bedrock was cored using an N-size core barrel in six borings: HA08-1, HA08-3, HA08-5, HA08-6, HA08-7 and HA08-104. Each of the "non-structure" HA08-100 series borings (HA08-107 through HA08-114) was advanced to either auger or sampler refusal except for HA08-109 and HA08-111, which were terminated at depths of 22 and 24 ft BGS, respectively, in glacial till. The "non-structure" HA08-200 series borings (HA08-201 through HA08-203) were each advanced to a depth of approximately 6 ft below proposed finish grades.

Observation wells were installed in two of the completed boreholes (HA08-7 and HA08-104) and were secured using a flush-mounted roadway box with a bolted aluminum cover.

All soil samples were collected and preserved in glass jars and are available for review upon request. The soil samples are being stored at the Haley & Aldrich laboratory facility in Portland, Maine.

Boreholes which were not used for observation well installation were backfilled with soil cuttings from the drilling operation.

Logs of the test borings are provided in Appendix A of this report, and observation well installation and groundwater monitoring reports are provided in Appendix C.

Previous Test Borings

Haley & Aldrich performed the B-series borings shown on Figure 2 in May 2000 in conjunction with the existing parking garage construction and master planning at the facility. Two of the borings in the series (B-1 and B-26) were drilled just northeast of the current terminal expansion project. Haley & Aldrich personnel were present to monitor drilling activities and prepare logs detailing soil and bedrock conditions encountered in each of the test borings.

Northrop, Devine & Tarbell, Inc. performed the B93-series borings shown on Figure 2 in November 1993 in conjunction with the previous terminal expansion. Six of the test borings in the series (B93-1, B93-4, B93-6, B93-8, B93-9 and B93-10) were drilled within the eastern portion of the proposed expansion footprint.

Logs of the previous borings conducted by Haley & Aldrich in 2000 and Northrop, Devine & Tarbell in 1993 are provided in Appendix B.

SUBSURFACE CONDITIONS

Soil/Bedrock Conditions

Generally, the subsurface explorations encountered the following geologic units, presented in order of increasing depth below existing ground surface:

- Topsoil or Pavement
- Fill
- Glaciomarine Deposit
- Glacial Till
- Bedrock

Refer to Table I for a summary of the test borings. Refer to Appendices A and B for test boring logs and Figures 3 through 6 for subsurface profiles through the proposed terminal expansion and sky bridge for more detailed information regarding the conditions encountered in the explorations. A brief description of each geologic unit is provided below.

Topsoil or Pavement – Topsoil was encountered in all of the recent explorations conducted in landscaped areas. The topsoil/forest mat ranged in thickness from 0.5 to 1.0 ft, with an average thickness of about 0.7 ft. Bituminous concrete pavement was encountered in the remaining recent explorations. The encountered thickness ranged from 0.2 to 0.7 ft, with typical thickness ranging from 0.3 to 0.4 ft (approximately 3 to 5 in.).

Fill – Man-placed fill was encountered in all of the test borings except HA08-102, HA08-103 and HA08-106. The fill encountered in the majority of the borings consisted of pavement base/subbase material (primarily poorly graded SAND and well-

graded SAND with varying silt content). The encountered base/subbase thickness ranged from 0.5 to 4.6 ft, and the material was typically dense to very dense. The fill encountered in four of the recent test borings (HA08-1, HA08-2, HA08-105 and HA08-107) and two of the previous borings (B-26 and B93-4) consisted of reworked natural soil (poorly graded SAND, silty SAND and clayey SAND). The reworked natural soil was typically encountered in the landscaped area to the west of the current terminal building and is likely associated with the creation of berms in that area. The reworked fill ranged in thickness from 0.5 to 4.7 ft, except for boring B-26, where the encountered fill thickness was 9.2 ft. The reworked fill is typically loose to medium dense, with SPT N-values ranging from 4 to 60 blows per foot (bpf).

In boring HA08-206, 9.7 ft of poorly graded SAND material was encountered beneath the bituminous pavement. The grain size distribution is similar to glacial till encountered at the same depth in borings HA08-5, HA08-6 and HA08-205, but the material does not have a structure that is characteristic of till. Considering the proximity to water and sewer lines that were installed in the area, we anticipate that this material either consists of trench backfill material or naturally deposited glacial till that was near the edge of a trench and became disturbed/loosened during trench excavation.

Glaciomarine Deposit – Glaciomarine soils were encountered beneath the topsoil or fill in all but nine of the test borings. The encountered thickness of the marine deposit soils ranged from about 3.0 to 18.9 ft. The deposit primarily consists of SILT and lean CLAY with varying amounts of interbedded fine sand and up to 2 ft of silty SAND or clayey SAND near the bottom of the deposit. The glaciomarine deposit included 4.8 to 13.2 ft of silty SAND and clayey SAND in borings HA08-3, HA08-4, HA08-101 and HA08-109. The glaciomarine deposits are generally thickest in the western portion of the site. The glaciomarine silt/clay is generally hard to medium stiff, and the sand is typically loose to medium dense. The thickest and softest glaciomarine clay was encountered northwest of the proposed expansion footprint, within the limits of the proposed parking area. SPT N-values range from 1 to greater than 100 bpf in the silt and clay soils and 6 to 66 bpf in the sandy soils.

Glacial Till – Glacial till was encountered in all but three of the test borings. The encountered thickness of the glacial till ranged from 1.2 to 16.7 ft. The thickness of glacial till at boring HA08-11 was greater than 22.3 ft. The deposit includes poorly graded SAND, well-graded SAND, silty SAND and clayey SAND. Cobbles were encountered in the till in some of the test borings. The glacial till is typically medium dense to very dense, but loose till was encountered in borings HA08-103, HA08-104, HA08-106, HA08-111, HA08-113, HA08-203, HA08-204 and HA08-206. Loose till typically contained a larger fraction of clay and/or silt than denser till. SPT N-values ranged from 4 to greater than 100 bpf.

Bedrock – Bedrock was cored in test borings HA08-1, HA08-3, HA08-5, HA08-6, HA08-7 and HA08-104. The top of bedrock was confirmed by refusal surfaces in several other borings. The encountered depth to the top of confirmed bedrock ranged from 10.2 to 25.3 ft BGS (El. 45 to El. 56). Refusal surfaces were encountered by the augers while drilling borings HA08-110 and HA08-113 at depths of 12.5 and 12.8 ft BGS, respectively, corresponding to El. 61 and El. 58.

The bedrock retrieved from the cores consisted of moderately hard to very hard, fresh to moderately weathered SLATE and SILTSTONE. Rock quality designation (RQD) is a common parameter that is used to aid in assessing the competency of sampled bedrock. RQD is defined as the sum of the lengths of pieces of recovered rock core greater than 4 in. in length, divided by the total length of the rock core interval. The RQD values for the bedrock encountered at the site ranged from 42 to 100 percent (average of 75 percent) and are shown on the core boring logs in Appendix A.

Groundwater Conditions

Water levels were measured during and after drilling in the completed boreholes. Measured groundwater depths in the boreholes varied from about 2 to 11 ft BGS at the time of our June and August 2008 explorations. Groundwater depths in test borings may not be representative because they are influenced by the drilling methods.

Observation wells were installed in the completed boreholes HA08-7 and HA08-104. Water level measurements were taken in each observation well between mid August and late September. The groundwater measurements in the observation wells are summarized below:

HA08-7(OW)	El. 58.5 to El. 59 (8.5 to 9 ft BGS)
HA08-104(OW)	El. 56.5 to El. 60.5 (5.5 to 9 ft BGS)

Groundwater levels can be expected to fluctuate, subject to seasonal variation, local soil conditions, topography and precipitation. Groundwater levels encountered during construction may differ from those observed in the test borings or observation well. Observation well installation and groundwater monitoring reports are provided in Appendix C.

LABORATORY SOIL TESTING

A laboratory testing program was conducted to assist in soil classification and for determination of engineering of the in-situ soils. The testing program consisted of grain size analyses (typically used to determine gradation characteristics of granular materials). The tests were conducted by R.W. Gillespie & Associates of Saco, Maine in accordance with appropriate ASTM test procedures.

Laboratory Test Results

The laboratory test reports are presented in Appendix D. Five grain size tests were conducted on samples of existing pavement section fill material from the borings to help assess the engineering properties relative to reuse for site fills. The results of the laboratory tests are summarized below.

Test Boring	Sample No: Depth Below Ground Surface (ft)	USCS Classification	Particle Size Distribution		
			Percent Gravel	Percent Sand (coarse/med./fine)	Percent Fines[1]
HA08-3	S1: 0.5-2.5	SP-SM	27.1	12.4/30.0/20.1	10.4
HA08-101	S1: 0.5-2.5	SM	15.0	8.0/23.1/20.7	33.2
HA08-109	S1B: 0-2	SP	17.3	11.1/56,4/12.3	2.9
HA08-112	S1: 0.5-2.5	SW	20.6	7.8/41.9/24.3	4.4
HA08-113	S1: 0.5-2.5	SM	21.8	8.3/22.9/27.4	19.6

[1] – Refers to the percentage of soil particles finer than the No. 200 (0.075 mm) sieve.

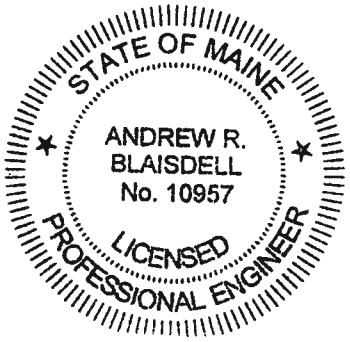
CLOSURE

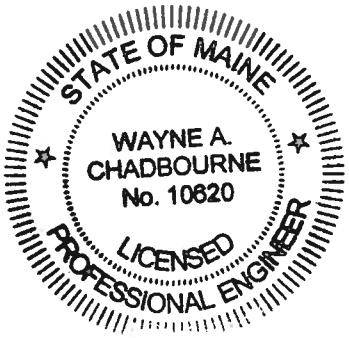
Based on the soil, bedrock and groundwater conditions present at the subject site, impacts of site grading, pavement evaluations and building/utility support should be considered carefully during the design-phase of the project. We will provide geotechnical design and foundation support recommendations during the design development phase of the project.

We appreciate the opportunity to provide geotechnical engineering services on this project. Please do not hesitate to contact us if you have any questions or comments.

Sincerely yours,
HALEY & ALDRICH, INC.

Andrew R. Blaisdell, P.E.
Senior Engineer





Wayne A. Chadbourne, P.E.
Vice President

Attachments:

Table I:	Summary of Test Borings
Figure 1:	Project Locus
Figure 2:	Site and Subsurface Exploration Location Plan
Figure 3:	Subsurface Profile A-A'
Figure 4:	Subsurface Profile B-B'
Figure 5:	Subsurface Profile C-C'
Figure 6:	Subsurface Profile D-D'
Appendix A:	HA08-Series, HA08-100 and HA08-200 Series Test Boring Logs
Appendix B:	Previous Test Boring Logs
Appendix C:	Observation Well Installation and Groundwater Monitoring Reports
Appendix D:	Laboratory Test Reports

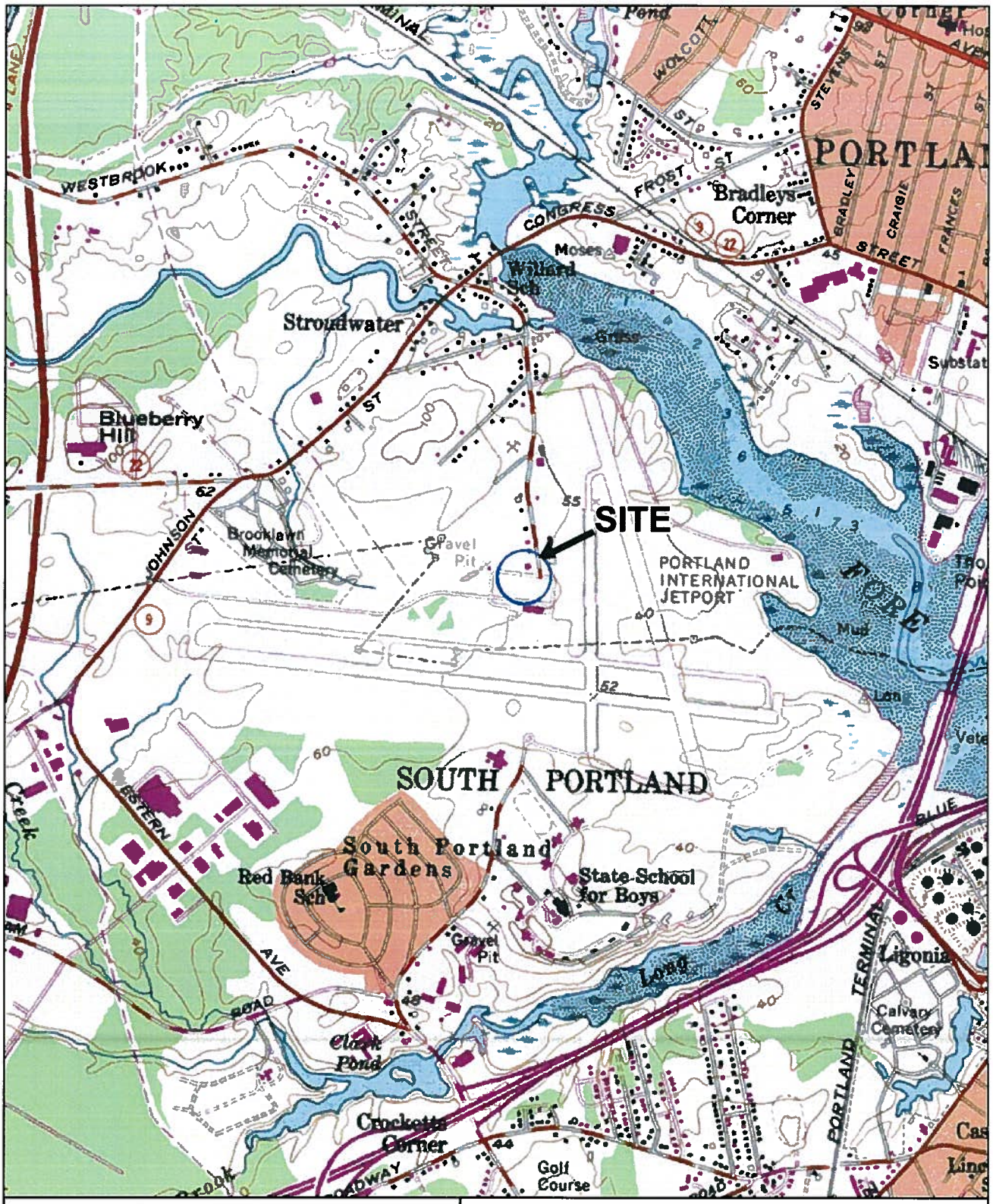
REFERENCES

1. Northrop, Devine & Tarbell, Inc., 1993. "Geotechnical Engineering Report, Jetport Terminal Expansion, City of Portland," dated 27 December 2003. (source of B93-series test borings)

2. OEST Associates, Inc., 2008. "Site Grading & Drainage Plan, Portland International Jetport, Design Development Set, (Sheet C02.02)" dated 22 September 2008.

3. OEST Associates, Inc., 2008. "Foundation Plans, Portland International Jetport, Design Development Set, (Sheets S02.01.04 through S02.01.06 and S02.B1.05)" dated 22 September 2008.

4. Sebago Technics, 2006. "Report on Subsurface and Foundation Investigation, Phase II Parking Garage, Portland International Jetport, Portland, Maine," dated 23 February 2006. (source of B-series test borings)



HALEY & ALDRICH

PROPOSED TERMINAL EXPANSION
PORTLAND INTERNATIONAL JETPORT
PORTLAND, MAINE

PROJECT LOCUS

SCALE: 1:24,000
SEPTEMBER 2008

FIGURE 1

35024-001 1.PDF

NOTES:

1. EXISTING AND PROPOSED SITE CONDITIONS, CONTOURS OF EXISTING AND PROPOSED GROUND SURFACE ELEVATIONS AND LOCATION AND ORIENTATION OF EXISTING AND PROPOSED SITE FEATURES ARE TAKEN FROM THE ELECTRONIC AUTOCAD FILE ENTITLED, "CO2.02.dwg," PROVIDED BY OEST ASSOCIATES, INC. ON 28 JULY 2008.
2. SUBSURFACE EXPLORATIONS WERE MONITORED IN THE FIELD BY HALEY & ALDRICH, INC. PERSONNEL.
3. LOCATIONS OF HA08-SERIES AND HA08-100 SERIES TEST BORINGS ARE APPROXIMATE AND WERE DETERMINED IN THE FIELD BY TAPING FROM EXISTING SITE FEATURES.
4. LOCATIONS OF PREVIOUS TEST BORINGS WERE DETERMINED USING SITE PLANS PROVIDED WITH THEIR GEOTECHNICAL REPORTS.
5. ELEVATIONS ARE IN FEET AND REFERENCE THE NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD 29).
6. REFER TO APPENDIX A FOR LOGS OF HA08-SERIES AND HA08-100 SERIES TEST BORINGS AND APPENDIX B FOR LOGS OF PREVIOUS TEST BORINGS BY OTHERS RELEVANT TO THE CURRENT DEVELOPMENT.

LEGEND:

- HA08-1 — DESIGNATION AND APPROXIMATE LOCATION OF HA08-SERIES TEST BORING (PHASE 1A) DRILLED BY MAINE TEST BORINGS, INC. OF BREWER, MAINE IN JUNE 2008
- HA08-101 — DESIGNATION AND APPROXIMATE LOCATION OF HA08-100 SERIES TEST BORING (PHASE 1B) DRILLED BY MAINE TEST BORINGS, INC. OF BREWER, MAINE IN AUGUST 2008
- HA08-201 — DESIGNATION AND APPROXIMATE LOCATION OF HA08-200 SERIES TEST BORING (SUPPLEMENTAL) DRILLED BY MAINE TEST BORINGS, INC. OF BREWER, MAINE IN SEPTEMBER 2008
- B93-1 — DESIGNATION AND APPROXIMATE LOCATION OF PREVIOUS TEST BORING DRILLED BY GREAT WORKS TEST BORING, INC. OF SOUTH BERWICK, MAINE IN NOVEMBER 1993
- B1 — DESIGNATION AND APPROXIMATE LOCATION OF PREVIOUS TEST BORING DRILLED BY MAINE TEST BORINGS, INC. OF BREWER, MAINE IN MAY AND JUNE 2000
- (OW) — DENOTES OBSERVATION WELL INSTALLED IN COMPLETED BOREHOLE
- 64 — ELEVATION CONTOUR OF EXISTING GROUND SURFACE
- 64 — ELEVATION CONTOUR OF PROPOSED GROUND SURFACE
- A A' — DESIGNATION, LOCATION AND ORIENTATION OF SUBSURFACE PROFILE

N W E S

0 60 120 180 240

APPROXIMATE SCALE IN FEET

HALEY & ALDRICH

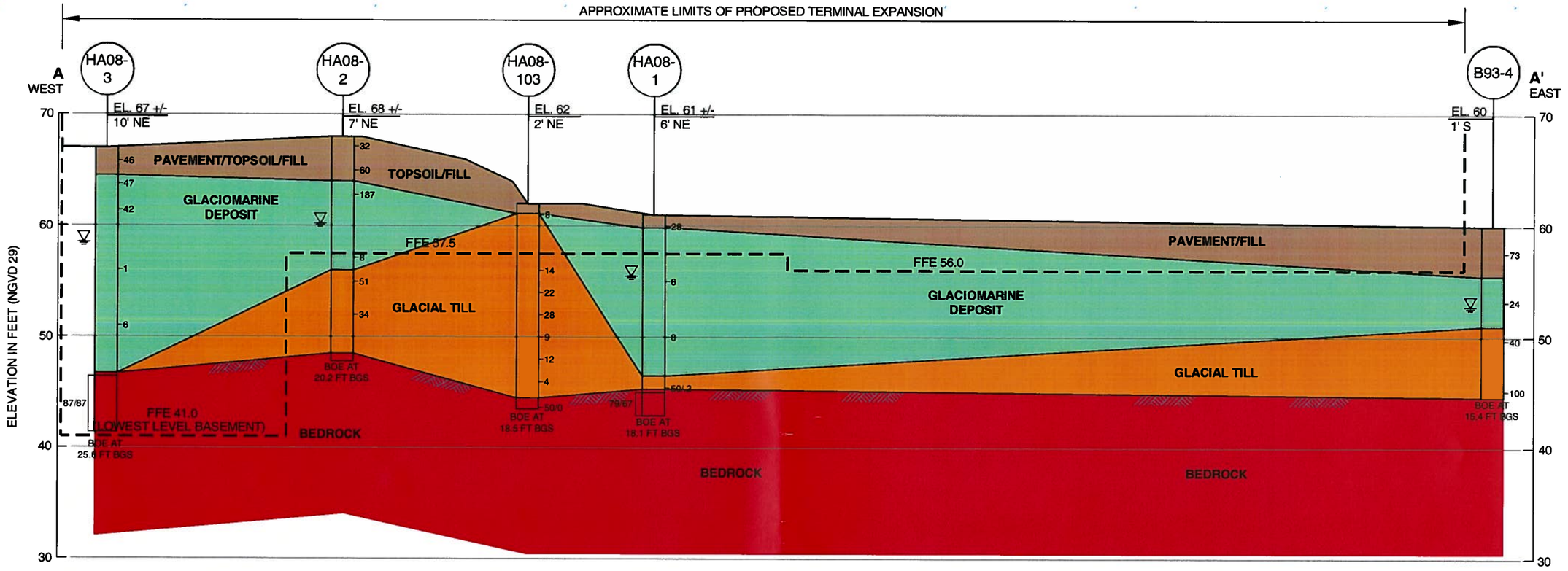
PROPOSED TERMINAL EXPANSION
PORTLAND INTERNATIONAL JETPORT
PORTLAND, MAINE

SITE AND SUBSURFACE EXPLORATION LOCATION PLAN

SCALE: AS SHOWN
OCTOBER 2008

FIGURE 2

S:\35024\CLIENT\2008-0728\HA-2008_10_13FIG2.DWG



LEGEND:

HA08-3 — TEST BORING DESIGNATION

EL. 67 +/- / 10' NE — GROUND SURFACE ELEVATION; OFFSET DISTANCE AND DIRECTION BETWEEN BORING AND LINE OF SUBSURFACE PROFILE

46 — STANDARD PENETRATION TEST (SPT) N-VALUE (BLOWS PER FOOT)

WATER LEVEL OBSERVED IN COMPLETED TEST BORING OR OBSERVATION WELL

INTERPRETED GEOLOGIC STRATUM INTERFACE

87/87 — PERCENT RECOVERY/ PERCENT ROCK QUALITY DESIGNATION (RQD)

BOE AT 25.6 FT BGS — BOTTOM OF EXPLORATION

KEY:

- TOPSOIL/FILL OR PAVEMENT/FILL
- GLACIOMARINE DEPOSIT
- GLACIAL TILL
- BEDROCK

NOTES:

1. SEE FIGURE 2 FOR LOCATION AND ORIENTATION OF SUBSURFACE PROFILE A-A'.
2. EXISTING GROUND SURFACE ELEVATIONS ARE APPROXIMATE AND WERE DETERMINED BY INTERPOLATION USING SITE ELEVATION CONTOURS PROVIDED BY OEST ASSOCIATES, INC. IN ELECTRONIC AUTOCAD FILE "C02.02.dwg" DATED 22 SEPTEMBER 2008.
3. PROPOSED BUILDING LIMITS AND FINISH FLOOR LEVELS ARE TAKEN FROM THE DESIGN DEVELOPMENT FOUNDATION DRAWINGS (SHEETS S02.01.04 THROUGH S02.01.05 AND S02.B1.05) PREPARED BY OEST ASSOCIATES, INC. DATED 22 SEPTEMBER 2008.
4. LINES REPRESENTING CHANGES IN STRATA SHOWN ON THE PROFILE ARE BASED ON LINEAR INTERPOLATION BETWEEN SUBSURFACE EXPLORATIONS. THESE INTERPRETED STRATA LINES DO NOT REPRESENT ACTUAL FIELD CONDITIONS OTHER THAN AT SPECIFIC EXPLORATION LOCATIONS.
5. LOCATIONS OF TEST BORINGS ARE APPROXIMATE AND WERE DETERMINED BY TAPING FROM EXISTING SITE FEATURES (HA08-SERIES AND HA08-100 SERIES BORINGS) OR FROM PLANS BY OTHERS (BORINGS BY OTHERS).
6. ELEVATIONS ARE IN FEET AND REFERENCE THE NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD 29).
7. REFER TO APPENDIX A FOR LOGS OF HA08-SERIES AND HA08-100 SERIES TEST BORINGS, APPENDIX B FOR LOGS OF TEST BORINGS BY OTHERS AND APPENDIX C FOR OBSERVATION WELL INSTALLATION AND GROUNDWATER MONITORING REPORTS.

HORIZ. 0 30 60
VERT. 0 10 20
APPROXIMATE SCALE IN FEET

HALEY & ALDRICH

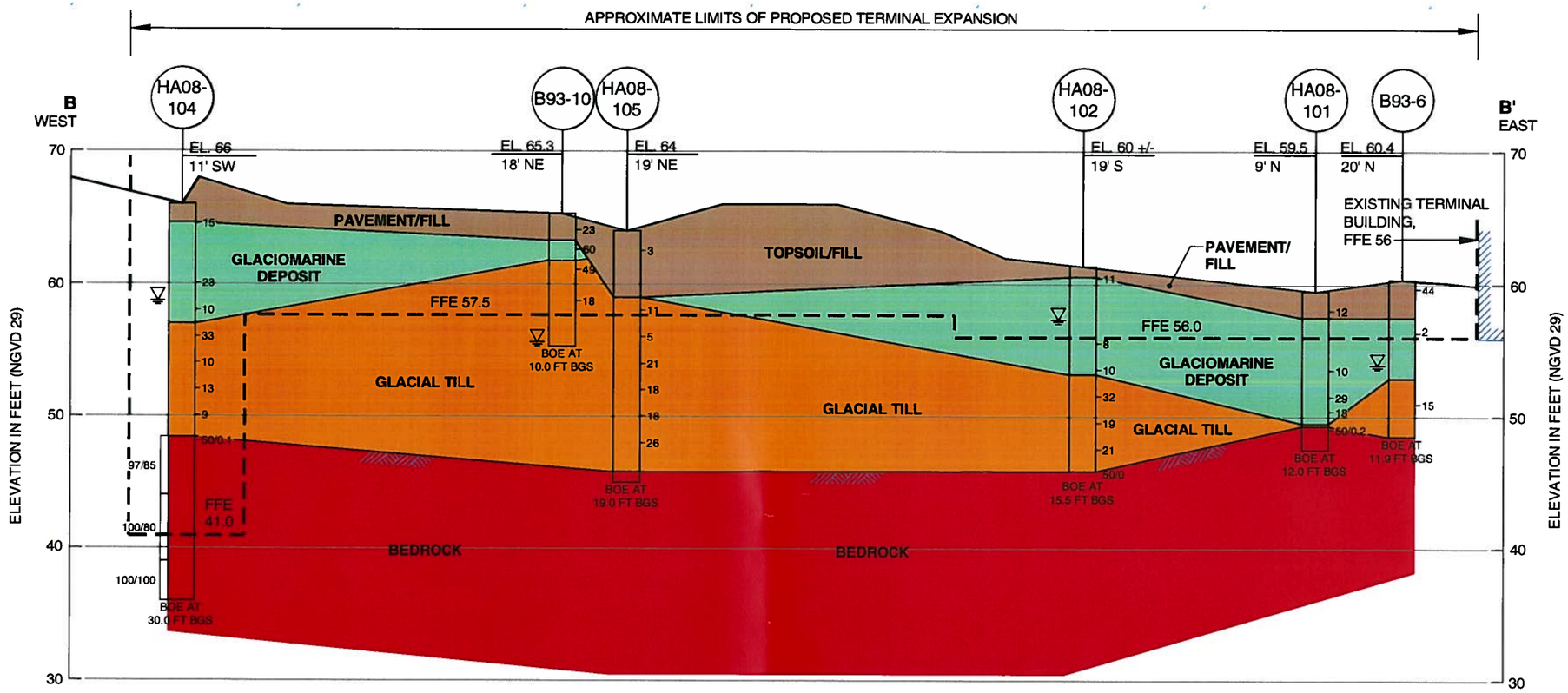
PROPOSED TERMINAL EXPANSION
PORTLAND INTERNATIONAL JETPORT
PORTLAND, MAINE

SUBSURFACE PROFILE A-A'

SCALE: AS SHOWN
OCTOBER 2008

FIGURE 3

S:\35024\PROFILES\35024-000_X-SECTIONS-OCT08.DWG



LEGEND:

HA08-104 — TEST BORING DESIGNATION

EL. 66 / 11' SW — GROUND SURFACE ELEVATION; OFFSET DISTANCE AND DIRECTION BETWEEN BORING AND LINE OF SUBSURFACE PROFILE

15 — STANDARD PENETRATION TEST (SPT) N-VALUE (BLOWS PER FOOT)

WATER LEVEL OBSERVED IN COMPLETED TEST BORING OR OBSERVATION WELL

INTERPRETED GEOLOGIC STRATUM INTERFACE

87/87 — PERCENT RECOVERY/ PERCENT ROCK QUALITY DESIGNATION (RQD)

BOE AT 25.6 FT BGS — BOTTOM OF EXPLORATION

KEY:

- TOPSOIL/FILL OR PAVEMENT/FILL
- GLACIOMARINE DEPOSIT
- GLACIAL TILL
- BEDROCK

NOTES:

1. SEE FIGURE 2 FOR LOCATION AND ORIENTATION OF SUBSURFACE PROFILE B-B'.
2. EXISTING GROUND SURFACE ELEVATIONS ARE APPROXIMATE AND WERE DETERMINED BY INTERPOLATION USING SITE ELEVATION CONTOURS PROVIDED BY OEST ASSOCIATES, INC. IN ELECTRONIC AUTOCAD FILE "C02.02.dwg" DATED 22 SEPTEMBER 2008.
3. PROPOSED BUILDING LIMITS AND FINISH FLOOR LEVELS ARE TAKEN FROM THE DESIGN DEVELOPMENT FOUNDATION DRAWINGS (SHEETS S02.01.04 THROUGH S02.01.05 AND S02.B1.05) PREPARED BY OEST ASSOCIATES, INC. DATED 22 SEPTEMBER 2008.
4. LINES REPRESENTING CHANGES IN STRATA SHOWN ON THE PROFILE ARE BASED ON LINEAR INTERPOLATION BETWEEN SUBSURFACE EXPLORATIONS. THESE INTERPRETED STRATA LINES DO NOT REPRESENT ACTUAL FIELD CONDITIONS OTHER THAN AT SPECIFIC EXPLORATION LOCATIONS.
5. LOCATIONS OF TEST BORINGS ARE APPROXIMATE AND WERE DETERMINED BY TAPING FROM EXISTING SITE FEATURES (HA08-SERIES AND HA08-100 SERIES BORINGS) OR FROM PLANS BY OTHERS (BORINGS BY OTHERS).
6. ELEVATIONS ARE IN FEET AND REFERENCE THE NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD 29).
7. REFER TO APPENDIX A FOR LOGS OF HA08-SERIES AND HA08-100 SERIES TEST BORINGS, APPENDIX B FOR LOGS OF TEST BORINGS BY OTHERS AND APPENDIX C FOR OBSERVATION WELL INSTALLATION AND GROUNDWATER MONITORING REPORTS.

HORIZ. 0 30 60
VERT. 0 10 20
APPROXIMATE SCALE IN FEET

HALEY & ALDRICH

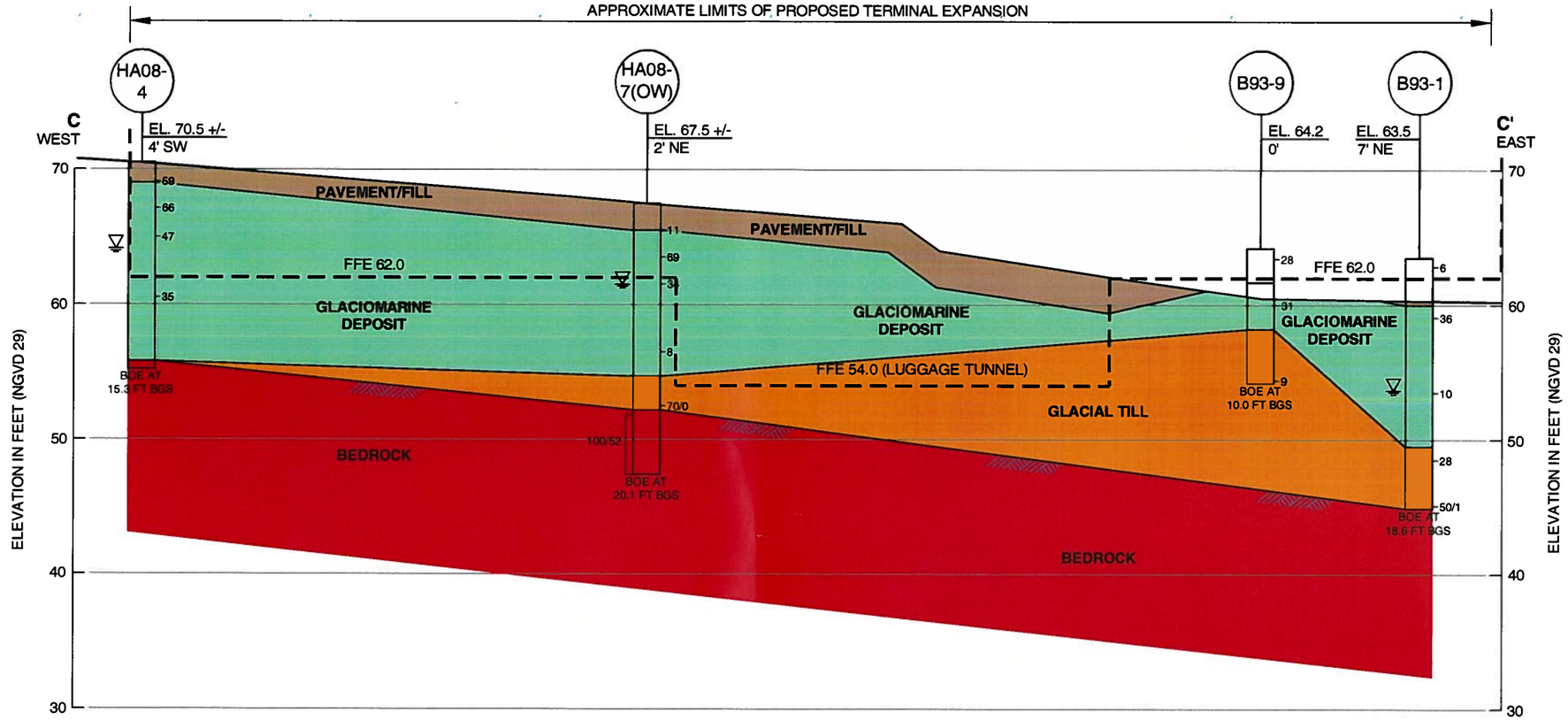
PROPOSED TERMINAL EXPANSION
PORTLAND INTERNATIONAL JETPORT
PORTLAND, MAINE

SUBSURFACE PROFILE B-B'

SCALE: AS SHOWN
OCTOBER 2008

FIGURE 4

S:\35024\PROFILES\35024-000_X-SECTIONS-OCT08.DWG



LEGEND:

HA08-4 — TEST BORING DESIGNATION

EL. 70.5± / 4' SW — GROUND SURFACE ELEVATION; OFFSET DISTANCE AND DIRECTION BETWEEN BORING AND LINE OF SUBSURFACE PROFILE

59 — STANDARD PENETRATION TEST (SPT) N-VALUE (BLOWS PER FOOT)

WATER LEVEL OBSERVED IN COMPLETED TEST BORING OR OBSERVATION WELL

INTERPRETED GEOLOGIC STRATUM INTERFACE

87/87 — PERCENT RECOVERY/ PERCENT ROCK QUALITY DESIGNATION (RQD)

BOE AT 15.3 FT BGS — BOTTOM OF EXPLORATION

KEY:

- TOPSOIL/FILL OR PAVEMENT/FILL
- GLACIOMARINE DEPOSIT
- GLACIAL TILL
- BEDROCK

NOTES:

1. SEE FIGURE 2 FOR LOCATION AND ORIENTATION OF SUBSURFACE PROFILE C-C'.
2. EXISTING GROUND SURFACE ELEVATIONS ARE APPROXIMATE AND WERE DETERMINED BY INTERPOLATION USING SITE ELEVATION CONTOURS PROVIDED BY OEST ASSOCIATES, INC. IN ELECTRONIC AUTOCAD FILE "C02.02.dwg" DATED 22 SEPTEMBER 2008.
3. PROPOSED BUILDING LIMITS AND FINISH FLOOR LEVELS ARE TAKEN FROM THE DESIGN DEVELOPMENT FOUNDATION DRAWINGS (SHEETS S02.01.04 THROUGH S02.01.05 AND S02.B1.05) PREPARED BY OEST ASSOCIATES, INC. DATED 22 SEPTEMBER 2008.
4. LINES REPRESENTING CHANGES IN STRATA SHOWN ON THE PROFILE ARE BASED ON LINEAR INTERPOLATION BETWEEN SUBSURFACE EXPLORATIONS. THESE INTERPRETED STRATA LINES DO NOT REPRESENT ACTUAL FIELD CONDITIONS OTHER THAN AT SPECIFIC EXPLORATION LOCATIONS.
5. LOCATIONS OF TEST BORINGS ARE APPROXIMATE AND WERE DETERMINED BY TAPING FROM EXISTING SITE FEATURES (HA08-SERIES AND HA08-100 SERIES BORINGS) OR FROM PLANS BY OTHERS (BORINGS BY OTHERS).
6. ELEVATIONS ARE IN FEET AND REFERENCE THE NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD 29).
7. REFER TO APPENDIX A FOR LOGS OF HA08-SERIES AND HA08-100 SERIES TEST BORINGS, APPENDIX B FOR LOGS OF TEST BORINGS BY OTHERS AND APPENDIX C FOR OBSERVATION WELL INSTALLATION AND GROUNDWATER MONITORING REPORTS.
8. EAST END OF PROFILE B-B' BASED ON PREVIOUSLY DRILLED BORINGS, IT IS ANTICIPATED THAT UPPER 2 TO 3 FEET NOW CONSISTS OF FILL MATERIAL (BENEATH PAVEMENT/SIDEWALK.

HORIZ. 0 30 60
VERT. 0 10 20
APPROXIMATE SCALE IN FEET

HALEY & ALDRICH

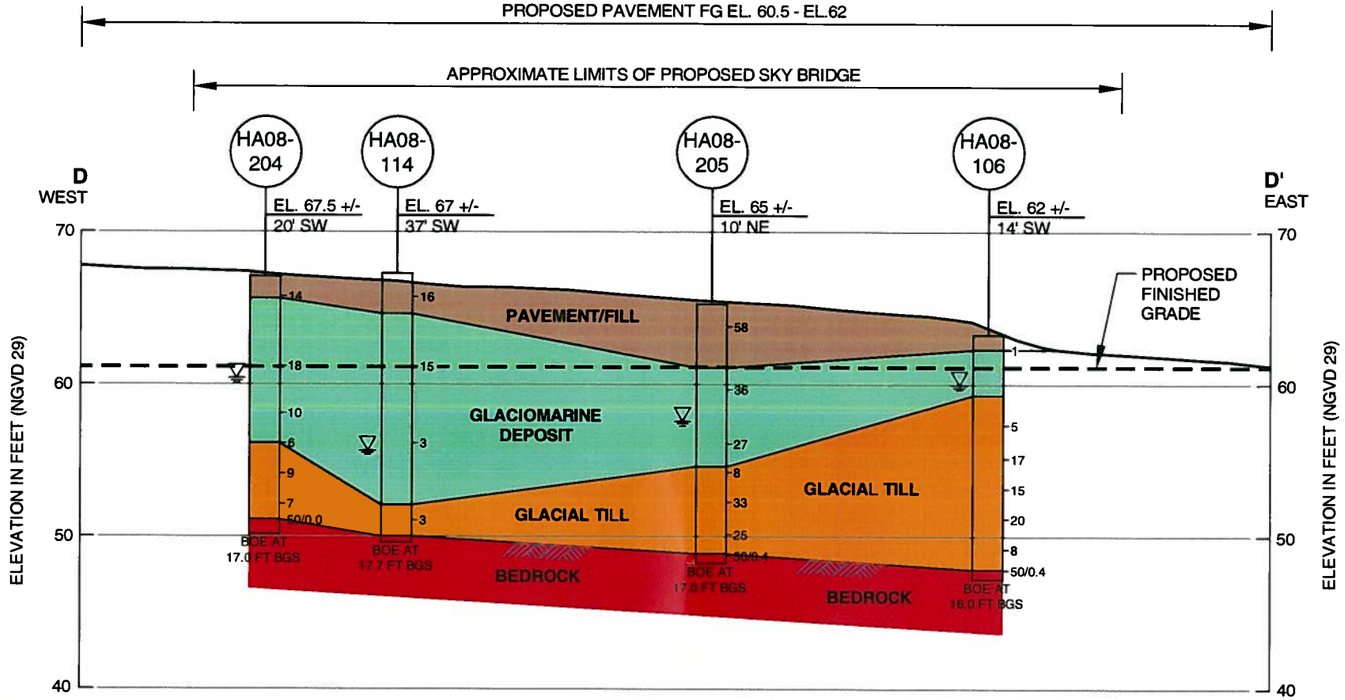
PROPOSED TERMINAL EXPANSION
PORTLAND INTERNATIONAL JETPORT
PORTLAND, MAINE

SUBSURFACE PROFILE C-C'

SCALE: AS SHOWN
OCTOBER 2008

FIGURE 5

S:\35024\PROFILES\35024-000_X-SECTIONS-OCT08.DWG



LEGEND:

HA08-204 — TEST BORING DESIGNATION

EL. 67± / 20' SW — GROUND SURFACE ELEVATION; OFFSET DISTANCE AND DIRECTION BETWEEN BORING AND LINE OF SUBSURFACE PROFILE

14 — STANDARD PENETRATION TEST (SPT) N-VALUE (BLOWS PER FOOT)

WATER LEVEL OBSERVED IN COMPLETED TEST BORING OR OBSERVATION WELL

INTERPRETED GEOLOGIC STRATUM INTERFACE

BOE AT 17.0 FT BGS — BOTTOM OF EXPLORATION

KEY:

- TOPSOIL/FILL OR PAVEMENT/FILL
- GLACIOMARINE DEPOSIT
- GLACIAL TILL
- BEDROCK

NOTES:

1. SEE FIGURE 2 FOR LOCATION AND ORIENTATION OF SUBSURFACE PROFILE D-D'.
2. EXISTING GROUND SURFACE ELEVATIONS ARE APPROXIMATE AND WERE DETERMINED BY INTERPOLATION USING SITE ELEVATION CONTOURS PROVIDED BY OEST ASSOCIATES, INC. IN ELECTRONIC AUTOCAD FILE "C02.02.dwg" DATED 28 JULY 2008.
3. PROPOSED BUILDING LIMITS AND FINISH FLOOR LEVELS ARE TAKEN FROM THE SCHEMATIC DESIGN FOUNDATION DRAWINGS (SHEETS S02.01.04 AND S02.01.05) PREPARED BY OEST ASSOCIATES, INC. DATED 11 JULY 2008.
4. LINES REPRESENTING CHANGES IN STRATA SHOWN ON THE PROFILE ARE BASED ON LINEAR INTERPOLATION BETWEEN SUBSURFACE EXPLORATIONS. THESE INTERPRETED STRATA LINES DO NOT REPRESENT ACTUAL FIELD CONDITIONS OTHER THAN AT SPECIFIC EXPLORATION LOCATIONS.
5. LOCATIONS OF HA08-SERIES AND HA08-100 SERIES TEST BORINGS ARE APPROXIMATE AND WERE DETERMINED BY TAPING FROM EXISTING SITE FEATURES. LOCATIONS OF HA08-200 SERIES TEST BORINGS WERE DETERMINED USING GPS EQUIPMENT.
6. ELEVATIONS ARE IN FEET AND REFERENCE THE NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD 29).
7. REFER TO APPENDIX A FOR LOGS OF HA08-SERIES, HA08-100 SERIES , AND HA08-200 SERIES TEST BORINGS, AND APPENDIX C FOR OBSERVATION WELL INSTALLATION AND GROUNDWATER MONITORING REPORTS.

HORIZ. 0 30 60
VERT. 0 10 20
APPROXIMATE SCALE IN FEET

HALEY & ALDRICH

PROPOSED TERMINAL EXPANSION
PORTLAND INTERNATIONAL JETPORT
PORTLAND, MAINE

SUBSURFACE PROFILE D-D'

SCALE: AS SHOWN
OCTOBER 2008

FIGURE 6

S:\35024\PROFILES\35024-000_X-SECTIONS-OCT08.DWG

APPENDIX A

HA08-Series, HA08-100 and HA08-200 Series Test Boring Logs

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA08-1

Project Portland International Jetport Terminal Expansion, Portland, Maine
Client Gensler
Contractor Maine Test Borings, Inc.

File No. 35024-000
Sheet No. 1 of 2
Start 19 June 2008
Finish 19 June 2008
Driller A. Francis
H&A Rep. H. Hollauer
Elevation 61 +/-
Datum NGVD 29
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	NW	S	NX	Rig Make & Model: Trailer
Inside Diameter (in.)	3.0	1 3/8	2.0	Bit Type: Roller Bit
Hammer Weight (lb)	300	140	-	Drill Mud: None
Hammer Fall (in.)	16	30	-	Casing: NW Driven to 15.7 ft.
				Hoist/Hammer: Winch Doughnut Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	5 14 14 17	S1 18	0.0 2.0	0.5	OL/ OH	Topsoil and root mat										
				1.0	SP	Medium dense, brown, poorly-graded SAND (SP), mps 1 mm, no odor, dry -FILL-	-	-	-	-	90	10 100				
					ML	Very stiff, gray-brown, SILT (ML), mps 0.075 mm, no odor, moist -GLACIOMARINE DEPOSIT-										
5	3 3 3 4	S2 24	5.0 7.0		ML	Stiff, gray, SILT with sand (ML), mps 1 mm, no structure, no odor, moist to wet -GLACIOMARINE DEPOSIT-	-	-	-	-	20	80				
				8.0		Drilling change at 8 ft. to granular material (gray, fine to coarse SAND).										
10	3 3 5 15	S3 18	10.0 12.0		ML- SM	Stiff, gray, SILT with sand (ML), interbedded with loose to medium dense, gray, silty SAND (SM), mps 1 mm, no structure, no odor, wet -GLACIOMARINE DEPOSIT-	-	-	-	-	70	30				
				14.5	SM	Dense, gray, silty SAND (SM), mps .5 in., no structure, no odor, wet -GLACIAL TILL-	5	5	10	30	30	20				
15	15 50/.2	S4 8	15.0 15.7	15.7		Casing refusal at 15.7 ft. - Probable bedrock surface.										
				16.0		Rollerbit to 16 ft. Began Coring at 16.0 ft. - See Core Boring Report										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
6/19/08	0620	0.15	16.0	17.7	5.2

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 16.0
Rock Cored (ft) 2.1
Samples 4S, 1C

Boring No. HA08-1

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

*Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY & ALDRICH

CORE BORING REPORT

Boring No. HA08-1
File No. 35024-000
Sheet No. 2 of 2

Depth (ft)	Drilling Rate (min./ft)	Run No.	Run Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weathering	Elev./ Depth (ft)	Visual Description and Remarks
								SEE TEST BORING REPORT FOR OVERBURDEN DETAILS
		C1	16.0 18.1	20 17	79 67	Fr to Sl		Moderately hard to hard, fresh to slightly weathered, gray to gray-brown, aphanitic to fine-grained SLATE. Joints very close to close, dipping at moderate to high angles, planar to undulating, smooth, tight to partly open, few calcite coatings on joint surfaces, occasional calcite stringers.
							18.1	Bottom of Exploration at 18.1 ft. Core barrel became plugged with rock and could not advance.

20
25
30
35
40
45

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA08-2

Project Portland International Jetport Terminal Expansion, Portland, Maine
Client Gensler
Contractor Maine Test Borings, Inc.

File No. 35024-000
Sheet No. 1 of 1
Start 19 June 2008
Finish 19 June 2008
Driller A. Francis
H&A Rep. H. Hollauer
Elevation 68 +/-
Datum NGVD 29
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	NW	S	-	Rig Make & Model: Trailer
Inside Diameter (in.)	3.0	1 3/8	-	Bit Type: Roller Bit
Hammer Weight (lb)	300	140	-	Drill Mud: None
Hammer Fall (in.)	16	30	-	Casing: NW Driven to 19.5 ft.
				Hoist/Hammer: Winch Doughnut Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	8 14 18 24	S1 20	0.0 2.0	0.5	OL/ OH SM	Topsoil and root mat Very dense, brown, silty SAND (SM), mps 0.75 in., no structure, no odor, dry	-	5	10	20	30	35				
	17 32 28 58	S2 18	2.0 4.0	2.0 2.6	SC SM	-FILL- Very dense, orange-brown, poorly-graded SAND (SC), mps 1 mm, no structure, no odor, dry -FILL-	-	-	-	-	95	5				
5	56 77 110	S3 20	4.0 5.5	4.0	ML	Very dense, gray-brown, silty SAND (SM), mps 1 mm, no structure, no odor, dry -FILL- Very dense, gray-brown, SILT (ML), mps 0.075 mm, blocky, no odor, moist -GLACIOMARINE DEPOSIT-	-	-	-	-	-	100				
10	3 5 3 5	S4 24	10.0 12.0	11.0	CL SM	Stiff, gray-brown, lean CLAY with sand (CL), mps 1 mm, no structure, no odor, wet Loose, gray, silty SAND (SM), mps 1 mm, no structure, no odor, wet -GLACIOMARINE DEPOSIT-	-	-	-	-	15	85				
	25 14 37 23	S5 20	12.0 14.0	12.0	SW	Very dense, brown, well-graded SAND (SW), mps 1 in., no structure, no odor, wet -GLACIAL TILL-	5	10	20	20	20	5				
15	27 22 12 13	S6 12	15.0 17.0		SW	Very dense, gray, well-graded SAND (SW), mps 1.5 in., no structure, no odor, wet -GLACIAL TILL-	5	10	20	20	20	5				
20				19.5 20.2		Casing refusal at 19.5 ft. - Rollerbit 19.5 to 20.2 ft. Probable bedrock. Bottom of Exploration at 20.2 ft.										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
6/19/08	1430	0	-	20.2	7.7

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 20.2
Rock Cored (ft) 0
Samples 6S
Boring No. HA08-2

Field Tests: **Dilatancy:** R - Rapid S - Slow N - None **Toughness:** L - Low M - Medium H - High **Plasticity:** N - Nonplastic L - Low M - Medium H - High **Dry Strength:** N - None L - Low M - Medium H - High V - Very High

*Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 HA-LIB07-1R-POR-06-03-08.GLB HA-TB+CORE+WELL-07-1.GDT G:\PROJECTS\35024\EXPLORATIONS\000035024-000_TB_HA08-1_HA08-7.GPJ 29 Aug 08

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA08-3

Project Portland International Jetport Terminal Expansion, Portland, Maine
Client Gensler
Contractor Maine Test Borings, Inc.

File No. 35024-000
Sheet No. 1 of 2
Start 19 June 2008
Finish 19 June 2008
Driller A. Francis
H&A Rep. H. Hollauer
Elevation 67 +/-
Datum NGVD 29
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	NW	S	NX	Rig Make & Model: Trailer
Inside Diameter (in.)	3.0	1 3/8	2.0	Bit Type: Cutting Head
Hammer Weight (lb)	300	140	-	Drill Mud: None
Hammer Fall (in.)	16	30	-	Casing: NW Driven to 20.3 ft.
				Hoist/Hammer: Winch Doughnut Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0						6 in. Bituminous pavement										
	20 23 23 25	S1 20	0.5 2.5	0.5	SW	Dense, brown, well-graded SAND with gravel (SW), mps 1.5 in., no structure, no odor, dry -FILL-	5	10	10	40	30	5				
	10 11 36 50	S2 20	2.5 4.5	2.5	ML	Hard, olive brown-gray, SILT (ML), mps 0.075 mm, blocky, no odor, moist -GLACIOMARINE DEPOSIT-	-	-	-	-	-	100				
5	8 20 22 22	S3 1	4.5 6.5		ML	Hard, olive brown-gray, SILT (ML), mps 0.075 mm, no structure, no odor, moist -GLACIOMARINE DEPOSIT-	-	-	-	-	-	100				
				9.0												
10	1 WOH 1 2	S4 24	10.0 12.0		CL	Medium stiff, gray, lean CLAY (CL), becoming softer with depth, mps 0.075 mm, no structure, no odor, wet, with coarse to fine sand lenses	-	-	-	-	-	100				
					CL	Medium stiff, gray, sandy lean CLAY (CL), mps 1 mm, no structure, no odor, wet -GLACIOMARINE DEPOSIT-	-	-	-	-	40	60				
				13.5		Coarser, gravelly layer										
				14.5												
15	11 3 3 2	S5 10	15.0 17.0		SM-CL	Loose to medium dense, gray, silty SAND (SM), interbedded with medium stiff to stiff, gray, sandy lean CLAY (CL), mps 2 in. (cobble), no structure, no odor, wet	-	-	10	40	35	15				
							-	-	-	-	35	65				
						-GLACIOMARINE DEPOSIT- Note: Gray sand and gravel in wash water from 17 to 20 ft.										
20				20.3		Rock surface at 20.3 ft.										
				20.6		Began Coring at 20.6 ft. - See Core Boring Report										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
6/19/08	1020	0	20.6	25.6	8.0
6/19/08	1050	0.5	-	15.8	8.8

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	20.3
Rock Cored (ft)	5.0
Samples	5S, 1C
Boring No.	**HA08-3**

Field Tests: **Dilatancy:** R - Rapid S - Slow N - None **Toughness:** L - Low M - Medium H - High **Plasticity:** N - Nonplastic L - Low M - Medium H - High **Dry Strength:** N - None L - Low M - Medium H - High V - Very High

*Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY & ALDRICH

CORE BORING REPORT

Boring No. HA08-3
File No. 35024-000
Sheet No. 2 of 2

Depth (ft)	Drilling Rate (min./ft)	Run No.	Run Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weathering	Elev./ Depth (ft)	Visual Description and Remarks
								SEE TEST BORING REPORT FOR OVERBURDEN DETAILS
25		C1	20.6 25.6	52 52	87 87	Fr to Sl		Moderately hard to hard, fresh to slightly weathered, gray to gray-brown, aphanitic to fine-grained SLATE with PHYLLITIC zones. Joints close to moderately spaced, dipping at moderate angles, planar to undulating, smooth, partly open. Foliation moderately dipping where present. Calcite veins and stringers throughout core stem, also present on some joint surfaces.
							25.6	Bottom of Exploration at 25.6 ft.
30								
35								
40								
45								
50								

HALEY & ALDRICH — TEST BORING REPORT

Boring No. HA08-4

Project Portland International Jetport Terminal Expansion, Portland, Maine
Client Gensler
Contractor Maine Test Borings, Inc.

File No. 35024-000
Sheet No. 1 of 1
Start 16 June 2008
Finish 16 June 2008
Driller A. Francis
H&A Rep. D. Dearden
Elevation 70.5 +/-
Datum NGVD 29
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	NW	S	-	Rig Make & Model: Trailer
Inside Diameter (in.)	3.0	1 3/8	-	Bit Type: Roller Bit
Hammer Weight (lb)	300	140	-	Drill Mud: None
Hammer Fall (in.)	16	30	-	Casing: NW Driven to 14.7 ft.
				Hoist/Hammer: Winch Doughnut Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0						4.5 in. Bituminous concrete										
	20 38 21 29	S1 15	0.5 2.5	0.4	SP	Very dense, brown, poorly-graded SAND with gravel (SP), mps 1.25 in., compacted, no odor, damp	15	15	15	30	35	-				
				1.5	SM	-FILL-	-	-	5	25	45	25				
	3 36 30 50/.3	S2 13	2.5 4.3			Dense to very dense, gray-brown, silty SAND (SM), mps 4.0 mm, bonded, no odor, moist -GLACIOMARINE DEPOSIT-										
5	24 23 24 28	S3 24	4.5 6.5	5.0	SM	Very dense, brown-gray, silty SAND (SM), mps 0.75 in., bonded, no odor, damp to moist, occasional rust-colored mottling	-	10	0	20	50	20				
					SM	Dense, gray-brown, silty SAND (SM), mps 0.5 in., well bonded, no odor, damp to moist, frequent mottling -GLACIOMARINE DEPOSIT-	-	5	0	20	55	20				
10	20 18 17 15	S4 9	9.0 11.0		SM	Dense, brown to gray, silty SAND (SM), mps 5 mm, bonded, no odor, wet, includes interbedded layers of gray, clayey SILT and brownish-gray, silty, medium to fine SAND -GLACIOMARINE DEPOSIT-	-	-	10	20	40	30				
15				14.7		Casing refusal at 14.7 ft. Tri-coned into probable bedrock to 15.3 ft.										
				15.3		Bottom of Exploration at 15.3 ft.										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
6/16/08	1530	0.5	-	14.3	6.5

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 14.7
Rock Cored (ft) 0
Samples 4S
Boring No. HA08-4

Field Tests: **Dilatancy:** R - Rapid S - Slow N - None **Toughness:** L - Low M - Medium H - High **Plasticity:** N - Nonplastic L - Low M - Medium H - High **Dry Strength:** N - None L - Low M - Medium H - High V - Very High

*Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 HA-LIB07-1R-POR-06-03-08.GLB HA-TB+CORE+WELL-07-1.GDT G:\PROJECTS\35024\EXPLORATIONS\000\35024-000_TB_HA08-1_HA08-7.GPJ 29 Aug 08

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA08-5

Project Portland International Jetport Terminal Expansion, Portland, Maine
Client Gensler
Contractor Maine Test Borings, Inc.

File No. 35024-000
Sheet No. 1 of 2
Start 17 June 2008
Finish 18 June 2008
Driller A. Francis
H&A Rep. H. Hollauer
Elevation 63 +/-
Datum NGVD 29
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	NW	S	NX	Rig Make & Model: Trailer
Inside Diameter (in.)	3.0	1 3/8	2.0	Bit Type: Roller Bit
Hammer Weight (lb)	300	140	-	Drill Mud: None
Hammer Fall (in.)	16	30	-	Casing: NW Driven to 17.3 ft.
				Hoist/Hammer: Winch Doughnut Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0						4 in. Bituminous pavement										
	28 31 33 29	S1 18	0.5 2.5	0.4	SP	Very dense, brown, poorly-graded SAND (SP), mps 1 in., no odor, dry -FILL-	5	5	5	5	80	-				
5	7 7 13 9	S2 20	5.5 7.5	5.0	SP	Medium dense, brown, poorly-graded SAND (SP), mps 1 in., no structure, no odor, wet at 6 ft. -GLACIAL TILL-	5	5	10	10	75	5				
10	31 21 9 7	S3 20	10.5 12.5		SM	Medium dense to dense, brown grading to gray, silty SAND (SM), mps 1 in., no structure, no odor, wet -GLACIAL TILL-	5	-	5	10	50	30				
15	25 26 68 50/0	S4 2	15.5 17.0	17.0	SM	Very dense, gray, silty SAND with gravel (SM), mps 2.25 in., no structure, no odor, wet -GLACIAL TILL-	10	5	20	15	20	30				
				17.3		Possible bedrock surface at 17.0 ft. Rollerbit to 17.3 ft. to confirm bedrock surface. Began Coring at 17.3 ft. - See Core Boring Report										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
6/18/08	1030	0.10	17.4	21.2	7.2
6/18/08	1045	0.25	-	12.4	3.2

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 17.0
Rock Cored (ft) 5.0
Samples 4S, 1C
Boring No. HA08-5

Field Tests: **Dilatancy:** R - Rapid S - Slow N - None **Toughness:** L - Low M - Medium H - High **Plasticity:** N - Nonplastic L - Low M - Medium H - High **Dry Strength:** N - None L - Low M - Medium H - High V - Very High

*Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 HA-LIB07-1R-POR-06-03-08.GLB HA-TB+CORE+WELL-07-1.GDT G:\PROJECTS\35024\EXPLORATIONS\000\35024-000_TB_HA08-1_HA08-7.GPJ 29 Aug 08

HALEY & ALDRICH

CORE BORING REPORT

Boring No. HA08-5
File No. 35024-000
Sheet No. 2 of 2

Depth (ft)	Drilling Rate (min./ft)	Run No.	Run Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weathering	Elev./ Depth (ft)	Visual Description and Remarks
								SEE TEST BORING REPORT FOR OVERBURDEN DETAILS
		C1	17.3 21.3	56 29.5	117 61	Fr-Sw		Hard to very hard, fresh to slightly weathered, gray to greenish-gray, fine-grained to aphanitic SILTSTONE. Joints are low angle to moderately dipping, very close to moderately spaced, planar and stepped, fresh to discolored, tight to partly open, some silt and calcite infilling. Quartz stringers throughout, pyrite in some joints.
20							21.3	Bottom of Exploration at 21.3 ft.
25								
30								
35								
40								
45								

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA08-6

Project Portland International Jetport Terminal Expansion, Portland, Maine
Client Gensler
Contractor Maine Test Borings, Inc.

File No. 35024-000
Sheet No. 1 of 2
Start 18 June 2008
Finish 18 June 2008
Driller A. Francis
H&A Rep. H. Hollauer
Elevation 65.5 +/-
Datum NGVD 29
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	NW	S	NX	Rig Make & Model: Trailer
Inside Diameter (in.)	3.0	1 3/8	2.0	Bit Type: Roller Bit
Hammer Weight (lb)	300	140	-	Drill Mud: None
Hammer Fall (in.)	16	140	-	Casing: NW Driven to 18.5 ft.
				Hoist/Hammer: Winch Doughnut Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel %	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test: Dilatancy	Toughness	Plasticity	Strength
0				0.3	SW	3.5 in. Bituminous pavement									
	2 16 14 14	S1 12	0.6 2.6			Medium dense, brown, well-graded SAND with gravel (SW), mps 0.75 in., no structure, no odor, dry	5	10	25	30	30	-			
				2.0	ML	-FILL-									
	6 7 12 30	S2 18	2.6 4.6			Stiff, gray-brown, SILT with sand (ML), mps 1 mm, no structure, no odor, moist	-	-	-	15	85	-			
				3.5	ML	-GLACIOMARINE DEPOSIT-	-	-	-	-	-	100			
5	3 5 5 5	S3 24	4.6 6.6		ML	Medium dense, olive brown-gray, SILT (ML), mps 0.075 mm, blocky, no odor, moist	-	-	-	-	30	70			
						-GLACIOMARINE DEPOSIT-									
						Stiff, olive brown-gray, sandy SILT (ML), mps 0.075 mm, blocky, becoming softer with depth, no odor, moist									
						-GLACIOMARINE DEPOSIT-									
				9.0											
10	30 30 17 13	S4 10	10.0 12.0		SP	Dense, brown, poorly-graded SAND (SP), mps 0.5 in., bonded, no odor, wet	5	5	10	10	75	5			
						-GLACIAL TILL-									
						Possible cobble at 14.0 ft.									
15	19 8 20 26	S5 14	15.0 17.0		SM	Medium dense, brown to gray, silty SAND (SM), with rock fragments, mps 0.75 in., bonded, no odor, wet	-	-	-	-	60	40			
						-GLACIAL TILL-									
				17.6		Rollerbit 17.6 to 18.5 ft. through weathered rock.									
				18.5		Began Coring at 18.5 ft. - See Core Boring Report									

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
6/18/08	1700	-	-	-	7.2

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 18.3
Rock Cored (ft) 5.9
Samples 5S, 2C
Boring No. HA08-6

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

*Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY & ALDRICH

CORE BORING REPORT

Boring No. HA08-6
File No. 35024-000
Sheet No. 2 of 2

Depth (ft)	Drilling Rate (min./ft)	Run No.	Run Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weathering	Elev./ Depth (ft)	Visual Description and Remarks
								SEE TEST BORING REPORT FOR OVERBURDEN DETAILS
20		C1	18.4 22.3	34 19.5	73 42	Fr-Sw		Hard, fresh to slightly weathered, gray, fine-grained to aphanitic SLATE. Joints are moderately dipping to horizontal, close to moderately spaced, planar, stepped and undulating, rough, fresh to discolored, tight to partly open, some silt and calcite infilling. Quartz stringers throughout.
		C2	22.3 24.3	33 32.5	138 135	Fr-Sw	22.3	Same as above, except joints are low angle to moderately dipping, moderately spaced.
25							24.3	Bottom of Exploration at 24.3 ft.
30								
35								
40								
45								

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA08-7(OW)

Project Portland International Jetport Terminal Expansion, Portland, Maine
Client Gensler
Contractor Maine Test Borings, Inc.

File No. 35024-000
Sheet No. 1 of 2
Start 16 June 2008
Finish 16 June 2008
Driller A. Francis
H&A Rep. D. Dearden
Elevation 67.5 +/-
Datum NGVD 29
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	NX	Rig Make & Model: Trailer
Inside Diameter (in.)	4.0	1 3/8	2.0	Bit Type: Roller Bit
Hammer Weight (lb)	300	140	-	Drill Mud: None
Hammer Fall (in.)	16	30	-	Casing: HW Driven to 15.6 ft.
				Hoist/Hammer: Winch Doughnut Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Well Diagram	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0					0.3		4 in. Bituminous pavement										
	2 7 4 6	S1 14	1.0 3.0		2.0	SW	Medium dense, brown, well-graded SAND with gravel (SW), mps 1.0 in., no odor, moist	5	15	20	25	35	0				
						CL	-FILL-	-	-	-	-	25	75				
	13 15 54 29	S2 20	3.0 5.0			CL	Stiff, brown-gray, lean CLAY with sand (CL), mps 0.2 mm, blocky, no odor, moist	-	-	-	-	5	95				
							-GLACIOMARINE DEPOSIT-										
5	7 17 17 20	S3 24	5.0 7.0			CL	Very stiff, brown-gray, lean CLAY (CL), mps 0.1 mm, blocky, no odor, moist, with mottling, with gravel fragments from 4.2 to 4.5 ft. Very stiff, brown-gray, lean CLAY (CL), mps 0.1 mm, blocky, no odor, moist, significant mottling throughout sample, with occasional gray-brown, fine sandy SILT partings	-	-	-	-	5	95				
							-GLACIOMARINE DEPOSIT-										
10	1 3 5 13	S4 24	10.0 12.0			CL-ML	Stiff, gray-brown, lean CLAY (CL), grading to a gray-brown SILT with sand (ML), stratified, no odor, wet	-	-	-	-	20	80				
							-GLACIOMARINE DEPOSIT-										
					12.8		Encountered granular soils at approx. 12.8 ft. - possible GLACIAL TILL. Continued through granular soils to approx. 15.3 ft.										
15					15.3		Possible refusal surface. Tri-coned approx. 0.4 ft. into probable bedrock.										
	70/0	S5 NR	15.7 15.7		15.7		Began Coring at 15.7 ft. - See Core Boring Report										

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
6/17/08	0700	14.0	10.0	11.0	6.0

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 15.7
Rock Cored (ft) 4.4
Samples 5S, 1C
Boring No. HA08-7(OW)

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Plasticity**: N - Nonplastic L - Low M - Medium H - High
Toughness: L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

*Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 HA-LIB07-1R-POR-06-03-08.GLB HA-TB+CORE+WELL-07-1.GDT G:\PROJECTS\35024\EXPLORATIONS\000\35024-000_TB_HA08-1_HA08-7.GPJ 29 Aug 08

HALEY & ALDRICH

CORE BORING REPORT

Boring No. HA08-7(OW)
File No. 35024-000
Sheet No. 2 of 2

Depth (ft)	Drilling Rate (min./ft)	Run No.	Run Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weathering	Well Diagram	Elev./ Depth (ft)	Visual Description and Remarks
									SEE TEST BORING REPORT FOR OVERBURDEN DETAILS
		C1	15.7 20.1	53 27.5	100 52	Fr-Mw			Hard, fresh to moderately weathered, gray to greenish-gray, aphanitic SILTSTONE. Joints are horizontal to high angle, extremely close to close, planar, stepped and undulating, rough, discolored to disintegrated, partly open to moderately wide, some silt and calcite infilling. Quartz stringers throughout. Weathering occurs around mica rich zones.
20								20.1	Bottom of Exploration at 20.1 ft.
25									
30									
35									
40									
45									

H+A_CORE+WELL07-1 HA-LIB07-1R-POR-06-03-08.GLB HA-TB+CORE+WELL-07-1.GDT G:\PROJECTS\35024\EXPLORATIONS\000\35024-000_TB_HA08-1_HA08-7.GPJ 29 Aug 08

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA08-101

Project Jetport Terminal Exansion, Portland, Maine
Client Gensler
Contractor Maine Test Borings, Inc.

File No. 35024-001
Sheet No. 1 of 1
Start 11 August 2008
Finish 11 August 2008
Driller D. McKeen
H&A Rep. H. Hollauer
Elevation 59.5
Datum NGVD 29
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	NW	S	--	Rig Make & Model: Mobile B53
Inside Diameter (in.)	3.0	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	300	140	-	Drill Mud: None
Hammer Fall (in.)	16	30	-	Casing: NW Drive to 12.0 ft.
				Hoist/Hammer: Winch Safety Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0						-BITUMINOUS PAVEMENT-										
	7 8 4 2	S1 18	0.5 2.5	0.4	SP	Medium dense, brown, poorly-graded SAND (SP), mps 1 in., no odor, moist	5	5	15	35	35	5				
						-FILL-										
				2.0	ML	Stiff, gray, SILT (ML), mps 0.075 mm, no odor, moist						100				
						-GLACIOMARINE DEPOSIT-										
				4.0												
5	3 4 6 10	S2 22	5.0 7.0		CL	Stiff, gray-brown, sandy lean CLAY (CL), mps 0.42 mm, no odor, moist					30	70				
				5.8	SM	Medium dense, gray-brown, silty SAND (SM), mps 0.5 in., no odor, moist		5	5	10	50	30				
	12 17 12 8	S3 20	7.0 9.0		SM	Medium dense, brown, silty SAND (SM), mps 0.75 in., no odor, wet	5	5	15	30	30	15				
						-GLACIOMARINE DEPOSIT-										
	18 60 50/0.2	S4 10	9.0 10.2													
10				10.0	SP-SM	Very dense, gray, poorly-graded SAND with silt and gravel (SP-SM), mps 1.5 in., no odor, wet	10	10	20	30	20	10				
				10.2		-GLACIAL TILL-										
						Probable bedrock										
				12.0		BOTTOM OF EXPLORATION, Roller bit refusal on probable bedrock										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 12.0
Rock Cored (ft)
Samples 4S

Boring No. HA08-101

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

*Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 H:\A-LIB\07-1R-POR-06-03-08.GLB HA-TB+CORE+WELL-07-1.GDT G:\PROJECTS\35024\EXPLORATIONS\001\35024-001.GPJ 12 Sep 08

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA08-102

Project Jetport Terminal Exansion, Portland, Maine
Client Gensler
Contractor Maine Test Borings, Inc.

File No. 35024-001
Sheet No. 1 of 1
Start 12 August 2008
Finish 12 August 2008
Driller D. McKeen
H&A Rep. E. Beirne
Elevation 60
Datum NGVD 29
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	NW	S	--	Rig Make & Model: Mobile B53
Inside Diameter (in.)	3.0	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	300	140	-	Drill Mud: None
Hammer Fall (in.)	16	30	-	Casing: NW Drive to 15.5
				Hoist/Hammer: Winch Safety Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	3 6 5 5	S1 3	0.0 2.0	0.8	ML	Stiff, dark brown, SILT with sand (ML), mps 0.25 in., no structure, organic odor, moist, roots throughout -TOPSOIL-				10	15	75				
5	2 3 5 4	S2 24	5.0 7.0	6.3	ML	Stiff, olive-brown, sandy SILT (ML), mps 0.075 mm, blocky to no structure, no odor, moist to wet, mottled -GLACIOMARINE DEPOSIT-					35	65				
	2 5 5 15	S3 23	7.0 9.0	8.2	CL CL SM	Stiff, gray, lean CLAY with sand (CL), mps 0.075 mm, no structure, no odor, wet -GLACIOMARINE DEPOSIT- Stiff, gray, lean CLAY to lean CLAY with sand (CL), mps 0.25 in., no structure, no odor, wet					20 15	80 85				
10	13 17 15 9	S4 19	9.0 11.0		SM SM	Medium dense, gray to gray-brown, silty SAND (SM), mps 0.75 in., no structure, no odor, wet Dense, gray-brown to brown, silty SAND with gravel (SM), mps 1.5 in., somewhat bonded, no odor, wet, layer of poorly-graded sand from approximately 10.0 to 10.2 ft -GLACIAL TILL-	10	10 10	5 10	15 20	50 35	20 15				
	6 9 10 11	S5 20	11.0 13.0		SM	Medium dense, gray-brown to gray, silty SAND with gravel (SM), mps 1.5 in., somewhat bonded, no odor, wet, increased percentage of fines with depth	10	10	5	15	35	25				
	11 11 10 8	S6 NR	13.0 15.0			No recovery										
15	50 50/0	S7 1	15.0 15.5	15.5		Poor recovery, gravel in sampler BOTTOM OF EXPLORATION, Split spoon refusal on probable bedrock										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
8/12/08	1800	0.1	-	14.8	4.1

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 15.5
Rock Cored (ft)
Samples 7S
Boring No. HA08-102

Field Tests: **Dilatancy:** R - Rapid S - Slow N - None **Toughness:** L - Low M - Medium H - High **Plasticity:** N - Nonplastic L - Low M - Medium H - High **Dry Strength:** N - None L - Low M - Medium H - High V - Very High

*Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 HA-LIB07-1R-POR-06-03-08.GLB HA-TB+CORE+WELL-07-1.GDT G:\PROJECTS\35024\EXPLORATIONS\001\35024-001.GPJ 12 Sep 08

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA08-103

Project Jetport Terminal Exansion, Portland, Maine
Client Gensler
Contractor Maine Test Borings, Inc.

File No. 35024-001
Sheet No. 1 of 1
Start 13 August 2008
Finish 13 August 2008
Driller D. McKeen
H&A Rep. E. Beirne
Elevation 62
Datum NGVD 29
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	NW	S	--	Rig Make & Model: Mobile B53
Inside Diameter (in.)	3.0	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	300	140	-	Drill Mud: None
Hammer Fall (in.)	16	30	-	Casing: NW Drive to 18.5 ft.
				Hoist/Hammer: Winch Safety Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	2 3 5 6	S1 18	0.0 2.0	0.8	ML	Medium stiff, dark brown, sandy SILT (ML), mps 0.75 in., no structure, organic odor, moist, roots throughout, top 0.2 ft highly organic	5	5		10	25	55				
					SM	-TOPSOIL-	5	5	5	25	40	20				
						Medium dense, gray-brown, silty SAND (SM), mps 1.0 in., no structure, no odor, moist										
						-GLACIAL TILL-										
5	8 10 4 4	S2 19	5.0 7.0		SM	Medium dense, brown to gray, silty SAND with gravel (SM), mps 1.5 in., somewhat bonded, no odor, moist to wet, increasing percentage of fines with depth	5	10	10	20	30	25				
						-GLACIAL TILL-										
	13 11 11 13	S3 15	7.0 9.0		SM	Medium dense, gray, silty SAND (SM), mps 1.5 in., no structure to somewhat bonded, no odor, wet	5	5	10	30	35	15				
	13 13 15 12	S4 18	9.0 11.0		SM	Medium dense, gray, silty SAND (SM), mps 0.5 in., no structure, no odor, wet		5	10	35	35	15				
10				10.4	SM	Medium dense, gray, silty SAND with gravel (SM), mps 1.5 in., bonded, no odor, moist	10	10	5	20	35	20				
	11 6 3 2	S5 11	11.0 13.0		SC	Loose, gray, clayey SAND with gravel (SC), mps 2.5 in., no structure, no odor, wet	5	10	5	15	25	40				
						-GLACIAL TILL-										
	4 7 5 4	S6 18	13.0 15.0		SC	Medium dense, gray, clayey SAND with gravel (SC), mps 1.5 in., no structure to somewhat bonded, no odor, wet	5	10		20	30	35				
15	2 3 1 1	S7 3	15.0 17.0	15.0	CL	Stiff, gray, sandy CLAY with gravel (CL), mps 1.5 in., bonded, no odor, wet	5	5	5	15	15	55				
						-GLACIAL TILL-										
	50 50/0	S8 6	17.0 17.5	17.0 17.5	SC	Very dense, gray, clayey SAND with gravel (SC), mps 1.5 in., bonded, no odor, wet	15	10		25	35	15				
				18.5		Spoon refusal on probable bedrock, advance roller cone to 18.5 ft to confirm rock										
						BOTTOM OF EXPLORATION on probable bedrock										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 18.5
Rock Cored (ft)
Samples 8S
Boring No. HA08-103

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

*Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 HA-LIB07-1R-POR-06-03-08.GLB HA-TB+CORE+WELL-07-1.GDT G:\PROJECTS\35024\EXPLORATIONS\001\35024-001.GPJ 11 Sep 08

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA08-104(OW)

Project Jetport Terminal Exansion, Portland, Maine
Client Gensler
Contractor Maine Test Borings, Inc.

File No. 35024-001
Sheet No. 1 of 2
Start 13 August 2008
Finish 13 August 2008
Driller D. McKeen
H&A Rep. E. Beirne
Elevation 66
Datum NGVD 29
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	NW	S	--	Rig Make & Model: Mobile B53
Inside Diameter (in.)	3.0	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	300	140	-	Drill Mud: None
Hammer Fall (in.)	16	30	-	Casing: NW Drive to 17.6 ft
				Hoist/Hammer: Winch Safety Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Well Diagram	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0					0.4		-BITUMINOUS PAVEMENT-										
	14 10 5 7	S1 18	0.5 2.5		1.4	SW-SM	Medium dense, brown, well-graded SAND with silt and gravel (SW-SM), mps 1.75 in., no structure, no odor, moist	15	10	5	30	30	10				
						ML	-FILL- Stiff, olive-brown, SILT with sand (ML), mps 1 mm, blocky, no odor, moist, black organic staining on partings -GLACIOMARINE DEPOSIT-					25	75				
					4.0												
5	8 10 13 12	S2 24	5.0 7.0			CL	Very stiff, olive-brown, lean CLAY with sand (CL), mps 0.075 mm, blocky, no odor, moist to wet, mottled, occasional fine sand layers -GLACIOMARINE DEPOSIT-					25	75				
	4 5 5 6	S3 24	7.0 9.0			CL	Stiff, olive-brown, lean CLAY with sand (CL), mps 2 mm, no structure to somewhat blocky, no odor, moist to wet, occasional medium to fine sand layers -GLACIOMARINE DEPOSIT-				5	10	85				
	10 20 13 6	S4 18	9.0 11.0		9.0	SC	Dense, brown, clayey SAND with gravel (SC), mps 1.5 in., no structure to somewhat bonded, no odor, wet, increasing percentage of fines with depth -GLACIAL TILL-	10	10	5	20	35	20				
10	3 4 6 18	S5 19	11.0 13.0			SC	Loose, gray-brown, clayey SAND with gravel (SC), mps 1.5 in., no structure to somewhat bonded, no odor, wet	10	5		15	25	45				
	3 4 9 8	S6 8	13.0 15.0			SC	Medium dense, gray-brown, clayey SAND with gravel (SC), mps 1.0 in., no structure, no odor, wet -GLACIAL TILL-	5	10	5	25	25	30				
15	11 5 4 4	S7 20	15.0 17.0			SC	Loose, gray, clayey SAND with gravel (SC), mps 1.25 in., somewhat bonded to no structure, no odor, wet -GLACIAL TILL-	10	10		20	40	20				
	5 50/0.1	S8 2	17.0 17.6		17.6	SC/CL	Very dense to hard, gray, clayey SAND to lean CLAY with sand (SC/CL), mps 0.5 in., no structure, no odor, wet		5	5	15	30	45				
							Split spoon refusal on probable bedrock Begin NQ rock core, see Core Boring Report for bedrock details										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
8/13/08	1700	0.5	-	30.0	7.3

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 17.6
Rock Cored (ft) 12.4
Samples 8S, 3C
Boring No. HA08-104(OW)

Field Tests: **Dilatancy:** R - Rapid S - Slow N - None **Toughness:** L - Low M - Medium H - High **Plasticity:** N - Nonplastic L - Low M - Medium H - High **Dry Strength:** N - None L - Low M - Medium H - High V - Very High

*Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 HA-LIB07-1R-POR-06-03-08.GLB HA-TB+CORE+WELL-07-1.GDT G:\PROJECTS\35024\EXPLORATIONS\00135024-001.GPJ 12 Sep 08

HALEY & ALDRICH

CORE BORING REPORT

Boring No. HA08-104(OW)
File No. 35024-001
Sheet No. 2 of 2

Depth (ft)	Drilling Rate (min./ft)	Run No.	Run Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weathering	Well Diagram	Elev./ Depth (ft)	Visual Description and Remarks
									SEE TEST BORING REPORT FOR OVERBURDEN DETAILS
	1	C1	17.6	51	97	FR			Hard, fresh, gray to dark-gray, fine-grained to aphanitic SLATE. Joints are close to moderately spaced, moderately dipping to high angle, planar and stepped, fresh to discolored. Foliation is high angle where present. Frequent quartz and calcite stringers throughout core stem, occasional pyrite crystals.
	2		22.0	45	85				
	3								
20	2								
	3								
	2	C2	22.0	60	100	FR-SW			Hard, fresh to slightly weathered, gray to dark-gray, fine-grained to aphanitic SLATE. Joints are very close to moderately spaced, low to high angle, planar, stepped and undulating, fresh to discolored. Frequent quartz and calcite stringers throughout core stem, occasional pyrite crystals.
	3		27.0	48	80				
	3								
25	3								
	3								
	3	C3	27.0	36	100	FR			Hard, fresh, gray to dark-gray, fine-grained to aphanitic SLATE. Joints are very close to moderately spaced, low to high angle, planar, stepped and undulating, fresh to discolored. Foliation is high angle where present. Frequent quartz and calcite stringers throughout core stem, occasional pyrite crystals.
	3		30.0	36	100				
	2								
30								30.0	BOTTOM OF EXPLORATION
35									
40									
45									

H+A_CORE+WELL07-1 HA-LIB07-1R-POR-06-03-08.GLB HA-TB+CORE+WELL-07-1.GDT G:\PROJECTS\35024\EXPLORATIONS\001\35024-001.GPJ 29 Aug 08

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA08-105

Project Jetport Terminal Exansion, Portland, Maine
Client Gensler
Contractor Maine Test Borings, Inc.

File No. 35024-001
Sheet No. 1 of 1
Start 12 August 2008
Finish 12 August 2008
Driller D. McKeen
H&A Rep. E. Beirne
Elevation 64
Datum NGVD 29
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	NW	S	--	Rig Make & Model: Mobile B53
Inside Diameter (in.)	3.0	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	300	140	-	Drill Mud: None
Hammer Fall (in.)	16	30	-	Casing: NW Drive to 19.0 ft
				Hoist/Hammer: Winch Safety Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0				0.3		-BITUMINOUS PAVEMENT-										
	3 1 2 3	S1 3	0.5 2.5		SM	Loose, gray, silty SAND with gravel (SM), mps 1.5 in., no structure, no odor, moist	5	15	10	25	25	20				
						-FILL-										
5	6 6 5 3	S2 24	5.0 7.0	5.0	SM	Medium dense, gray-brown, silty SAND with gravel (SM), mps 1.5 in., no structure, no odor, moist	10	10	5	15	30	30				
				5.9	SC	-GLACIAL TILL-		5	5	10	30	50				
						Medium dense, gray-brown, clayey SAND (SC), mps 0.5 in., no structure, no odor, moist										
	3 2 3 4	S3 24	7.0 9.0		SM	Loose, gray-brown, silty SAND with gravel (SM), mps 0.75 in., no structure, no odor, wet	5	10	5	15	25	40				
	9 8 13 16	S4 17	9.0 11.0		SM	Medium dense, gray, silty SAND with gravel (SM), mps 0.5 in., somewhat bonded, no odor, moist		15	5	25	35	20				
10						-GLACIAL TILL-										
	12 9 9 7	S5 2	11.0 13.0		SM	Medium dense, gray, silty SAND with gravel (SM), mps 0.75 in., no structure, no odor, moist		5	5	20	45	25				
	6 8 10 11	S6 18	13.0 15.0		SM	Medium dense, gray, silty SAND with gravel (SM), mps 1.0 in., somewhat bonded, no odor, moist	5	10	10	20	25	30				
15	15 12 14 10	S7 16	15.0 17.0		SM	Medium dense, gray, silty SAND with gravel (SM), mps 1.0 in., somewhat bonded, no odor, moist	5	10	10	20	25	30				
						-GLACIAL TILL-										
				18.2		Probable top of bedrock, advance roller bit to 19.0 ft										
				19.0		BOTTOM OF EXPLORATION										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
8/12/08	1015	0.1	-	18.0	2.0

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 19
Rock Cored (ft)
Samples 7S

Boring No. HA08-105

Field Tests: **Dilatancy:** R - Rapid S - Slow N - None **Toughness:** L - Low M - Medium H - High **Plasticity:** N - Nonplastic L - Low M - Medium H - High **Dry Strength:** N - None L - Low M - Medium H - High V - Very High

*Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 HA-LIB07-1R-POR-06-03-08.GLB HA-TB+CORE+WELL-07-1.GDT G:\PROJECTS\35024\EXPLORATIONS\001\35024-001.GPJ 11 Sep 08

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA08-106

Project Jetport Terminal Exansion, Portland, Maine
Client Gensler
Contractor Maine Test Borings, Inc.

File No. 35024-001
Sheet No. 1 of 1
Start 12 August 2008
Finish 12 August 2008
Driller D. McKeen
H&A Rep. E. Beirne
Elevation 62
Datum NGVD 29
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	NW	S	--	Rig Make & Model: Mobile B53
Inside Diameter (in.)	3.0	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	300	140	-	Drill Mud: None
Hammer Fall (in.)	16	30	-	Casing: NW Drive to 16.0 ft
				Hoist/Hammer: Winch Safety Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	1 WOH 1 4	S1 17	0.0 2.0	1.0	ML	Soft, dark brown, sandy SILT (ML), mps 1.5 in., no structure, organic odor, moist, organics throughout	10			15	25	50				
					CL	-TOPSOIL-		5			20	75				
						Stiff, gray-brown, lean CLAY with sand (CL), mps 0.5 in., no structure, no odor, moist, mottled										
						-GLACIOMARINE DEPOSIT-										
						Note: Rolled through a cobble at approximately 2.5 ft.										
				4.0		Note: Driller noted a change to loose clayey sand at approximately 4.0 ft.										
5	4 4 1 3	S2 20	5.0 7.0		SC	Loose, gray-brown, clayey SAND (SC), mps 1.0 in., no structure, no odor, moist to wet	5	5	10	20	35	25				
						-GLACIAL TILL-										
	9 9 8 10	S3 19	7.0 9.0		SM	Medium dense, gray-brown, silty SAND with gravel (SC), mps 1.5 in., bonded, no odor, moist to wet	5	10	5	25	35	20				
10	10 11 4 3	S4 10	9.0 11.0		SM	Medium dense, gray-brown, silty SAND (SM), mps 0.75 in., bonded, no odor, wet	5	5	5	20	50	15				
						-GLACIAL TILL-										
	3 10 10 10	S5 14	11.0 13.0		SM	Medium dense, gray-brown, silty SAND with gravel (SM), mps 2.0 in., somewhat bonded, no odor, wet	10	10	5	20	40	15				
	6 5 3 14	S6 9	13.0 15.0		SM	Loose, gray, silty SAND (SM), mps 0.75 in., no structure, no odor, wet		10		15	45	30				
						-GLACIAL TILL-										
15	50/0.4	S7 3	15.0 15.4	15.4	SM	Very dense, gray, silty SAND with gravel (SM), mps 1.75 in., no structure, no odor, wet	15	5	5	15	45	15				
				16.0		Spoon refusal on probable top of bedrock at 15.4 ft.										
						BOTTOM OF EXPLORATION, Roller bit refusal on probable bedrock										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
8/12/08	1433	0.1	-	14.0	3.5

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 16
Rock Cored (ft)
Samples 7S
Boring No. HA08-106

Field Tests: **Dilatancy:** R - Rapid S - Slow N - None **Plasticity:** N - Nonplastic L - Low M - Medium H - High
Toughness: L - Low M - Medium H - High **Dry Strength:** N - None L - Low M - Medium H - High V - Very High

*Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA08-107

Project Jetport Terminal Exansion, Portland, Maine
Client Gensler
Contractor Maine Test Borings, Inc.

File No. 35024-001
Sheet No. 1 of 2
Start 14 August 2008
Finish 14 August 2008
Driller D. McKeen
H&A Rep. E. Beirne
Elevation 70.5
Datum NGVD 29
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	S	--	Rig Make & Model: Mobile B53
Inside Diameter (in.)	3.0	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	-	140	-	Drill Mud: None
Hammer Fall (in.)	-	30	-	Casing: HSA Spun to 20.0 ft
				Hoist/Hammer: Winch Safety Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel %	Sand %	Sand %	Sand %	% Fines	Field Test: Dilatancy	Toughness	Plasticity	Strength
							Coarse	Fine	Coarse	Medium	Fine				
0						-BITUMINOUS PAVEMENT-									
	10 9 5 2	S1 3	0.5 2.5	0.2	SM	Medium dense, black to brown, silty SAND with gravel (SM), mps 2.0 in., no structure, no odor, moist, pushing gravel -FILL-	15	15	10	20	25	15			
	3 6 8 12	S2 20	2.5 4.5	2.8	SM	Medium dense, brown, silty SAND (SM), mps 0.5 in., no structure, no odor, moist		5	10	30	40	15			
					CL	Stiff, olive-brown, lean CLAY with sand (CL), mps 0.075 mm, blocky, no odor, moist, mottled					15	85			
5	4 6 8 8	S3 24	5.0 7.0		CL	Stiff, olive-brown, lean CLAY with sand (CL), mps 0.075 mm, blocky to no structure, no odor, moist -GLACIOMARINE DEPOSIT-					25	75			
	8 7 43 10	S4 14	7.0 9.0	7.4	CL	Stiff, olive-brown, lean CLAY with sand (CL), mps 0.075 mm, blocky to no structure, no odor, moist					25	75			
					CL	Hard, gray-brown, sandy lean CLAY (CL), mps 1.0 in., no structure, no odor, wet, weathered piece of gravel from 8.7 to 9.0 ft	5	10	5	10	15	55			
	1 1 2 1	S5 21	9.0 11.0		CL	Medium stiff, gray-brown, sandy lean CLAY (CL), mps 0.5 in., no structure, no odor, wet		10		10	30	50			
10						-GLACIOMARINE DEPOSIT-									
15	5 10 11 13	S6 12	15.0 17.0	15.0	CL	Very stiff, brown, sandy lean CLAY (CL), mps 2.5 in., no structure, no odor, wet, layer of sand and gravel between sandy clay -GLACIAL TILL-	10	10	5	10	15	50			
20															

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
8/14/08	1100	0.1	20.0	21.4	17.0
8/14/08	1245	1.75	-	13.5	8.0

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 21.4
Rock Cored (ft)
Samples 7S
Boring No. HA08-107

Field Tests: **Dilatancy:** R - Rapid S - Slow N - None **Plasticity:** N - Nonplastic L - Low M - Medium H - High
Toughness: L - Low M - Medium H - High **Dry Strength:** N - None L - Low M - Medium H - High V - Very High

*Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 HA-UB07-1R-POR-06-03-08.GLB HA-TB+CORE+WELL-07-1.GDT G:\PROJECTS\35024\EXPLORATIONS\001\35024-001.GPJ 29 Aug 08

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA08-107
File No. 35024-001
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	5 7 50/0.4	S7 18	20.0 21.4	21.4	SM	Very dense, gray-brown, silty SAND (SM), mps 0.75 in., somewhat bonded, no odor, wet -GLACIAL TILL-		10	5	15	20	50				
						BOTTOM OF EXPLORATION, Split spoon refusal on probable bedrock										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA08-107

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA08-108

Project Jetport Terminal Exansion, Portland, Maine
Client Gensler
Contractor Maine Test Borings, Inc.

File No. 35024-001
Sheet No. 1 of 2
Start 14 August 2008
Finish 14 August 2008
Driller D. McKeen
H&A Rep. E. Beirne
Elevation 71
Datum NGVD 29
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	S	--	Rig Make & Model: Mobile B53
Inside Diameter (in.)	3.0	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	-	140	-	Drill Mud: None
Hammer Fall (in.)	-	30	-	Casing: HSA Spun to 25.0 ft
				Hoist/Hammer: Winch Safety Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0						-BITUMINOUS PAVEMENT-										
	9 9 4 7	S1 18	0.5 2.5	0.3	SW	Medium dense, brown, well-graded SAND with gravel (SW), mps 1.75 in., no structure, no odor, moist	10	10	5	35	40					
				1.4	ML	-FILL-										
	11 10 5 6	S2 NR	2.5 4.5			Stiff, gray to dark gray, sandy SILT (ML), mps 0.5 in., no structure, no odor, moist Note: No recovery from 2.5 to 4.5 ft, cuttings indicate gray clayey SAND and sandy lean CLAY			5	10	35	50				
5	4 6 8 10	S3 22	5.0 7.0		CL	Stiff, olive-brown, lean CLAY with sand (CL), mps 0.075 mm, blocky, no odor, moist					15	85				
						-GLACIOMARINE DEPOSIT-										
	8 7 7 7	S4 21	7.0 9.0		CL	Stiff, olive-brown, lean CLAY (CL), mps 0.075 mm, blocky to no structure, no odor, moist to wet, occasional black staining on partings					10	90				
	1 2 1 1	S5 24	9.0 11.0		CL	Stiff, olive-brown, lean CLAY (CL), mps 0.075 mm, blocky to no structure, no odor, moist to wet, occasional black staining on partings					10	90				
10				9.8	CL	Medium stiff, gray, lean CLAY (CL), mps 0.075 mm, no structure, no odor, moist, fine sand layers						100				
						-GLACIOMARINE DEPOSIT-										
15	WOH WOH WOH WOH	S6 24	15.0 17.0		CL	Medium stiff, gray, lean CLAY (CL), mps 0.075 mm, no odor, wet, occasional fine sand partings					10	90				
						-GLACIOMARINE DEPOSIT-										
				18.5												
20																

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
8/14/08	1425	0.5	25.0	25.3	19.3
8/14/08	1440	0.5	-	17.0	7.0

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 25.3
Rock Cored (ft)
Samples 8S
Boring No. HA08-108

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Plasticity**: N - Nonplastic L - Low M - Medium H - High
Toughness: L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

*Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 HA-LIB07-1R-POR-06-03-08.GLB HA-TB+CORE+WELL-07-1.GDT G:\PROJECTS\35024\EXPLORATIONS\00135024-001.GPJ 29 Aug 08

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA08-108
File No. 35024-001
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	1 1 2 4	S7 10	20.0 22.0		SC	Very loose, gray, clayey SAND (SC), mps 0.5 in., no structure, no odor, wet -GLACIAL TILL- Note: Driller noted weathered rock beginning at approximately 23.0 ft. -GLACIAL TILL-		5	5	20	50	20				
25	50/0.3	S8 4	25.0 25.3	25.3	SC	Very dense, gray, clayey SAND (SC), mps 0.5 in., no structure, no odor, wet, white weathered rock in tip BOTTOM OF EXPLORATION, Split spoon refusal on probable bedrock		5	5	20	50	20				

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA08-108

HALEY & ALDRICH — TEST BORING REPORT

Boring No. HA08-109

Project Jetport Terminal Exansion, Portland, Maine
Client Gensler
Contractor Maine Test Borings, Inc.

File No. 35024-001
Sheet No. 1 of 2
Start 14 August 2008
Finish 14 August 2008
Driller D. McKeen
H&A Rep. E. Beirne
Elevation 71
Datum NGVD 29
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	S	--	Rig Make & Model: Mobile B53
Inside Diameter (in.)	3.0	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	-	140	-	Drill Mud: None
Hammer Fall (in.)	-	30	-	Casing: HSA Spun to 20.0 ft
				Hoist/Hammer: Winch Safety Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	2 2 7 9	S1 18	0.0 2.0	0.8	ML	Stiff, dark brown, SILT with sand (ML), mps 0.25 in., no structure, organic odor, moist, roots throughout				5	20	75				
					SW	-TOPSOIL-	5	5	10	30	50					
	6 5 6 9	S2 20	2.0 4.0	2.3	SP	Loose, brown, well graded SAND (SW), mps 0.75 in., no structure, no odor, moist				5	25	70				
					CL	-FILL-					20	80				
						Medium dense, brown, poorly graded SAND (SP), mps 0.75 in., no structure, no odor, moist										
	5 6 11 12	S3 21	4.0 6.0		CL	Stiff, olive-brown, lean CLAY with sand (CL), mps 0.075 mm, blocky, no odor, dry, mottled, occasional fine sand layers					10	90				
5						Very stiff, olive-brown, lean CLAY (CL), mps 0.075 mm, blocky to no structure, no odor, dry to moist											
						-GLACIOMARINE DEPOSIT-										
	8 10 10 8	S4 19	6.0 8.0		CL	Very stiff, gray, lean CLAY (CL), mps 0.075 mm, no structure, no odor, moist, occasional fine sand layers					10	90				
	3 3 4 5	S5 24	8.0 10.0		CL	Medium stiff, gray, lean CLAY (CL) mps 4 mm, no structure, no odor, moist					5	95				
						-GLACIOMARINE DEPOSIT-										
10	8 13 5 7	S6 12	10.0 12.0	10.2	SC	Medium dense, gray, clayey SAND with gravel (SC), mps 2 in., somewhat bonded, no odor, wet	5	10	5	25	35	20				
						-GLACIOMARINE DEPOSIT-										
15	1 1 1 1	S7 14	15.0 17.0	15.0	CL	Medium stiff, gray, sandy lean CLAY (CL), mps 2 mm, no structure, no odor, moist to wet					25	75				
						-GLACIOMARINE DEPOSIT-										
20																

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
8/14/08	0850	0.1	20.0	22.0	15.0
8/14/08	0915	0.5	-	13.5	9.5

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 22.0
Rock Cored (ft)
Samples 8S
Boring No. HA08-109

Field Tests: **Dilatancy:** R - Rapid S - Slow N - None **Plasticity:** N - Nonplastic L - Low M - Medium H - High
Toughness: L - Low M - Medium H - High **Dry Strength:** N - None L - Low M - Medium H - High V - Very High

*Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA08-109
File No. 35024-001
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	3 3 13 10	S8 18	20.0 22.0		CL	Very stiff, gray, sandy lean CLAY (CL), mps 0.5 in., no structure, no odor, wet		5	5	15	20	55				
				21.2	SC	Medium dense, gray, clayey SAND with gravel (SC), mps 1.0 in., somewhat bonded, no odor, moist to wet	5	10	5	10	30	40				
				22.0		-GLACIAL TILL- BOTTOM OF EXPLORATION, No refusal encountered										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA08-109

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA08-110

Project Jetport Terminal Exansion, Portland, Maine
Client Gensler
Contractor Maine Test Borings, Inc.

File No. 35024-001
Sheet No. 1 of 1
Start 15 August 2008
Finish 15 August 2008
Driller D. McKeen
H&A Rep. E. Beirne
Elevation 73
Datum NGVD 29
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	S	--	Rig Make & Model: Mobile B53
Inside Diameter (in.)	3.0	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	-	140	-	Drill Mud: None
Hammer Fall (in.)	-	30	-	Casing: HSA Spun to 13.1 ft
				Hoist/Hammer: Winch Safety Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0				0.7		-BITUMINOUS PAVEMENT-										
	10 16 10 8	S1 16	1.0 3.0		SW	Medium dense, brown, well-graded SAND with gravel (SW), mps 1.25 in., no structure, no odor, moist -FILL-	10	10	5	30	45					
				2.4	CL	Very stiff, olive-brown, lean CLAY with sand (CL), mps 2 mm, blocky structure, no odor, dry, black organic staining on partings, mottled -GLACIOMARINE DEPOSIT-					20	80				
5	3 2 3 2	S2 23	5.0 7.0		CL	Medium stiff, olive-brown to gray, sandy lean CLAY (CL), mps 0.075 mm, no odor, wet, frequent fine sand layers throughout					40	60				
	3 2 1 1	S3 24	7.0 9.0		CL	Medium stiff, gray, sandy lean CLAY (CL), mps 2 mm, no structure, no odor, wet -GLACIOMARINE DEPOSIT-					30	70				
10	1 2 13 7	S4 17	10.0 12.0	10.0	SC/CL	Medium dense, gray-brown, sandy lean CLAY alternating with clayey SAND (SC/CL), mps 1.25 in., no structure to somewhat bonded, no odor, wet -GLACIAL TILL- Note: Driller noted top of rock at 12.5 ft.	5	5	10	15	30	35				
				13.1		BOTTOM OF EXPLORATION, Auger refusal on probable bedrock										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
8/15/08	1110	0.1	13.1	13.1	12.0
8/15/08	1125	0.3	-	10.0	8.0

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 13.1
Rock Cored (ft)
Samples 4S

Boring No. HA08-110

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

*Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 HA-LIB07-1R-POR-06-03-08.GLB HA-TB+CORE+WELL-07-1.GDT G:\PROJECTS\35024\EXPLORATIONS\001\35024-001.GPJ 29 Aug 08

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA08-111

Project Jetport Terminal Exansion, Portland, Maine
Client Gensler
Contractor Maine Test Borings, Inc.

File No. 35024-001
Sheet No. 1 of 2
Start 15 August 2008
Finish 15 August 2008
Driller D. McKeen
H&A Rep. E. Beirne
Elevation 69.5
Datum NGVD 29
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	S	--	Rig Make & Model: Mobile B53
Inside Diameter (in.)	3.0	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	-	140	-	Drill Mud: None
Hammer Fall (in.)	-	30	-	Casing: HSA Spun to 24.0 ft
				Hoist/Hammer: Winch Safety Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0				0.3		-BITUMINOUS PAVEMENT-										
	6 7 5 3	S1 12	0.5 2.5		SW-SM	Medium dense, brown, well-graded SAND with silt and gravel (SW-SM), mps 1.5 in., no structure, no odor, moist	5	10	5	25	45	10				
				1.7		-FILL-										
					SM	Medium dense, brown, silty SAND with gravel (SM), mps 0.75 in., no structure, no odor, wet		15		15	40	30				
						-GLACIAL TILL-										
5	6 8 9 10	S2 17	5.0 7.0		SM	Medium dense, gray-brown, silty SAND with gravel (SM), mps 1.0 in., bonded, no odor, wet	5	10		15	35	35				
				5.8	SM	Medium dense, brown, silty SAND with gravel (SM), mps 1.5 in., no structure, no odor, wet	5	15	5	30	30	15				
10	2 2 4 1	S3 14	10.0 12.0		SM	Loose, gray, silty SAND with gravel (SM), mps 1.0 in., somewhat bonded, no odor, wet		15	5	10	20	50				
						-GLACIAL TILL-										
15	2 4 2 2	S4 10	15.0 17.0		SM	Loose, gray, silty SAND with gravel (SM), mps 1.0 in., somewhat bonded, no odor, wet	5	10	5	10	20	50				
20																

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
8/15/08	1235	0.1	22.0	22.0	18.0

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 24
Rock Cored (ft)
Samples 6S
Boring No. HA08-111

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Plasticity**: N - Nonplastic L - Low M - Medium H - High
Toughness: L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

*Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA08-111
File No. 35024-001
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	1 1 2 6	S5 24	20.0 22.0		SM	Very loose, gray, silty SAND with gravel (SM), mps 2.0 in., somewhat bonded, no odor, wet	5	10	5	10	20	50				
						-GLACIAL TILL-										
	6 7 8 12	S6 24	22.0 24.0		SM/ SC	Medium dense, gray, silty SAND with gravel to clayey SAND with gravel (SM/SC), mps 2.0 in., no structure to somewhat bonded, no odor, wet	5	10	5	15	30	35				
				24.0		BOTTOM OF EXPLORATION, No refusal encountered										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA08-111

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA08-112

Project Jetport Terminal Exansion, Portland, Maine
Client Gensler
Contractor Maine Test Borings, Inc.

File No. 35024-001
Sheet No. 1 of 2
Start 14 August 2008
Finish 14 August 2008
Driller D. McKeen
H&A Rep. E. Beirne
Elevation 72
Datum NGVD 29
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	S	--	Rig Make & Model: Mobile B53
Inside Diameter (in.)	3.0	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	-	140	-	Drill Mud: None
Hammer Fall (in.)	-	30	-	Casing: HSA Spun to 20.1 ft
				Hoist/Hammer: Winch Safety Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0				0.3		-BITUMINOUS PAVEMENT-										
	9 9 10 12	S1 12	0.5 2.5		SW	Medium dense, brown, well-graded SAND with gravel (SW), mps 1.75 in., no structure, no odor, moist	5	10	10	35	40					
				2.5		-FILL-										
5	4 6 8 8	S2 19	5.0 7.0		CL	Stiff, gray, lean CLAY (CL), mps 2 mm, blocky, no odor, moist, sandy clay in sampler tip					10	90				
						-GLACIOMARINE DEPOSIT-										
10	2 2 3 3	S3 24	10.0 12.0		CL	Medium stiff, gray, lean CLAY with sand (CL), mps 2 mm, no structure, no odor, wet, fine sand layers throughout					25	75				
						-GLACIOMARINE DEPOSIT-										
15	1 1 1 1	S4 20	15.0 17.0		CL	Medium stiff, gray, sandy lean CLAY (CL), mps 0.75 in., no structure, no odor, wet		5	5	15	25	50				
						-GLACIOMARINE DEPOSIT-										
20																

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
8/14/08	1635	0.1	20.0	20.1	11.0
8/14/08	1700	0.4	-	4.0	dry

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 20.1
Rock Cored (ft)
Samples 5S
Boring No. HA08-112

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Plasticity**: N - Nonplastic L - Low M - Medium H - High
Toughness: L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

*Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA08-112
File No. 35024-001
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	50/0.1	S5 trace	20.0 20.1	20.1		Rock fragments BOTTOM OF EXPLORATION, Split spoon refusal on probable bedrock										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA08-112

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA08-113

Project Jetport Terminal Exansion, Portland, Maine
Client Gensler
Contractor Maine Test Borings, Inc.

File No. 35024-001
Sheet No. 1 of 1
Start 15 August 2008
Finish 15 August 2008
Driller D. McKeen
H&A Rep. E. Beirne
Elevation 70.5
Datum NGVD 29
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	S	--	Rig Make & Model: Mobile B53
Inside Diameter (in.)	3.0	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	-	140	-	Drill Mud: None
Hammer Fall (in.)	-	30	-	Casing: HSA Spun to 13.0 ft
				Hoist/Hammer: Winch Safety Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0				0.3	SM	-BITUMINOUS PAVEMENT-										
	10 12 21 8	S1 15	0.5 2.5		SM	Dense, brown, silty SAND with gravel (SM), mps 2.0 in., no structure, no odor, moist -FILL-	15	10	5	25	25	20				
	8 4 2 2	S2 24	2.5 4.5	2.5	SM	Loose, brown, silty SAND with gravel (SM), mps 1.0 in., no odor, wet -GLACIAL TILL-	5	10	5	15	30	35				
5	2 1 4 9	S3 5	5.0 7.0		SM	Loose, brown, silty SAND with gravel (SM), mps 2.0 in., no odor, wet	5		10	30	40	15				
	10 8 4 3	S4 24	7.0 9.0	7.3	SM	Medium dense, gray-brown, silty SAND with gravel (SM), mps 1.25 in., no structure, no odor, wet, occasional lean clay layers	5	15	5	15	25	35				
10	4 9 12 18	S5 18	9.0 11.0		SM/CL	Medium dense, gray-brown, silty SAND with gravel to sandy lean CLAY with gravel (SM/CL), mps 2.0 in., no structure to somewhat bonded, no odor, wet -GLACIAL TILL-	5	10	5	15	25	40				
	8 8 8 50/0.3	S6 20	11.0 12.8		SM	Medium dense, gray-brown to gray, silty SAND (SM), mps 0.5 in., bonded, no odor, wet		5	5	15	25	50				
				12.8		Split spoon refusal at 12.8 ft., auger refusal at 13.0 ft. BOTTOM OF EXPLORATION, auger refusal on probable bedrock										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
8/15/08	0815	0.1	13.0	13.0	dry
8/15/08	0840	0.4	-	4.5	dry

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 13.0
Rock Cored (ft)
Samples 6S
Boring No. HA08-113

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

*Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 HA-LIB07-1R-POR-06-03-08.GLB HA-TB+CORE+WELL-07-1.GDT G:\PROJECTS\35024\EXPLORATIONS\001\35024-001.GPJ 29 Aug 08

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA08-114

Project Jetport Terminal Exansion, Portland, Maine
Client Gensler
Contractor Maine Test Borings, Inc.

File No. 35024-001
Sheet No. 1 of 1
Start 15 August 2008
Finish 15 August 2008
Driller D. McKeen
H&A Rep. E. Beirne
Elevation 67
Datum NGVD 29
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	S	--	Rig Make & Model: Mobile B53
Inside Diameter (in.)	3.0	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	-	140	-	Drill Mud: None
Hammer Fall (in.)	-	30	-	Casing: HSA Spun to 17.7
				Hoist/Hammer: Winch Safety Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0				0.3		-BITUMINOUS PAVEMENT-										
	8 8 8 9	S1 12	0.5 2.5		SW-SM	Medium dense, brown, well-graded SAND with silt and gravel (SW-SM), mps 1.5 in., no structure, no odor, moist -FILL-	10	15	5	25	35	10				
				2.4	CL	Very stiff, olive-brown, lean CLAY with sand (CL), mps 2 mm, no structure, no odor, moist -GLACIOMARINE DEPOSIT-					20	80				
5	4 7 8 8	S2 19	5.0 7.0		CL	Very stiff, olive-brown, lean CLAY with sand (CL), mps 2 mm, blocky, no odor, moist to wet, occasional fine sand layers -GLACIOMARINE DEPOSIT-					20	80				
10	1 1 2 4	S3 24	10.0 12.0		CL	Medium stiff, olive-brown, sandy lean CLAY (CL), mps 2 mm, no structure, no odor, wet, frequent sand layers below 11.0 ft. -GLACIOMARINE DEPOSIT-				5	25	70				
15	1 1 2 1	S4 14	15.0 17.0	15.0	SM	Very loose, brown, silty SAND with gravel (SM), mps 1.25 in., no structure, no odor, wet -GLACIAL TILL-	5	10	5	20	25	35				
				17.7		Note: Driller noted top of bedrock at 17.5 ft BOTTOM OF EXPLORATION, Auger refusal at 17.7 ft.										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
8/15/08	0945	0.1	17.7	17.7	15.0
8/15/08	0955	0.2	-	12.5	11.5

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 17.7
Rock Cored (ft)
Samples 4S
Boring No. HA08-114

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Plasticity**: N - Nonplastic L - Low M - Medium H - High
Toughness: L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

*Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 HA-LIB07-1R-POR-08-03-08.GLB HA-TB+CORE+WELL-07-1.GDT G:\PROJECTS\35024\EXPLORATIONS\001\35024-001.GPJ 29 Aug 08

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA08-201

Project Jetport Terminal Expansion, Portland, Maine
Client Gensler
Contractor Maine Test Borings, Inc.

File No. 35024-001
Sheet No. 1 of 1
Start 24 September 2008
Finish 24 September 2008
Driller D. McKeen
H&A Rep. E. Beirne
Elevation 79 (est.)
Datum NGVD 29
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	S	--	Rig Make & Model: Mobile B47 ATV
Inside Diameter (in.)	2.5	1 3/8	--	Bit Type: Cutting Head
Hammer Weight (lb)	-	140	-	Drill Mud: None
Hammer Fall (in.)	-	30	-	Casing: HSA Spun to 8.0 ft.
				Hoist/Hammer: Winch Safety Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	1	S1	0.0	0.2	OL/OH	Soft, dark brown, ORGANIC SOIL (OL/OH), mps 2.0 mm, no structure, organic odor, moist					5	95				
	WOH	17	2.0								10	90				
	2			1.2	ML	-FOREST MAT/TOPSOIL-										
	7				SM	Soft, dark brown to black, SILT (ML), mps 2.0 mm, no structure, organic odor, moist				10	55	35				
				2.5	CL	-FOREST MAT/TOPSOIL-					10	90				
						Loose, gray-brown, silty SAND (SM), mps 4.0 mm, no structure, no odor, moist, coarser with depth										
						-GLACIOMARINE DEPOSIT-										
	7	S2	4.0			NOTE: Augered through small obstruction at 2.2 ft.										
	8	24	6.0			Very stiff, olive-brown to gray, lean CLAY (CL), mps 0.42 mm, blocky, no odor, moist, somewhat mottled										
5	10					-GLACIOMARINE DEPOSIT-										
	12															
	9	S3	6.0		CL	Very stiff, gray, lean CLAY with sand (CL), mps 0.42 mm, blocky, no odor, moist, occasional fine sand layers					20	80				
	10	20	8.0			-GLACIOMARINE DEPOSIT-										
	9															
	8															
	2	S4	8.0		CL	Stiff, gray, lean CLAY with sand (CL), mps 2.0 mm, no odor, moist to wet				5	10	85				
	3	18	10.0			-GLACIOMARINE DEPOSIT-										
	21			9.0	CL	Very stiff, gray, sandy lean CLAY with gravel (CL), mps 2.0 in., no structure to somewhat bonded, no odor, moist, sand and gravel for last 0.2 ft of spoon	5	10	5	10	15	55				
	7					-GLACIAL TILL-										
10				10.0		BOTTOM OF EXPLORATION, no refusal encountered										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
9/24/08	0850	0.1	8.0	9.5	dry
9/24/08	0915	0.3	-	7.6	7.5

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 10
Rock Cored (ft) -
Samples 4S
Boring No. HA08-201

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

*Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 HA-LIB07-1R-POR-06-03-08.GLB HA-TB+CORE+WELL-07-1.GDT G:\PROJECTS\35024\EXPLORATIONS\001\35024-001-200 SERIES.GPJ 13 Oct 08

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA08-202

Project Jetport Terminal Expansion, Portland, Maine
Client Gensler
Contractor Maine Test Borings, Inc.

File No. 35024-001
Sheet No. 1 of 1
Start 24 September 2008
Finish 24 September 2008
Driller D. McKeen
H&A Rep. E. Beirne
Elevation 77 (est.)
Datum NGVD 29
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	S	--	Rig Make & Model: Mobile B47 ATV
Inside Diameter (in.)	2.5	1 3/8	--	Bit Type: Cutting Head
Hammer Weight (lb)	-	140	-	Drill Mud: None
Hammer Fall (in.)	-	30	-	Casing: HSA Spun to 4.0 ft
				Hoist/Hammer: Winch Safety Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	2 10 10 11	S1 19	0.0 2.0	0.2	SM SM	Medium dense, light brown, silty SAND (SM), mps 4.0 mm, no structure, no odor, moist, roots to 0.3 ft -TOPSOIL-		10	10	20 20	45 35	35 25				
	31 20 14 11	S2 20	2.0 4.0		SM	Medium dense, gray-brown, silty SAND (SM), mps 0.5 in., no structure to somewhat bonded, no odor, moist -GLACIAL TILL- Dense, gray-brown, silty SAND (SM), mps 0.5 in., no structure to somewhat bonded, no odor, moist, occasional poorly graded sand layers		10	5	20	35	30				
5	8 7 6 8	S3 18	4.0 6.0	4.0	SC	Medium dense, gray, clayey SAND with gravel (SC), mps 1.5 in., somewhat bonded, no odor, moist -GLACIAL TILL-	10	10	5	20	30	25				
				6.0		BOTTOM OF EXPLORATION, no refusal encountered										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
9/24/08	0750	0.1	-	5.0	dry

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 6
Rock Cored (ft) -
Samples 3S
Boring No. HA08-202

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Plasticity**: N - Nonplastic L - Low M - Medium H - High
Toughness: L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

*Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 HA-LIB07-1R-POR-06-03-08.GLB HA-TB+CORE+WELL-07-1.GDT G:\PROJECTS\35024\EXPLORATIONS\001\35024-001-200 SERIES.GPJ 1 Oct 08

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA08-203

Project Jetport Terminal Expansion, Portland, Maine
Client Gensler
Contractor Maine Test Borings, Inc.

File No. 35024-001
Sheet No. 1 of 1
Start 24 September 2008
Finish 24 September 2008
Driller D. McKeen
H&A Rep. E. Beirne
Elevation 73 (est.)
Datum NGVD 29
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	S	--	Rig Make & Model: Mobile B47 ATV
Inside Diameter (in.)	2.5	1 3/8	--	Bit Type: Cutting Head
Hammer Weight (lb)	-	140	-	Drill Mud: None
Hammer Fall (in.)	-	30	-	Casing: HSA Spun to 15.0 ft
				Hoist/Hammer: Winch Safety Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	2 2 3 5	S1 13	0.0 2.0	0.4	ML	Medium stiff, brown, sandy SILT (ML), mps 0.25 in., no structure, organic odor, dry, 30% organics, roots to 2.0 ft -TOPSOIL-			5	15	20	60				
5	5 7 9 10	S2 19	5.0 7.0		ML	Very stiff, brown to gray-brown, SILT with sand (ML), mps 2.0 mm, blocky, no odor, moist, lean CLAY content below 6.6 ft, wet sand seam at 6.6 ft -GLACIOMARINE DEPOSIT-					15	85				
	3 2 2 3	S3 24	8.0 10.0	8.0	CL	Stiff, gray-brown, lean CLAY with sand (CL), mps 4.0 mm, somewhat blocky, no odor, moist to wet, occasional sand layers -GLACIOMARINE DEPOSIT-					25	75				
10	1 1 2 1	S4 24	10.0 12.0		CL	Medium stiff to stiff, gray-brown, lean CLAY with sand (CL), mps 0.42 mm, no odor, moist to wet, occasional sand layers -GLACIOMARINE DEPOSIT-					20	80				
				11.1	CL	Medium stiff to stiff, gray, sandy lean CLAY (CL), mps 4.0 mm, no odor, wet			5	10	20	60				
	3 2 2 2	S5 24	12.0 14.0	12.0	SC	Loose, gray, clayey SAND with gravel (SC), mps 1.5 in., no structure to somewhat bonded, no odor, wet -GLACIAL TILL-	5	10	5	15	35	30				
15	2 1 2 3	S6 24	15.0 17.0		SC	Loose, gray, clayey SAND (SC), mps 0.5 in., no structure to somewhat bonded, no odor, wet, terminating in poorly graded medium to fine sand -GLACIAL TILL-		10	5	15	45	25				
				17.0		BOTTOM OF EXPLORATION, no refusal encountered										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
9/24/08	1145	0.5	-	12.6	11.3
9/24/08	1305	1.0	-	12.3	8.5

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 17
Rock Cored (ft) -
Samples 6S

Boring No. HA08-203

Field Tests: **Dilatancy:** R - Rapid S - Slow N - None **Toughness:** L - Low M - Medium H - High **Plasticity:** N - Nonplastic L - Low M - Medium H - High **Dry Strength:** N - None L - Low M - Medium H - High V - Very High

*Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 HA-LIB07-1R-POR-06-03-08.GLB HA-TB+CORE+WELL-07-1.GDT G:\PROJECTS\35024\EXPLORATIONS\001\35024-001-200 SERIES.GPJ 1 Oct 08

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA08-204

Project Jetport Terminal Expansion, Portland, Maine
Client Gensler
Contractor Maine Test Borings, Inc.

File No. 35024-001
Sheet No. 1 of 1
Start 24 September 2008
Finish 24 September 2008
Driller D. McKeen
H&A Rep. E. Beirne
Elevation 67.5(est.)
Datum NGVD 29
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	NW	S	--	Rig Make & Model: Mobile B47 ATV
Inside Diameter (in.)	3.0	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	300	140	-	Drill Mud: None
Hammer Fall (in.)	16	30	-	Casing: NW Drive to 10.0 ft
				Hoist/Hammer: Winch Safety Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0						3.5 in. bituminous concrete										
	8 9 5 5	S1 15	0.5 2.5	0.3	SP	Medium dense, brown, poorly graded SAND with gravel (SP), mps 2.0 in., no structure, no odor, moist	10	10	10	25	45					
				1.5	CL	-FILL- Stiff, olive-brown, lean CLAY (CL), mps 2.0 mm, blocky, no odor, moist -GLACIOMARINE DEPOSIT-					5	95				
5	4 8 10 13	S2 20	5.0 7.0		CL	Very stiff, olive-brown, lean CLAY (CL), mps 0.42 mm, blocky, no odor, moist, black organic staining on partings -GLACIOMARINE DEPOSIT-					10	90				
	3 5 5 4	S3 24	8.0 10.0		CL	Stiff, olive-brown to gray, lean CLAY (CL), mps 2.0 mm, blocky, no odor, wet, occasional sand seams -GLACIOMARINE DEPOSIT-					10	90				
10	1 2 4 5	S4 24	10.0 12.0		CL	Stiff, gray, lean CLAY with sand (CL), mps 0.5 in., no odor, wet -GLACIOMARINE DEPOSIT-				5	10	85				
				11.0	CL/SC	Stiff, brown, sandy lean CLAY interbedded with clayey SAND (CL/SC), mps 1.0 in., no odor, wet -GLACIAL TILL-		5	5	15	35	40				
	2 4 5 2	S5 22	12.0 14.0	13.1	SM	Loose, brown, silty SAND with gravel (SM), mps 1.5 in., somewhat bonded, no odor, wet	5	10	10	20	30	25				
15	2 1 6 22	S6 19	14.0 16.0		SM	-GLACIAL TILL- Loose, brown, silty SAND with gravel (SM), mps 1.5 in., somewhat bonded, no odor, wet -GLACIAL TILL-	10	15	10	25	25	15				
	40 50/0.0	S7 3	16.0 16.5	16.0		Weathered Rock										
				17.0		NOTE: Advanced roller cone to 17.0 ft to confirm bedrock. BOTTOM OF EXPLORATION, refusal on probable bedrock										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
9/24/08	1630	0.1	-	15.2	6.8

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 17
Rock Cored (ft) -
Samples 7S
Boring No. HA08-204

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

*Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA08-205

Project Jetport Terminal Expansion, Portland, Maine
Client Gensler
Contractor Maine Test Borings, Inc.

File No. 35024-001
Sheet No. 1 of 1
Start 25 September 2008
Finish 25 September 2008
Driller D. McKeen
H&A Rep. E. Beirne
Elevation 65 (est.)
Datum NGVD 29
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	NW	S	--	Rig Make & Model: Mobile B47 ATV
Inside Diameter (in.)	3.0	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	300	140	-	Drill Mud: None
Hammer Fall (in.)	16	30	-	Casing: NW Drive to 14.0
				Hoist/Hammer: Winch Safety Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0				0.3		4 in. bituminous concrete										
	17 25 33 36	S1 0	0.5 2.5		SP	Very dense, brown, poorly graded SAND with gravel (SP), mps 2.0 in., no structure, no odor, moist, finer with depth -FILL- NOTE: Lost spoon shoe attempting first sample, sampled from auger cuttings.	10	10	10	25	40	5				-
				4.0												
5	16 18 18 18	S2 20	5.0 7.0		SM	Dense, brown, silty SAND with gravel (SM), mps 1.25 in., somewhat bonded, no odor, moist -GLACIAL TILL-	5	15	10	20	30	20				
	19 13 14 14	S3 11	8.0 10.0		SM	Dense, brown, silty SAND with gravel (SM), mps 2.0 in., somewhat bonded, no odor, wet -GLACIAL TILL-	15	10	10	20	25	20				
10	15 4 4 11	S4 14	10.0 12.0	10.5	SM SC	Dense, brown, silty SAND with gravel (SM), mps 2.0 in., somewhat bonded, no odor, wet Loose to medium dense, gray, clayey SAND (SC), mps 0.5 in., somewhat bonded, no odor, wet -GLACIAL TILL-		5	10	30	25	30				
	7 13 20 19	S5 17	12.0 14.0		SC	Dense, gray, clayey SAND with gravel (SC), mps 1.75 in., bonded, no odor, wet, bands of orange oxidized material throughout -GLACIAL TILL-	15	10	10	25	25	15				
15	9 11 14 26	S6 8	14.0 16.0		SC	Medium dense, gray, clayey SAND with gravel (SC), mps 2.0 in., bonded, no odor, wet	20	10	10	25	20	15				
				15.7	GP	Medium dense, gray, poorly graded GRAVEL with sand (GP), mps 2.0 in., no structure, no odor, wet -GLACIAL TILL-	50	20	10	10	10					
	50/0.4	S7 1	16.0 16.4	16.3												
				17.0		Weathered rock in tip of spoon NOTE: Roller cone ahead to 17.0 ft to confirm bedrock. BOTTOM OF EXPLORATION, refusal on probable bedrock										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
9/25/08	1035	0.2	-	9.0	7.7

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 17
Rock Cored (ft) -
Samples 7S
Boring No. HA08-205

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

*Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA08-206

Project Jetport Terminal Expansion, Portland, Maine
Client Gensler
Contractor Maine Test Borings, Inc.

File No. 35024-001
Sheet No. 1 of 1
Start 24 September 2008
Finish 25 September 2008
Driller D. McKeen
H&A Rep. E. Beirne
Elevation 64 (est.)
Datum NGVD 29
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	NW	S	--	Rig Make & Model: Mobile B47 ATV
Inside Diameter (in.)	3.0	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	300	140	-	Drill Mud: None
Hammer Fall (in.)	16	30	-	Casing: NW Drive to 15.0
				Hoist/Hammer: Winch Safety Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0				0.3		3.5 in. bituminous concrete										
	8 18 9 5	S1 5	0.5 2.5		SP	Medium dense, brown, poorly graded SAND with gravel (SP), mps 1.5 in., no structure, no odor, moist -FILL-	15	10	10	25	40					
5	10 12 11 13	S2 16	5.0 7.0		SP	Medium dense, brown, poorly graded SAND with gravel (SP), mps 2.0 in., no structure, no odor, moist -FILL (?)-	10	10	5	20	50	5				
	5 7 7 8	S3 15	7.0 9.0		SP	Medium dense, dark brown, poorly graded SAND with gravel (SP), mps 1.5 in., no structure, no odor, wet -FILL (?)-	10	15	10	20	40	5				
10	8 9 4 2	S4 2	9.0 11.0	10.0	SC	Medium dense, gray, clayey SAND with gravel (SC), mps 1.0 in., somewhat bonded, no odor, wet -GLACIAL TILL-	5	10	5	20	35	25				
	3 3 4 7	S5 2	11.0 13.0		SP-SC	Loose, gray, poorly graded SAND with clay and gravel (SP-SC), mps 1.0 in., somewhat bonded, no odor, wet -GLACIAL TILL-	5	15	5	25	40	10				
	7 6 5 5	S6 0	13.0 15.0			No Recovery										
15	11 50/0.4	S7 8	15.0 15.9	15.9	SC	Very dense, gray, clayey SAND with gravel (SC), mps 1.75 in., bonded, no odor, wet -GLACIAL TILL-	15	10	5	20	25	25				
						NOTE: Advance roller cone to 18.0 ft to confirm bedrock.										
				18.0		BOTTOM OF EXPLORATION NOTE: Encountered bedrock much softer than HA08-204 and HA08-205; however, chips are consistent in appearance from 15.9-18.0 ft.										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
9/25/08	0740	0.1	-	7.5	5.5

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 18
Rock Cored (ft) -
Samples 7S

Boring No. HA08-206

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Plasticity**: N - Nonplastic L - Low M - Medium H - High
Toughness: L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

*Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

APPENDIX B

Previous Test Boring Logs

CLIENT: HALEY & ALDRICH, INC.

SHEET 1 OF 1

HOLE NO. B-1

DRILLER: MEL COFFIN

PROJECT NAME: PROPOSED GARAGE & MASTER PLAN PORTLAND

LINE & STATION:

M.T.B. JOB NUMBER: 00-121

LOCATION: PORTLAND, MAINE

OFFSET:

GROUND WATER OBSERVATIONS

AT FT. AFTER HOURS

AT FT. AFTER HOURS

	HSA	SS
TYPE		
SIZE I.D.	2 1/2"	1 3/8"
HAMMER WT.		140
HAMMER FALL		30"

DATE START: 05/22/00 DATE FINISH: 05/22/00

SURFACE ELEVATION: 63.5

SAMPLE			BLOWS PER 6" ON SAMPLER					
1D	2"	24"	4.0	2	2	3	4	
2D	2"	24"	7.0	1	1	1	1	
3D	2"	24"	12.0	2	10	9	7	
4D	2"	24"	17.0	6	19	19	25	

0.2	TAR
2.0	BROWN SILTY SAND -FILL-
5.5	BROWN MOTTLED SILTY CLAY -MARINE DEPOSIT-
10.0	GRAY SILTY CLAY -MARINE DEPOSIT-
18.4	GRAY SILTY SAND & GRAVEL -GLACIAL TILL-
	REFUSAL @ 18.4'

SAMPLES
S = SPLIT SPOON
C = 2" SHELBY TUBE
S = 3" SHELBY TUBE
P = 3½" SHELBY TUBE

SOIL CLASSIFIED BY:
[XX] DRILLER-VISUALLY
[ ] SOIL TECHNICIAN-VISUALLY
[ ] LABORATORY TESTS

REMARKS:
- WATER @ 12.0' INSIDE AUGERS
OPEN HOLE CAVED & DRY @ 5.5'

COMMENTS BY HALEY + ALDRICH, INC.

HOLE NO. B-1

	CLIENT HALEY & ALDRICH, INC.	SHEET 1 OF 1 HOLE NO. B-26
LER MARK GUNNING	PROJECT NAME PROPOSED GARAGE & MASTER PLAN PORTLAND	LINE & STATION
M.T.B. JOB NUMBER 00-121	LOCATION PORTLAND, MAINE	OFFSET
GROUND WATER OBSERVATIONS AT FT. AFTER HOURS AT FT. AFTER HOURS	TYPE / SIZE I.D. / HAMMER WT. / HAMMER FALL BW: 2 3/8", 300, 16" SS: 1 3/8", 140, 30"	DATE START 06/13/00 DATE FINISH 06/13/00 SURFACE ELEVATION 62.9

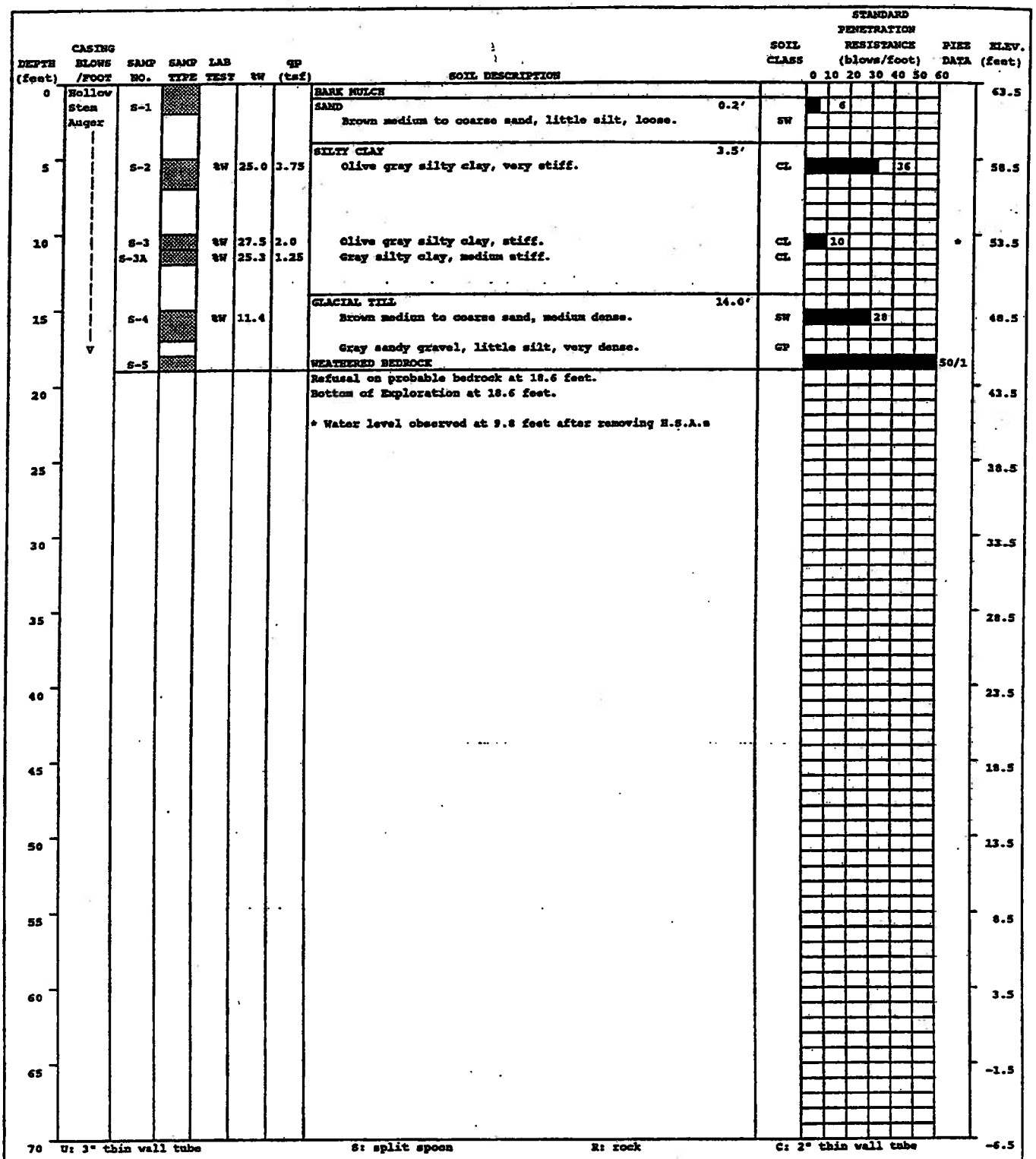
SAMPLE			BLOWS PER 6" ON SAMPLER						
1D	2"	18"		1.9	16*	23*	17*	0.35	TAR
2D	2"	18"		6.5	7	6	13		BROWN SILTY GRAVELY SAND -FILL-
								9.5	
3D	2"	18"		10.0	9	20	24	10.0	3 LOOSE F-C GRAVELLY SAND -GLACIAL TILL-
									BOTTOM OF BORING @ 10.0'
									* HAMMER DROP LESS THAN 30".
									BORING DRILLED WITH TRUCK RIG EQUIPMENT.

SAMPLES
- SPLIT SPOON
- 2" SHELBY TUBE
- S = 3" SHELBY TUBE
- P = 3½" SHELBY TUBE

SOIL CLASSIFIED BY:
- [XX] DRILLER-VISUALLY
- [ ] SOIL TECHNICIAN-VISUALLY
- [ ] LABORATORY TESTS

REMARKS:
3:50 PM WATER @ 5.6' W/NO CASING
COMMENTS BY HALEY & ALDRICH, ENG.

HOLE NO. B-26

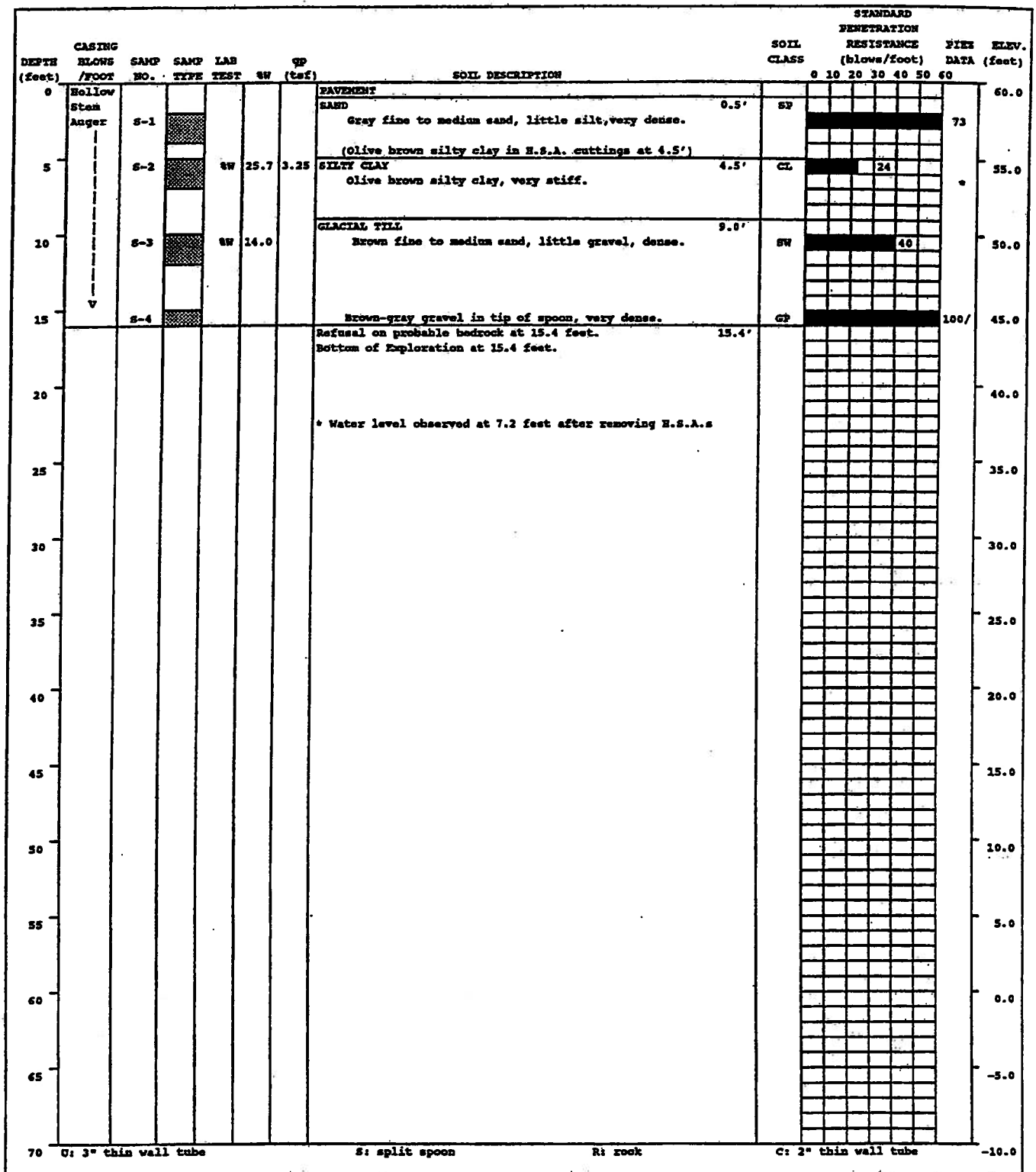


JETPORT TERMINAL EXPANSION
PORTLAND, MAINE
CITY OF PORTLAND

NORTHROP, DEVINE & TARBELL, INC.

BORING B93-1

Project No.:	Date Drilled:	Logged by:
93-569-00	11/29/93	M. Napoleone

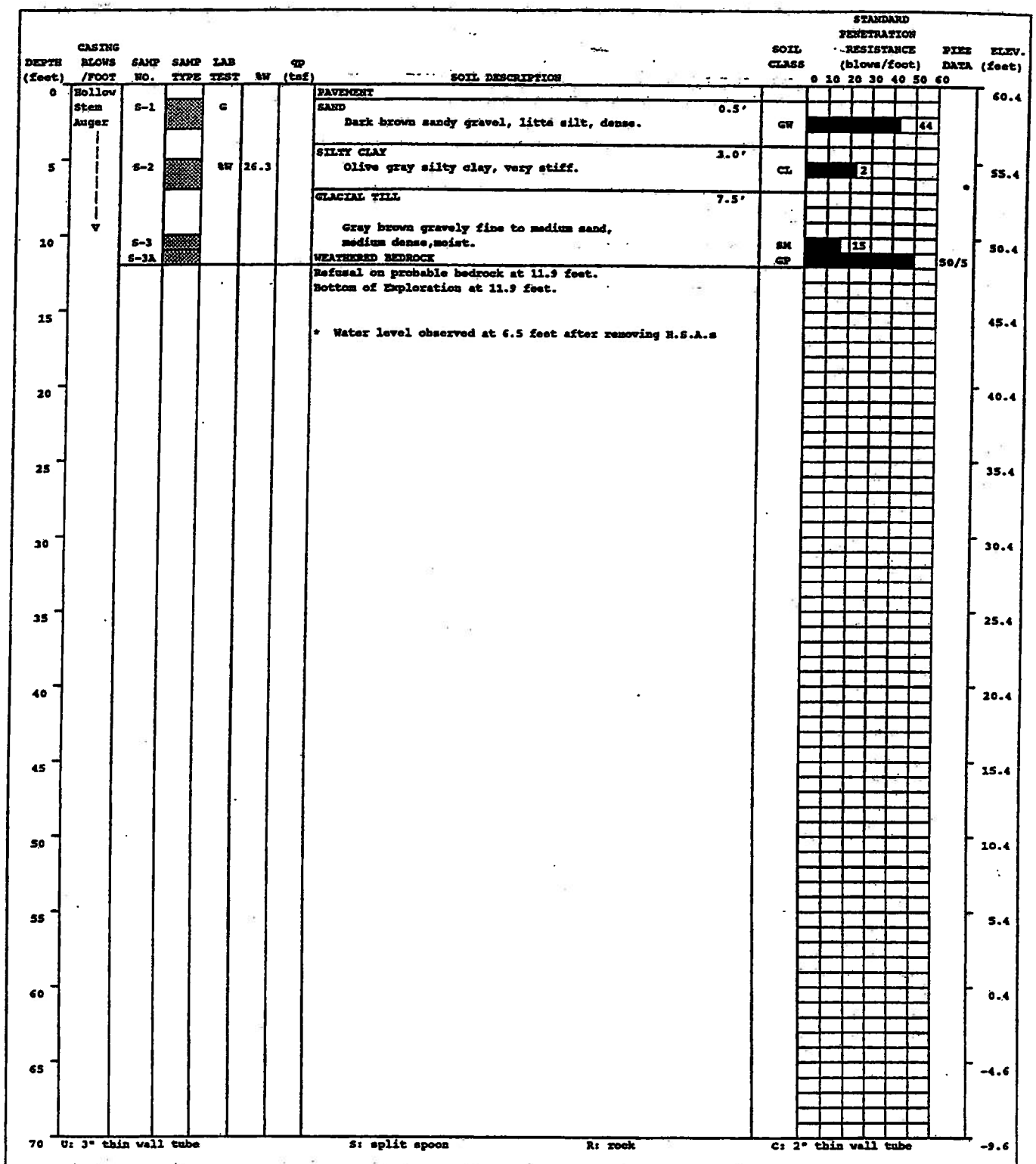


JETPORT TERMINAL EXPANSION
PORTLAND, MAINE
CITY OF PORTLAND

NORTHROP, DEVINE & TARBELL, INC.

BORING B93-4

Project No.:	Date Drilled:	Logged by:
93-569-00	11/23/93	C. Karam

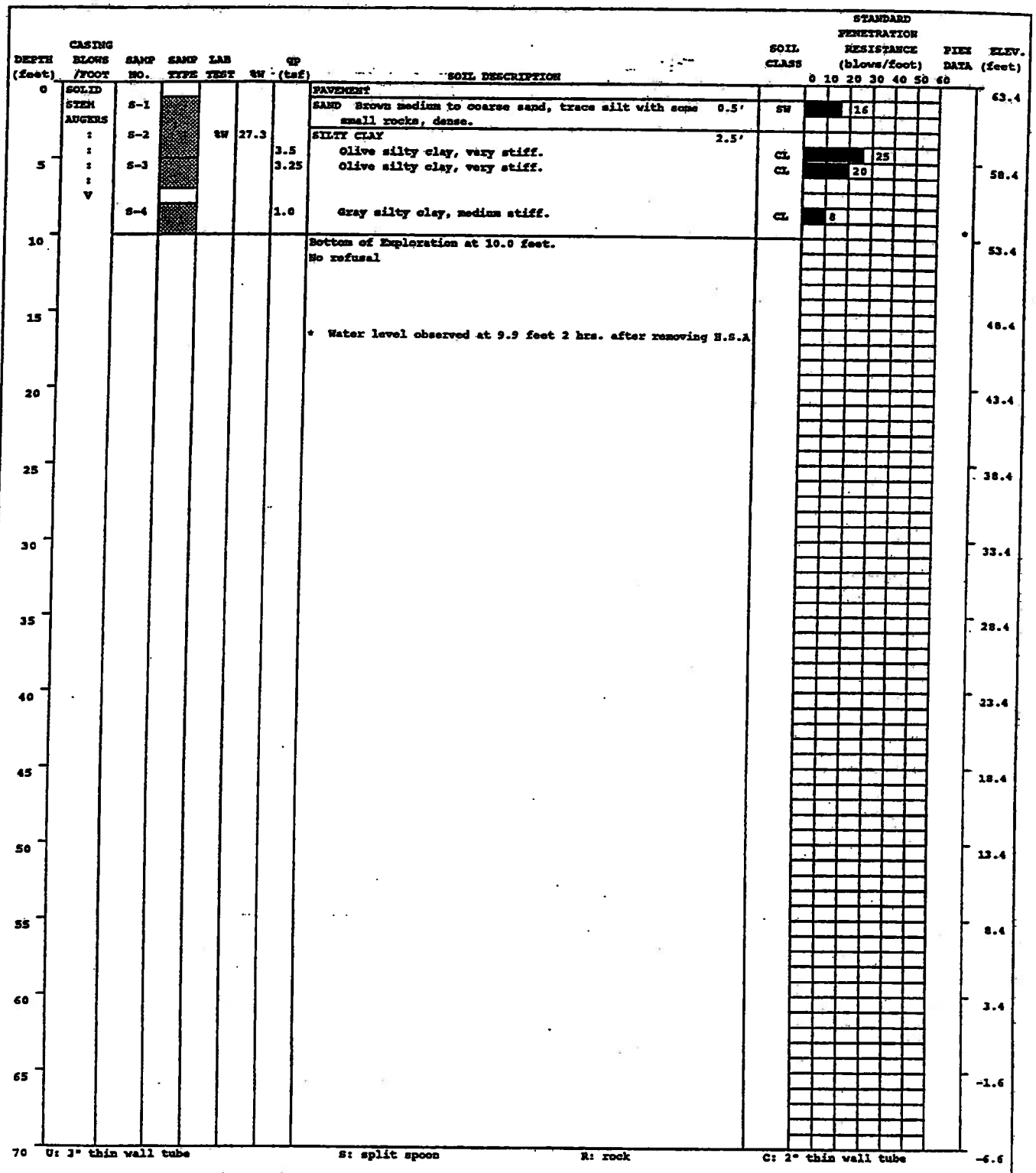


JETPORT TERMINAL EXPANSION
PORTLAND, MAINE
CITY OF PORTLAND

NORTHROP, DEVINE & TARBELL, INC.

BORING B93-6

Project No.:	Date Drilled:	Logged by:
93-569-00	11/29/93	M. Napoleone

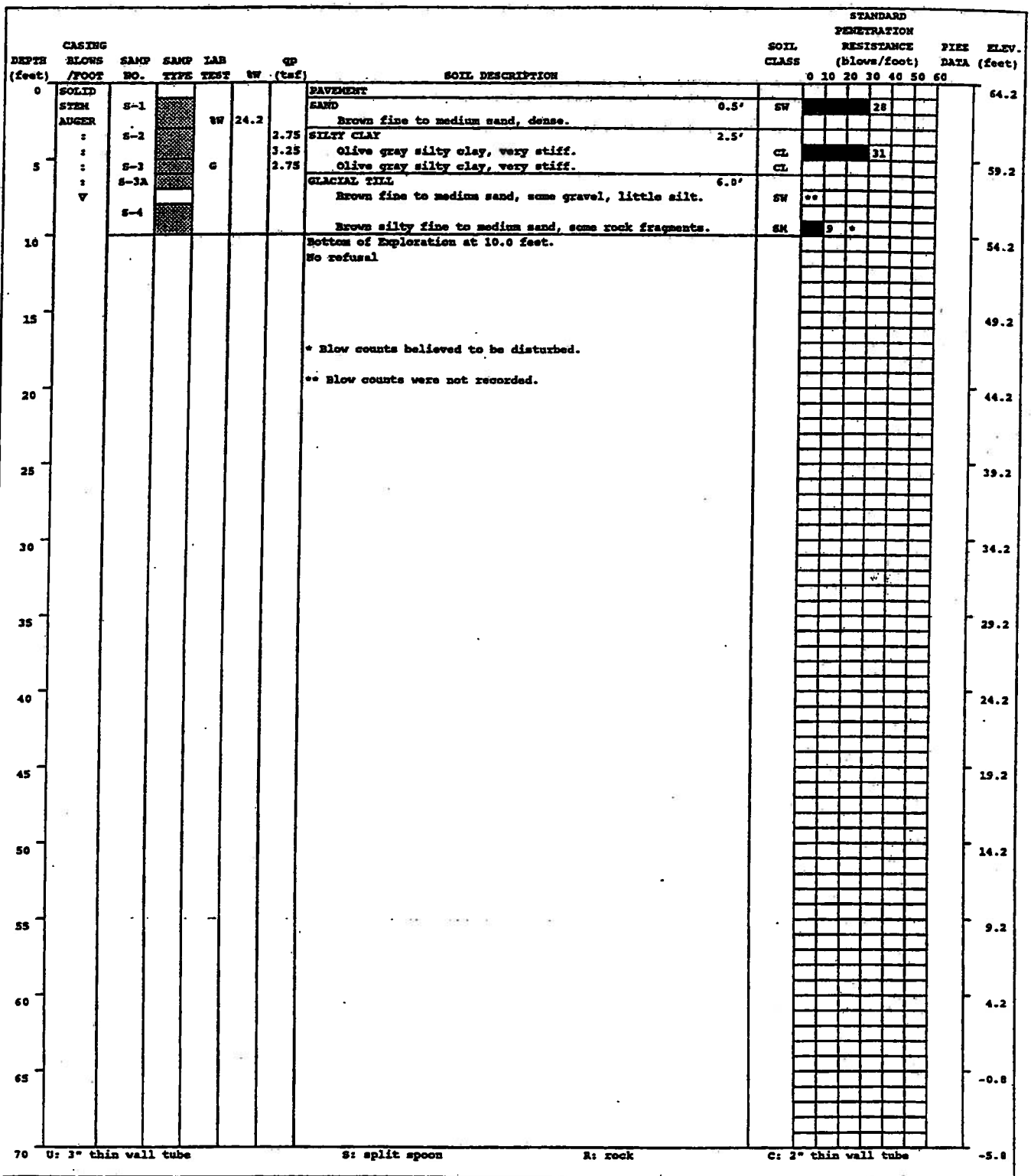


JETPORT TERMINAL EXPANSION
PORTLAND, MAINE
CITY OF PORTLAND

NORTHROP, DEVINE & TARBELL, INC.

BORING B93-8

Project No.:	Date Drilled:	Logged by:
93-569-00	11/29/93	M. Napoleone

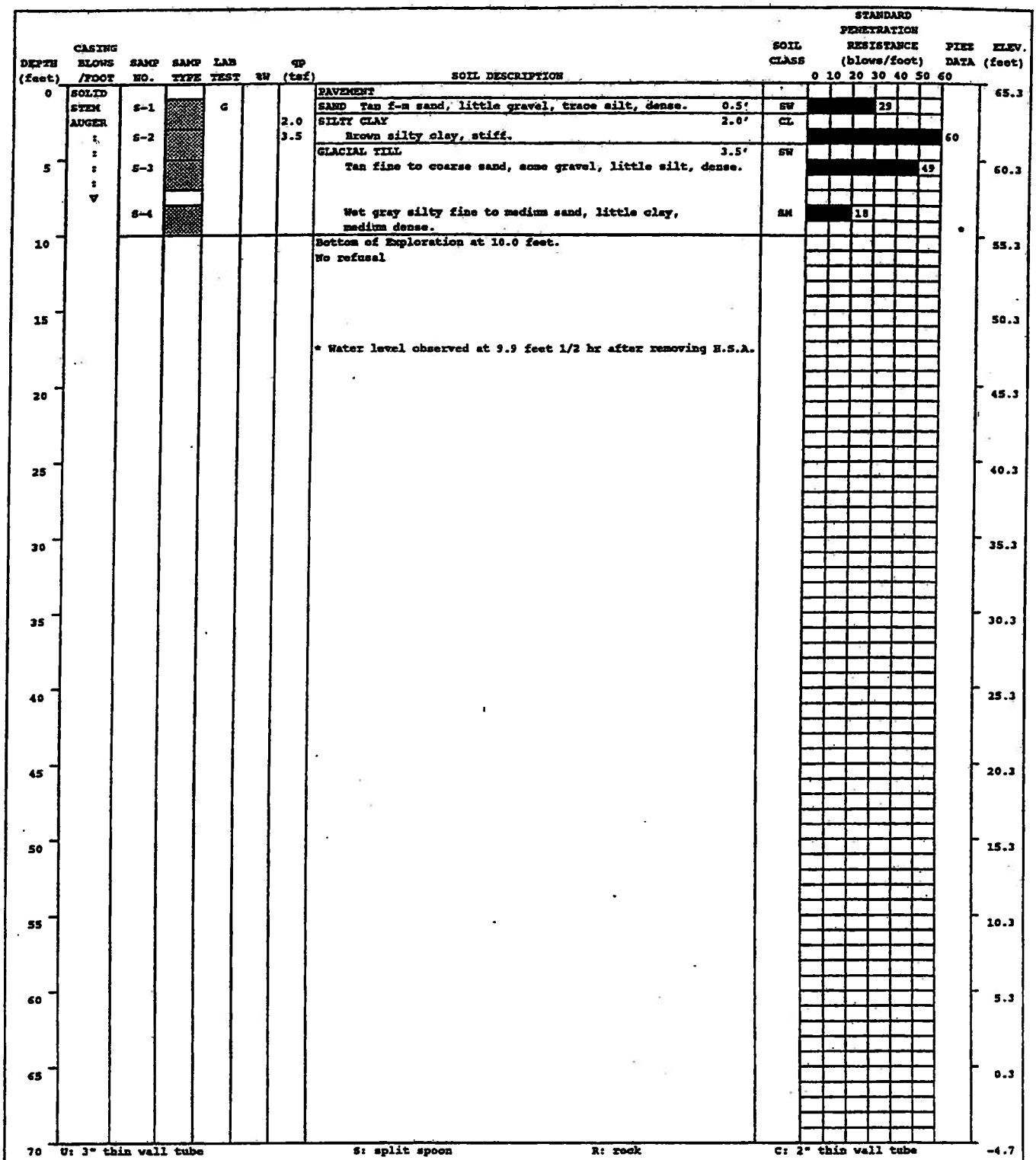


JETPORT TERMINAL EXPANSION
PORTLAND, MAINE
CITY OF PORTLAND

NORTHROP, DEVINE & TARBELL, INC.

BORING B93-9

Project No.:	Date Drilled:	Logged by:
93-569-00	11/29/93	M. Napoleone



JETPORT TERMINAL EXPANSION
PORTLAND, MAINE
CITY OF PORTLAND

NORTHROP, DEVINE & TARBELL, INC.

BORING B93-10

Project No.:	Date Drilled:	Logged by:
93-569-00	11/29/93	M. Napoleone

APPENDIX C

Observation Well Installation and Groundwater Monitoring Reports

HALEY & ALDRICH

OBSERVATION WELL INSTALLATION REPORT

Well No. HA08-7(OW)

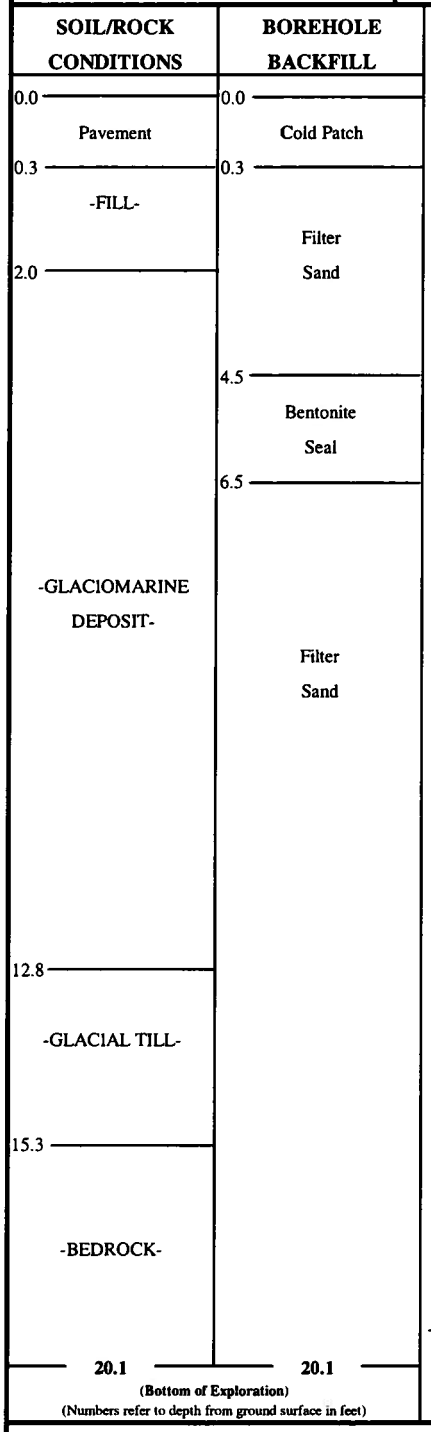
Boring No. HA08-7(OW)

PROJECT	Portland International Jetport Terminal Expansion	H&A FILE NO.	35024-000
LOCATION	Portland, Maine	PROJECT MGR.	A. Blaisdell
CLIENT	Gensler	FIELD REP.	D. Dearden
CONTRACTOR	Maine Test Borings, Inc.	DATE INSTALLED	6/16/2008
DRILLER	A. Francis	WATER LEVEL	

Ground El. 67.5 +/- ft
El. Datum NGVD 29

Location See Plan

☐ Guard Pipe
☑ Roadway Box



Type of protective cover/lock	Steel cover with 0.5 in. bolts
Depth of top of roadway box below ground surface	0.0 ft
Depth of top of riser pipe below ground surface	0.1 ft
Type of protective casing:	Roadway Box
Length	0.8 ft
Inside Diameter	6.0 in
Depth of bottom of guard pipe/roadway box	0.8 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Cold Patch	0.0	0.3
Bentonite Seal	4.5	2.0

Type of riser pipe:	Sch. 40 PVC
Inside diameter of riser pipe	2.0 in
Type of backfill around riser	Filter Sand/Bentonite Seal
Diameter of borehole	4.0 in
Depth to top of well screen	10.3 ft
Type of screen	Sch. 40 PVC
Screen gauge or size of openings	0.010 in
Diameter of screen	2.0 in
Type of backfill around screen	Filter Sand
Depth of bottom of well screen	15.3 ft
Bottom of Silt trap	15.4 ft
Depth of bottom of borehole	20.1 ft

10.3 ft	+	5.0 ft	+	0.1 ft	=	15.4 ft
Riser Pay Length (L1)		Length of screen (L2)		Length of silt trap (L3)		Pay length

COMMENTS:

Form 2007

HALEY & ALDRICH

GROUNDWATER MONITORING REPORT

OW/PZ NUMBER
HA08-7 (OW)
Page of

PROJECT	Jetport Terminal Expansion	**H&A FILE NO.**	35024-000
LOCATION	Portland, Maine	**PROJECT MGR.**	A. Blaisdell
CLIENT	Gensler	**FIELD REP.**	E. Beirne
CONTRACTOR	Maine Test Borings, Inc.	**DATE**	6/16/2008
ELEVATION SUBTRAHEND	67.5 ft. +/-		

Date	Time	Elapsed Time (days)	Depth of Water from Ground Surface	Elevation of Water	Remarks	Read By
8/14/2008	17:07	59	8.6	58.9		ECB
8/15/2008	15:56	60	8.6	58.9		ECB
8/25/2008	14:15	70	8.9	58.6		ECB
10/17/2009	17:20	488	8.9	58.7	prior to small rain event	CLH
10/20/2009	9:15	491	8.8	58.7	about 24 hrs after small rain event	CLH

HALEY & ALDRICH

OBSERVATION WELL INSTALLATION REPORT

Well No. HA08-104(OW)

Boring No. HA08-104(OW)

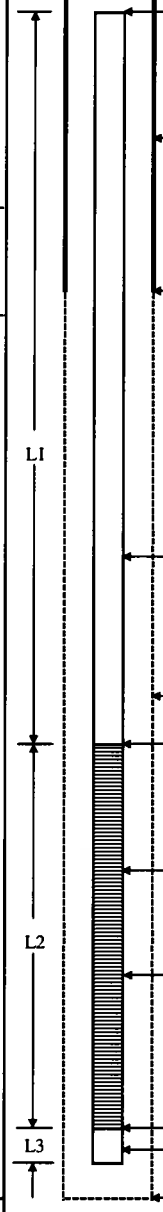
PROJECT	Jetport Terminal Expansion	H&A FILE NO.	35024-001
LOCATION	Portland, Maine	PROJECT MGR.	A. Blaisdell
CLIENT	Gensler	FIELD REP.	E. Beirne
CONTRACTOR	Maine Test Borings, Inc.	DATE INSTALLED	8/13/2008
DRILLER	D. McKeen	WATER LEVEL	7.3

Ground El.	66 ft	Location	See Plan
El. Datum	NGVD 29		

☐ Guard Pipe
☑ Roadway Box

SOIL/ROCK CONDITIONS	BOREHOLE BACKFILL
0.0 -PAVEMENT-	
0.3 -FILL-	Filter Sand
2.0	
5.0 -GLACIOMARINE DEPOSIT-	Bentonite Seal
7.0	
9.0 -GLACIAL TILL-	Filter Sand
17.6 -BEDROCK-	
30.0 (Bottom of Exploration)	30.0

(Numbers refer to depth from ground surface in feet)



(Not to Scale)

Type of protective cover/lock	Steel Roadway Box - 0.5 in. bolts
Height/Depth of top of guard pipe/roadway box above/below ground surface	0.0 ft
Height/Depth of top of riser pipe above/below ground surface	0.23 ft
Type of protective casing:	Steel Roadway Box - 0.5 in. bolts
Length	0.8 ft
Inside Diameter	6.0 in
Depth of bottom of guard pipe/roadway box	0.8 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Bentonite Seal	5.0	2.0

Type of riser pipe:	Sch. 40 PVC
Inside diameter of riser pipe	1.5 in
Type of backfill around riser	Filter Sand/Bentonite Chips
Diameter of borehole	3.0 in
Depth to top of well screen	20.0 ft
Type of screen	Sch. 40 PVC - slotted
Screen gauge or size of openings	0.010 in
Diameter of screen	1.5 in
Type of backfill around screen	Filter Sand
Depth of bottom of well screen	29.8 ft
Bottom of Silt trap	30.0 ft
Depth of bottom of borehole	30.0 ft

20.0 ft	+	9.8 ft	+	0.2 ft	=	30.0 ft
Riser Pay Length (L1)		Length of screen (L2)		Length of silt trap (L3)		Pay length

COMMENTS:

HALEY & ALDRICH

GROUNDWATER MONITORING REPORT

OW/PZ NUMBER
HA08-104 (OW)

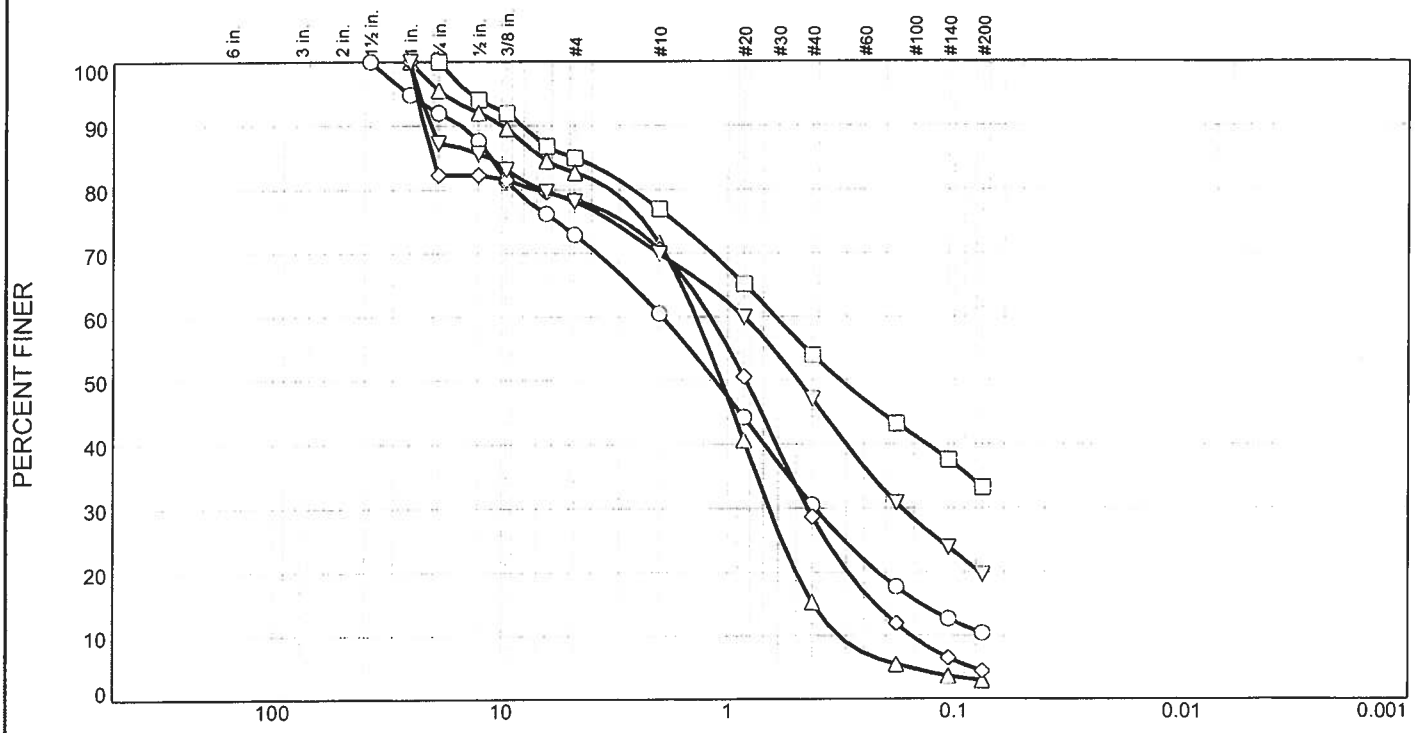
PROJECT	Jetport Terminal Expansion	**H&A FILE NO.**	35024-001
LOCATION	Portland, Maine	**PROJECT MGR.**	A. Blaisdell
CLIENT	Gensler	**FIELD REP.**	E. Beirne
CONTRACTOR	Maine Test Borings, Inc.	**DATE**	8/14/2008
ELEVATION SUBTRAHEND	66.0 ft. +/-		

Date	Time	Elapsed Time (days)	Depth of Water from Ground Surface	Elevation of Water	Remarks	Read By
8/14/2008	16:58	0	5.8	60.2		ECB
8/15/2008	14:23	1	5.8	60.2		ECB
8/25/2008	13:40	11	5.9	60.1		ECB
9/25/2008	10:45	42	9.2	56.8		ECB
10/17/2009	17:15	429	6.3	59.7	prior to small rain event	CLH
10/20/2009	9:10	432	6.4	59.6	about 24 hrs after small rain event	CLH

APPENDIX D

Laboratory Test Reports

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	8.0	19.1	12.4	30.0	20.1	10.4	
□	0.0	0.0	15.0	8.0	23.1	20.7	33.2	
△	0.0	4.5	12.8	11.1	56.4	12.3	2.9	
◇	0.0	17.7	3.9	7.8	41.9	24.3	4.4	
▽	0.0	12.7	9.1	8.3	22.9	27.4	19.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	nv	np	11.1959	1.9396	1.1341	0.4140	0.1399			
□	nv	np	4.7368	0.6199	0.3213					
△			6.6241	1.3790	1.0653	0.6575	0.4209	0.3249	0.96	4.24
◇			20.3195	1.1923	0.8353	0.4454	0.2230	0.1542	1.08	7.73
▽	nv	np	11.3078	0.8521	0.4921	0.1704				

Material Description	USCS	AASHTO
○ poorly graded sand with silt and gravel	SP-SM	A-1-b
□ silty sand with gravel	SM	A-2-4(0)
△ poorly graded sand with gravel	SP	
◇ well-graded sand with gravel	SW	
▽ silty sand with gravel	SM	A-1-b

Project No. 956-07 **Client:** Haley & Aldrich, Inc.

Project: Misc. Testing

○ **Location:** HA08-3 **Depth:** 0.5'0.5'-2.5' **Sample Number:** S-1

□ **Location:** HA08-101 **Depth:** 0.5'-2.5' **Sample Number:** S-1

△ **Location:** HA08-109 **Depth:** 0-2' **Sample Number:** S-1B

◇ **Location:** HA08-112 **Depth:** 0.5'-2.5' **Sample Number:** S-1

▽ **Location:** HA08-113 **Depth:** 0.5'-2.5' **Sample Number:** S-1

R.W. Gillespie & Associates, Inc.

Saco, Maine

Remarks:

○ Moisture content: 5.2%

□ Moisture content: 15.0%

△ Moisture content: 3.6%

◇ Moisture content: 2.5%

▽ Moisture content: 9.1%

Lab No. 10382

Tested By: JJH/DCH **Checked By:** MTG MTG