

REVISIONS	DATE & MARK
ISSUED FOR BID	06/30/2026



SUBJECT TO FEDERAL FUNDING

PROJECT MANUAL

EUGENE AIRPORT

**CONCOURSE A
PASSENGER
BOARDING BRIDGE
UPGRADES**

ISSUED FOR BID

JUNE 30, 2026

EUGENE, OREGON

NOT FOR CONSTRUCTION

SECTION 00 01 07 - SEALS PAGE

1.00 DESIGN PROFESSIONALS OF RECORD IN THE STATE OF OREGON.

1.01 ARCHITECT: MARK IP

- A. License # ARI-14151 .
- B. Responsible for Divisions 02-10 except where indicated or prepared by other design professionals of record.

2.01 CIVIL ENGINEER: DYLAN ANDERSON

- A. License # 96120PE .
- B. Responsible for Divisions 32 AND FAA GENERAL PROVISIONS AND SPECIAL CONDITIONS .

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- B. Responsible for Divisions 06 .

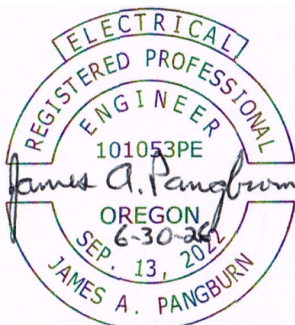
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- B. Responsible for Divisions 26 .

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- B. Responsible for Divisions 28.

END OF SECTION



EXPIRES: 12/31/2026

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SECTION 10 DEFINITION OF TERMS

When the following terms are used in these specifications, in the contract, or in any documents or other instruments pertaining to construction where these specifications govern, the intent and meaning shall be defined as follows:

Paragraph Number	Term	Definition
10-01	AASHTO	The American Association of State Highway and Transportation Officials.
10-02	Access Road	The right-of-way, the roadway and all improvements constructed thereon connecting the airport to a public roadway.
10-03	Advertisement	A public announcement, as required by local law, inviting bids for work to be performed and materials to be furnished.
10-04	Airport	Airport means an area of land or water which is used or intended to be used for the landing and takeoff of aircraft; an appurtenant area used or intended to be used for airport buildings or other airport facilities or rights of way; airport buildings and facilities located in any of these areas, and a heliport.
10-05	Airport Improvement Program (AIP)	A grant-in-aid program, administered by the Federal Aviation Administration (FAA).
10-06	Air Operations Area (AOA)	The term air operations area (AOA) shall mean any area of the airport used or intended to be used for the landing, takeoff, or surface maneuvering of aircraft. An air operation area shall include such paved or unpaved areas that are used or intended to be used for the unobstructed movement of aircraft in addition to its associated runway, taxiway, or apron.
10-07	Apron	Area where aircraft are parked, unloaded or loaded, fueled and/or serviced.
10-08	ASTM International (ASTM)	Formerly known as the American Society for Testing and Materials (ASTM).

Paragraph Number	Term	Definition
10-09	Award	The Owner's notice to the successful bidder of the acceptance of the submitted bid.
10-10	Bidder	Any individual, partnership, firm, or corporation, acting directly or through a duly authorized representative, who submits a proposal for the work contemplated.
10-11	Building Area	An area on the airport to be used, considered, or intended to be used for airport buildings or other airport facilities or rights-of-way together with all airport buildings and facilities located thereon.
10-12	Calendar Day	Every day shown on the calendar.
10-13	Certificate of Analysis (COA)	The COA is the manufacturer's Certificate of Compliance (COC) including all applicable test results required by the specifications.
10-14	Certificate of Compliance (COC)	The manufacturer's certification stating that materials or assemblies furnished fully comply with the requirements of the contract. The certificate shall be signed by the manufacturer's authorized representative.
10-15	Change Order	A written order to the Contractor covering changes in the plans, specifications, or proposal quantities and establishing the basis of payment and contract time adjustment, if any, for work within the scope of the contract and necessary to complete the project.
10-16	Contract	A written agreement between the Owner and the Contractor that establishes the obligations of the parties including but not limited to performance of work, furnishing of labor, equipment and materials and the basis of payment. The awarded contract includes but may not be limited to: Advertisement, Contract form, Proposal, Performance bond, payment bond, General provisions, certifications and representations, Technical Specifications, Plans, Supplemental Provisions, standards incorporated by reference and issued addenda.
10-17	Contract Item (Pay Item)	A specific unit of work for which a price is provided in the contract.
10-18	Contract Time	The number of calendar days or working days, stated in the proposal, allowed for completion of the contract, including authorized time extensions. If a calendar date of completion is stated in the proposal, in lieu of a number of

Paragraph Number	Term	Definition
		calendar or working days, the contract shall be completed by that date.
10-19	Contractor	The individual, partnership, firm, or corporation primarily liable for the acceptable performance of the work contracted and for the payment of all legal debts pertaining to the work who acts directly or through lawful agents or employees to complete the contract work.
10-20	Contractors Quality Control (QC) Facilities	The Contractor's QC facilities in accordance with the Contractor Quality Control Program (CQCP).
10-21	Contractor Quality Control Program (CQCP)	Details the methods and procedures that will be taken to assure that all materials and completed construction required by the contract conform to contract plans, technical specifications and other requirements, whether manufactured by the Contractor, or procured from subcontractors or vendors.
10-22	Control Strip	A demonstration by the Contractor that the materials, equipment, and construction processes results in a product meeting the requirements of the specification.
10-23	Construction Safety and Phasing Plan (CSPP)	The overall plan for safety and phasing of a construction project developed by the airport operator, or developed by the airport operator's consultant and approved by the airport operator. It is included in the invitation for bids and becomes part of the project specifications.
10-24	Drainage System	The system of pipes, ditches, and structures by which surface or subsurface waters are collected and conducted from the airport area.
10-25	Engineer	The individual, partnership, firm, or corporation duly authorized by the Owner to be responsible for engineering, inspection, and/or observation of the contract work and acting directly or through an authorized representative.
10-26	Equipment	All machinery, together with the necessary supplies for upkeep and maintenance; and all tools and apparatus necessary for the proper construction and acceptable completion of the work.
10-27	Extra Work	An item of work not provided for in the awarded contract as previously modified by change order or supplemental agreement, but which is found by the Owner's Engineer or Resident Project Representative (RPR) to be necessary to

Paragraph Number	Term	Definition
		complete the work within the intended scope of the contract as previously modified.
10-28	FAA	The Federal Aviation Administration. When used to designate a person, FAA shall mean the Administrator or their duly authorized representative.
10-29	Federal Specifications	The federal specifications and standards, commercial item descriptions, and supplements, amendments, and indices prepared and issued by the General Services Administration.
10-30	Force Account	a. Contract Force Account - A method of payment that addresses extra work performed by the Contractor on a time and material basis. b. Owner Force Account - Work performed for the project by the Owner's employees.
10-31	Intention of Terms	Whenever, in these specifications or on the plans, the words “directed,” “required,” “permitted,” “ordered,” “designated,” “prescribed,” or words of like import are used, it shall be understood that the direction, requirement, permission, order, designation, or prescription of the Engineer and/or Resident Project Representative (RPR) is intended; and similarly, the words “approved,” “acceptable,” “satisfactory,” or words of like import, shall mean approved by, or acceptable to, or satisfactory to the Engineer and/or RPR, subject in each case to the final determination of the Owner. Any reference to a specific requirement of a numbered paragraph of the contract specifications or a cited standard shall be interpreted to include all general requirements of the entire section, specification item, or cited standard that may be pertinent to such specific reference.
10-32	Lighting	A system of fixtures providing or controlling the light sources used on or near the airport or within the airport buildings. The field lighting includes all luminous signals, markers, floodlights, and illuminating devices used on or near the airport or to aid in the operation of aircraft landing at, taking off from, or taxiing on the airport surface.
10-33	Major and Minor Contract Items	A major contract item shall be any item that is listed in the proposal, the total cost of which is equal to or greater than 20% of the total amount of the award contract. All other items shall be considered minor contract items.

Paragraph Number	Term	Definition
10-34	Materials	Any substance specified for use in the construction of the contract work.
10-35	Modification of Standards (MOS)	Any deviation from standard specifications applicable to material and construction methods in accordance with FAA Order 5300.1.
10-36	Notice to Proceed (NTP)	A written notice to the Contractor to begin the actual contract work on a previously agreed to date. If applicable, the Notice to Proceed shall state the date on which the contract time begins.
10-37	Owner	The term “Owner” shall mean the party of the first part or the contracting agency signatory to the contract. Where the term “Owner” is capitalized in this document, it shall mean airport Sponsor only. The Owner for this project is Eugene Airport.
10-38	Passenger Facility Charge (PFC)	Per 14 Code of Federal Regulations (CFR) Part 158 and 49 United States Code (USC) § 40117, a PFC is a charge imposed by a public agency on passengers enplaned at a commercial service airport it controls.
10-39	Pavement Structure	The combined surface course, base course(s), and subbase course(s), if any, considered as a single unit.
10-40	Payment Bond	The approved form of security furnished by the Contractor and their own surety as a guaranty that the Contractor will pay in full all bills and accounts for materials and labor used in the construction of the work.
10-41	Performance Bond	The approved form of security furnished by the Contractor and their own surety as a guaranty that the Contractor will complete the work in accordance with the terms of the contract.
10-42	Plans	The official drawings or exact reproductions which show the location, character, dimensions and details of the airport and the work to be done and which are to be considered as a part of the contract, supplementary to the specifications. Plans may also be referred to as 'contract drawings.'
10-43	Project	The agreed scope of work for accomplishing specific airport development with respect to a particular airport.

Paragraph Number	Term	Definition
10-44	Proposal	The written offer of the bidder (when submitted on the approved proposal form) to perform the contemplated work and furnish the necessary materials in accordance with the provisions of the plans and specifications.
10-45	Proposal Guaranty	The security furnished with a proposal to guarantee that the bidder will enter into a contract if their own proposal is accepted by the Owner.
10-46	Quality Assurance (QA)	Owner's responsibility to assure that construction work completed complies with specifications for payment.
10-47	Quality Control (QC)	Contractor's responsibility to control material(s) and construction processes to complete construction in accordance with project specifications.
10-48	Quality Assurance (QA) Inspector	An authorized representative of the Engineer and/or Resident Project Representative (RPR) assigned to make all necessary inspections, observations, tests, and/or observation of tests of the work performed or being performed, or of the materials furnished or being furnished by the Contractor.
10-49	Quality Assurance (QA) Laboratory	The official quality assurance testing laboratories of the Owner or such other laboratories as may be designated by the Engineer or RPR. May also be referred to as Engineer's, Owner's, or QA Laboratory.
10-50	Resident Project Representative (RPR)	The individual, partnership, firm, or corporation duly authorized by the Owner to be responsible for all necessary inspections, observations, tests, and/or observations of tests of the contract work performed or being performed, or of the materials furnished or being furnished by the Contractor, and acting directly or through an authorized representative.
10-51	Runway	The area on the airport prepared for the landing and takeoff of aircraft.
10-52	Runway Safety Area (RSA)	A defined surface surrounding the runway prepared or suitable for reducing the risk of damage to aircraft. See the construction safety and phasing plan (CSPP) for limits of the RSA.
10-53	Safety Plan Compliance Document (SPCD)	Details how the Contractor will comply with the CSPP.

Paragraph Number	Term	Definition
10-54	Specifications	A part of the contract containing the written directions and requirements for completing the contract work. Standards for specifying materials or testing which are cited in the contract specifications by reference shall have the same force and effect as if included in the contract physically.
10-55	Sponsor	A Sponsor is defined in 49 USC § 47102(24) as a public agency that submits to the FAA for an AIP grant; or a private Owner of a public-use airport that submits to the FAA an application for an AIP grant for the airport.
10-56	Structures	Airport facilities such as bridges; culverts; catch basins, inlets, retaining walls, cribbing; storm and sanitary sewer lines; water lines; underdrains; electrical ducts, manholes, handholes, lighting fixtures and bases; transformers; navigational aids; buildings; vaults; and, other manmade features of the airport that may be encountered in the work and not otherwise classified herein.
10-57	Subgrade	The soil that forms the pavement foundation.
10-58	Superintendent	The Contractor's executive representative who is present on the work during progress, authorized to receive and fulfill instructions from the RPR, and who shall supervise and direct the construction.
10-59	Supplemental Agreement	A written agreement between the Contractor and the Owner that establishes the basis of payment and contract time adjustment, if any, for the work affected by the supplemental agreement. A supplemental agreement is required if: (1) in scope work would increase or decrease the total amount of the awarded contract by more than 25%; (2) in scope work would increase or decrease the total of any major contract item by more than 25%; (3) work that is not within the scope of the originally awarded contract; or (4) adding or deleting of a major contract item.
10-60	Surety	The corporation, partnership, or individual, other than the Contractor, executing payment or performance bonds that are furnished to the Owner by the Contractor.
10-61	Taxilane	A taxiway designed for low speed movement of aircraft between aircraft parking areas and terminal areas.
10-62	Taxiway	The portion of the air operations area of an airport that has been designated by competent airport authority for

Paragraph Number	Term	Definition
		movement of aircraft to and from the airport's runways, aircraft parking areas, and terminal areas.
10-63	Taxiway/Taxilane Safety Area (TSA)	A defined surface alongside the taxiway prepared or suitable for reducing the risk of damage to an aircraft. See the construction safety and phasing plan (CSPP) for limits of the TSA.
10-64	Work	The furnishing of all labor, materials, tools, equipment, and incidentals necessary or convenient to the Contractor's performance of all duties and obligations imposed by the contract, plans, and specifications.
10-65	Working Day	A working day shall be any day other than a legal holiday, Saturday, or Sunday on which the normal working forces of the Contractor may proceed with regular work for at least six (6) hours toward completion of the contract. When work is suspended for causes beyond the Contractor's control, it will not be counted as a working day. Saturdays, Sundays and holidays on which the Contractor's forces engage in regular work will be considered as working days.
10-66	Owner Defined Terms	None

END OF SECTION 10

SECTION 20 PROPOSAL REQUIREMENTS AND CONDITIONS

20-01 ADVERTISEMENT (NOTICE TO BIDDERS). This project has been advertised on the State of Oregon's OregonBuys website on the date indicated in the Invitation to Bidders.

20-02 QUALIFICATION OF BIDDERS.

See Invitation to Bid for specific requirements.

20-03 CONTENTS OF PROPOSAL FORMS. The Owner's proposal forms state the location and description of the proposed construction; the place, date, and time of opening of the proposals; and the estimated quantities of the various items of work to be performed and materials to be furnished for which unit bid prices are asked. The proposal form states the time in which the work must be completed, and the amount of the proposal guaranty that must accompany the proposal. The Owner will accept only those Proposals properly executed on physical forms or electronic forms provided by the Owner. Bidder actions that may cause the Owner to deem a proposal irregular are given in paragraph 20-09 *Irregular proposals*.

Mobilization is limited to 10 percent of the total project cost.

A non-mandatory pre-bid conference will be held for this project to discuss as a minimum, the following items: material requirements; submittals; Quality Control/Quality Assurance requirements; the construction safety and phasing plan including airport access and staging areas; and unique airfield paving construction requirements. See Invitation to Bid for time, date and place of the non-mandatory pre-bid conference.

20-04 ISSUANCE OF PROPOSAL FORMS. The Owner reserves the right to refuse to accept a proposal form to a prospective bidder if the bidder is in default for any of the following reasons:

- a. Failure to comply with any prequalification regulations of the Owner, if such regulations are cited, or otherwise included, in the proposal as a requirement for bidding.
- b. Failure to pay, or satisfactorily settle, all bills due for labor and materials on former contracts in force with the Owner at the time the Owner issues the proposal to a prospective bidder.
- c. Documented record of Contractor default under previous contracts with the Owner.
- d. Documented record of unsatisfactory work on previous contracts with the Owner.

20-05 INTERPRETATION OF ESTIMATED PROPOSAL QUANTITIES. An estimate of quantities of work to be done and materials to be furnished under these specifications is given in the proposal. It is the result of careful calculations and is believed to be correct. It is given only as a basis for comparison of proposals and the award of the contract. The Owner does not expressly, or by implication, agree that the actual quantities involved will correspond exactly therewith; nor shall the bidder plead misunderstanding or deception because of such estimates of quantities, or of the character, location, or other conditions pertaining to the work. Payment to the Contractor will be made only for the actual quantities of work performed or materials furnished in accordance with the plans and specifications. It is understood that the quantities may be increased or decreased as provided in the Section 40, paragraph 40-02, Alteration of Work and Quantities, without in any way invalidating the unit bid prices.

20-06 EXAMINATION OF PLANS, SPECIFICATIONS, AND SITE. The bidder is expected to carefully examine the site of the proposed work, the proposal, plans, specifications, and contract forms. Bidders shall satisfy themselves to the character, quality, and quantities of work to be performed, materials to be furnished, and to the requirements of the proposed contract. The submission of a proposal shall be

prima facie evidence that the bidder has made such examination and is satisfied to the conditions to be encountered in performing the work and the requirements of the proposed contract, plans, and specifications.

Boring logs and other records of subsurface investigations and tests are available for inspection of bidders. It is understood and agreed that such subsurface information, whether included in the plans, specifications, or otherwise made available to the bidder, was obtained and is intended for the Owner's design and estimating purposes only. Such information has been made available for the convenience of all bidders. It is further understood and agreed that each bidder is solely responsible for all assumptions, deductions, or conclusions which the bidder may make or obtain from their own examination of the boring logs and other records of subsurface investigations and tests that are furnished by the Owner.

20-07 PREPARATION OF PROPOSAL. The bidder shall submit their proposal on the forms furnished by the Owner. All blank spaces in the proposal forms, unless explicitly stated otherwise, must be correctly filled in where indicated for each and every item for which a quantity is given. The bidder shall state the price (written in ink or typed) in numerals which they propose for each pay item furnished in the proposal.

The bidder shall correctly sign the proposal in ink. If the proposal is made by an individual, their name and post office address must be shown. If made by a partnership, the name and post office address of each member of the partnership must be shown. If made by a corporation, the person signing the proposal shall give the name of the state where the corporation was chartered and the name, titles, and business address of the president, secretary, and the treasurer. Anyone signing a proposal as an agent shall file evidence of their authority to do so and that the signature is binding upon the firm or corporation.

20-08 RESPONSIVE AND RESPONSIBLE BIDDER. A responsive bid conforms to all significant terms and conditions contained in the Owner's invitation for bid. It is the Owner's responsibility to decide if the exceptions taken by a bidder to the solicitation are material or not and the extent of deviation it is willing to accept.

A responsible bidder has the ability to perform successfully under the terms and conditions of a proposed procurement, as defined in 2 CFR § 200.318(h). This includes such matters as Contractor integrity, compliance with public policy, record of past performance, and financial and technical resources.

20-09 IRREGULAR PROPOSALS. See ITB for additional information. Proposals shall be considered irregular for the following reasons:

- a. If the proposal is on a form other than that furnished by the Owner, or if the Owner's form is altered, or if any part of the proposal form is detached.
- b. If there are unauthorized additions, conditional or alternate pay items, or irregularities of any kind that make the proposal incomplete, indefinite, or otherwise ambiguous.
- c. If the proposal does not contain a unit price for each pay item listed in the proposal, except in the case of authorized alternate pay items, for which the bidder is not required to furnish a unit price.
- d. If the proposal contains unit prices that are obviously unbalanced.
- e. If the proposal is not accompanied by the proposal guaranty specified by the Owner.
- f. If the applicable Disadvantaged Business Enterprise information is incomplete.

The Owner reserves the right to reject any irregular proposal and the right to waive technicalities if such waiver is in the best interest of the Owner and conforms to local laws and ordinances pertaining to the letting of construction contracts.

20-10 BID GUARANTEE. See Invitation to Bid for requirements.

20-11 DELIVERY OF PROPOSAL. See Invitation to Bid for requirements.

20-12 WITHDRAWAL OR REVISION OF PROPOSALS. See Invitation to Bid for requirements.

20-13 PUBLIC OPENING OF PROPOSALS. Proposals shall be opened, and read, publicly at the time and place specified in the advertisement. Bidders, their authorized agents, and other interested persons are invited to attend. Proposals that have been withdrawn (by written or telegraphic request) or received after the time specified for opening bids shall be returned to the bidder unopened. See Invitation to Bid.

20-14 DISQUALIFICATION OF BIDDERS. See invitation to bid. A bidder shall be considered disqualified for any of the following reasons:

a. Submitting more than one proposal from the same partnership, firm, or corporation under the same or different name.

b. Evidence of collusion among bidders. Bidders participating in such collusion shall be disqualified as bidders for any future work of the Owner until any such participating bidder has been reinstated by the Owner as a qualified bidder.

c. If the bidder is considered to be in “default” for any reason specified in paragraph 20-04, *Issuance of Proposal Forms*, of this section.

20-15 DISCREPANCIES AND OMISSIONS. A Bidder who discovers discrepancies or omissions with the project bid documents shall immediately notify the Owner’s Engineer of the matter. A bidder that has doubt as to the true meaning of a project requirement may submit to the Owner’s Engineer a written request for interpretation as noted in Invitation to Bid.

Any interpretation of the project bid documents by the Owner’s Engineer will be by written addendum issued by the Owner. The Owner will not consider any instructions, clarifications or interpretations of the bidding documents in any manner other than written addendum.

END OF SECTION 20

Section 30 AWARD AND EXECUTION OF CONTRACT

See Invitation to Bid.

END OF SECTION 30

SECTION 40 SCOPE OF WORK

40-01 INTENT OF CONTRACT. The intent of the contract is to provide for construction and completion, in every detail, of the work described. It is further intended that the Contractor shall furnish all labor, materials, equipment, tools, transportation, and supplies required to complete the work in accordance with the plans, specifications, and terms of the contract.

40-02 ALTERATION OF WORK AND QUANTITIES. The Owner reserves the right to make such changes in quantities and work as may be necessary or desirable to complete, in a satisfactory manner, the original intended work. Unless otherwise specified in the Contract, the Owner's Engineer or RPR shall be and is hereby authorized to make, in writing, such in-scope alterations in the work and variation of quantities as may be necessary to complete the work, provided such action does not represent a significant change in the character of the work.

For purpose of this section, a significant change in character of work means: any change that is outside the current contract scope of work; any change (increase or decrease) in the total contract cost by more than 25%; or any change in the total cost of a major contract item by more than 25%.

Work alterations and quantity variances that do not meet the definition of significant change in character of work shall not invalidate the contract nor release the surety. Contractor agrees to accept payment for such work alterations and quantity variances in accordance with Section 90, paragraph 90-03, *Compensation for Altered Quantities*.

Should the value of altered work or quantity variance meet the criteria for significant change in character of work, such altered work and quantity variance shall be covered by a supplemental agreement. Supplemental agreements shall also require consent of the Contractor's surety and separate performance and payment bonds. If the Owner and the Contractor are unable to agree on a unit adjustment for any contract item that requires a supplemental agreement, the Owner reserves the right to terminate the contract with respect to the item and make other arrangements for its completion.

40-03 OMITTED ITEMS. The Owner, the Owner's Engineer or the RPR may provide written notice to the Contractor to omit from the work any contract item that does not meet the definition of major contract item. Major contract items may be omitted by a supplemental agreement. Such omission of contract items shall not invalidate any other contract provision or requirement.

Should a contract item be omitted or otherwise ordered to be non-performed, the Contractor shall be paid for all work performed toward completion of such item prior to the date of the order to omit such item. Payment for work performed shall be in accordance with Section 90, paragraph 90-04, *Payment for Omitted Items*.

40-04 EXTRA WORK. Should acceptable completion of the contract require the Contractor to perform an item of work not provided for in the awarded contract as previously modified by change order or supplemental agreement, Owner may issue a Change Order to cover the necessary extra work. Change orders for extra work shall contain agreed unit prices for performing the change order work in accordance with the requirements specified in the order, and shall contain any adjustment to the contract time that, in the RPR's opinion, is necessary for completion of the extra work.

When determined by the RPR to be in the Owner's best interest, the RPR may order the Contractor to proceed with extra work as provided in Section 90, paragraph 90-05, *Payment for Extra Work*. Extra work that is necessary for acceptable completion of the project, but is not within the general scope of the work

covered by the original contract shall be covered by a supplemental agreement as defined in Section 10, paragraph 10-59, *Supplemental Agreement*.

If extra work is essential to maintaining the project critical path, RPR may order the Contractor to commence the extra work under a Time and Material contract method. Once sufficient detail is available to establish the level of effort necessary for the extra work, the Owner shall initiate a change order or supplemental agreement to cover the extra work.

Any claim for payment of extra work that is not covered by written agreement (change order or supplemental agreement) shall be rejected by the Owner.

40-05 MAINTENANCE OF TRAFFIC. It is the explicit intention of the contract that the safety of aircraft, as well as the Contractor's equipment and personnel, is the most important consideration. The Contractor shall maintain traffic in the manner detailed in the Construction Safety and Phasing Plan (CSPP).

a. It is understood and agreed that the Contractor shall provide for the free and unobstructed movement of aircraft in the air operations areas (AOAs) of the airport with respect to their own operations and the operations of all subcontractors as specified in Section 80, paragraph 80-04, *Limitation of Operations*. It is further understood and agreed that the Contractor shall provide for the uninterrupted operation of visual and electronic signals (including power supplies thereto) used in the guidance of aircraft while operating to, from, and upon the airport as specified in Section 70, paragraph 70-15, *Contractor's Responsibility for Utility Service and Facilities of Others*.

b. With respect to their own operations and the operations of all subcontractors, the Contractor shall provide marking, lighting, and other acceptable means of identifying personnel, equipment, vehicles, storage areas, and any work area or condition that may be hazardous to the operation of aircraft, fire-rescue equipment, or maintenance vehicles at the airport in accordance with the construction safety and phasing plan (CSPP) and the safety plan compliance document (SPCD).

c. When the contract requires the maintenance of an existing road, street, or highway during the Contractor's performance of work that is otherwise provided for in the contract, plans, and specifications, the Contractor shall keep the road, street, or highway open to all traffic and shall provide maintenance as may be required to accommodate traffic. The Contractor, at their expense, shall be responsible for the repair to equal or better than preconstruction conditions of any damage caused by the Contractor's equipment and personnel. The Contractor shall furnish, erect, and maintain barricades, warning signs, flag person, and other traffic control devices in reasonable conformity with the Manual on Uniform Traffic Control Devices (MUTCD) (<http://mutcd.fhwa.dot.gov/>), unless otherwise specified. The Contractor shall also construct and maintain in a safe condition any temporary connections necessary for ingress to and egress from abutting property or intersecting roads, streets or highways.

40-06 REMOVAL OF EXISTING STRUCTURES. All existing structures encountered within the established lines, grades, or grading sections shall be removed by the Contractor, unless such existing structures are otherwise specified to be relocated, adjusted up or down, salvaged, abandoned in place, reused in the work or to remain in place. The cost of removing such existing structures shall not be measured or paid for directly, but shall be included in the various contract items.

Should the Contractor encounter an existing structure (above or below ground) in the work for which the disposition is not indicated on the plans, the Resident Project Representative (RPR) shall be notified prior to disturbing such structure. The disposition of existing structures so encountered shall be immediately determined by the RPR in accordance with the provisions of the contract.

Except as provided in Section 40, paragraph 40-07, *Rights in and Use of Materials Found in the Work*, it is intended that all existing materials or structures that may be encountered (within the lines, grades, or grading sections established for completion of the work) shall be used in the work as otherwise provided for in the contract and shall remain the property of the Owner when so used in the work.

40-07 RIGHTS IN AND USE OF MATERIALS FOUND IN THE WORK. Should the Contractor encounter any material such as (but not restricted to) sand, stone, gravel, slag, or concrete slabs within the established lines, grades, or grading sections, the use of which is intended by the terms of the contract to be embankment, the Contractor may at their own option either:

- a. Use such material in another contract item, providing such use is approved by the RPR and is in conformance with the contract specifications applicable to such use; or,
- b. Remove such material from the site, upon written approval of the RPR; or
- c. Use such material for the Contractor's own temporary construction on site; or,
- d. Use such material as intended by the terms of the contract.

Should the Contractor wish to exercise option a., b., or c., the Contractor shall request the RPR's approval in advance of such use.

Should the RPR approve the Contractor's request to exercise option a., b., or c., the Contractor shall be paid for the excavation or removal of such material at the applicable contract price. The Contractor shall replace, at their expense, such removed or excavated material with an agreed equal volume of material that is acceptable for use in constructing embankment, backfills, or otherwise to the extent that such replacement material is needed to complete the contract work. The Contractor shall not be charged for use of such material used in the work or removed from the site.

Should the RPR approve the Contractor's exercise of option a., the Contractor shall be paid, at the applicable contract price, for furnishing and installing such material in accordance with requirements of the contract item in which the material is used.

It is understood and agreed that the Contractor shall make no claim for delays by reason of their own exercise of option a., b., or c.

The Contractor shall not excavate, remove, or otherwise disturb any material, structure, or part of a structure which is located outside the lines, grades, or grading sections established for the work, except where such excavation or removal is provided for in the contract, plans, or specifications.

40-08 FINAL CLEANUP. Upon completion of the work and before acceptance and final payment will be made, the Contractor shall remove from the site all machinery, equipment, surplus and discarded materials, rubbish, temporary structures, and stumps or portions of trees. The Contractor shall cut all brush and woods within the limits indicated and shall leave the site in a neat and presentable condition. Material cleared from the site and deposited on adjacent property will not be considered as having been disposed of satisfactorily, unless the Contractor has obtained the written permission of the property Owner.

END OF SECTION 40

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SECTION 50 CONTROL OF WORK

50-01 AUTHORITY OF THE RESIDENT PROJECT REPRESENTATIVE (RPR). The RPR has final authority regarding the interpretation of project specification requirements. The RPR shall determine acceptability of the quality of materials furnished, method of performance of work performed, and the manner and rate of performance of the work. The RPR does not have the authority to accept work that does not conform to specification requirements.

50-02 CONFORMITY WITH PLANS AND SPECIFICATIONS. All work and all materials furnished shall be in reasonably close conformity with the lines, grades, grading sections, cross-sections, dimensions, material requirements, and testing requirements that are specified (including specified tolerances) in the contract, plans, or specifications.

If the RPR finds the materials furnished, work performed, or the finished product not within reasonably close conformity with the plans and specifications, but that the portion of the work affected will, in their opinion, result in a finished product having a level of safety, economy, durability, and workmanship acceptable to the Owner, the RPR will advise the Owner of their determination that the affected work be accepted and remain in place. The RPR will document the determination and recommend to the Owner a basis of acceptance that will provide for an adjustment in the contract price for the affected portion of the work. Changes in the contract price must be covered by contract change order or supplemental agreement as applicable.

If the RPR finds the materials furnished, work performed, or the finished product are not in reasonably close conformity with the plans and specifications and have resulted in an unacceptable finished product, the affected work or materials shall be removed and replaced or otherwise corrected by and at the expense of the Contractor in accordance with the RPR's written orders.

The term "reasonably close conformity" shall not be construed as waiving the Contractor's responsibility to complete the work in accordance with the contract, plans, and specifications. The term shall not be construed as waiving the RPR's responsibility to insist on strict compliance with the requirements of the contract, plans, and specifications during the Contractor's execution of the work, when, in the RPR's opinion, such compliance is essential to provide an acceptable finished portion of the work.

The term "reasonably close conformity" is also intended to provide the RPR with the authority, after consultation with the Sponsor and FAA, to use sound engineering judgment in their determinations to accept work that is not in strict conformity, but will provide a finished product equal to or better than that required by the requirements of the contract, plans and specifications.

The RPR will not be responsible for the Contractor's means, methods, techniques, sequences, or procedures of construction or the safety precautions incident thereto.

50-03 COORDINATION OF CONTRACT, PLANS, AND SPECIFICATIONS. The contract, plans, specifications, and all referenced standards cited are essential parts of the contract requirements. If electronic files are provided and used on the project and there is a conflict between the electronic files and hard copy plans, the hard copy plans shall govern. A requirement occurring in one is as binding as though occurring in all. They are intended to be complementary and to describe and provide for a complete work. In case of discrepancy, calculated dimensions will govern over scaled dimensions; contract technical specifications shall govern over contract general provisions, plans, cited standards for materials or testing, and cited advisory circulars (ACs); contract general provisions shall govern over plans, cited standards for materials or testing, and cited ACs; plans shall govern over cited standards for materials or testing and cited

ACs. If any paragraphs contained in the Special Provisions conflict with General Provisions or Technical Specifications, the Special Provisions shall govern.

From time to time, discrepancies within cited testing standards occur due to the timing of the change, edits, and/or replacement of the standards. If the Contractor discovers any apparent discrepancy within standard test methods, the Contractor shall immediately ask the RPR for an interpretation and decision, and such decision shall be final.

The Contractor shall not take advantage of any apparent error or omission on the plans or specifications. In the event the Contractor discovers any apparent error or discrepancy, Contractor shall immediately notify the Owner or the designated representative in writing requesting their written interpretation and decision.

50-04 List of Special Provisions. See Invitation to Bid and RS&H Special Conditions.

50-05 COOPERATION OF CONTRACTOR. The Contractor shall be supplied with five hard copies or an electronic PDF of the plans and specifications. The Contractor shall have available on the construction site at all times one hardcopy each of the plans and specifications. Additional hard copies of plans and specifications may be obtained by the Contractor for the cost of reproduction.

The Contractor shall give constant attention to the work to facilitate the progress thereof, and shall cooperate with the RPR and their inspectors and with other Contractors in every way possible. The Contractor shall have a competent superintendent on the work at all times who is fully authorized as their agent on the work. The superintendent shall be capable of reading and thoroughly understanding the plans and specifications and shall receive and fulfill instructions from the RPR or their authorized representative.

50-06 COOPERATION BETWEEN CONTRACTORS. The Owner reserves the right to contract for and perform other or additional work on or near the work covered by this contract.

When separate contracts are let within the limits of any one project, each Contractor shall conduct the work not to interfere with or hinder the progress of completion of the work being performed by other Contractors. Contractors working on the same project shall cooperate with each other as directed.

Each Contractor involved shall assume all liability, financial or otherwise, in connection with their own contract and shall protect and hold harmless the Owner from any and all damages or claims that may arise because of inconvenience, delays, or loss experienced because of the presence and operations of other Contractors working within the limits of the same project.

The Contractor shall arrange their work and shall place and dispose of the materials being used to not interfere with the operations of the other Contractors within the limits of the same project. The Contractor shall join their work with that of the others in an acceptable manner and shall perform it in proper sequence to that of the others.

50-07 CONSTRUCTION LAYOUT AND STAKES. The Engineer/RPR shall establish necessary horizontal and vertical control. The establishment of Survey Control and/or reestablishment of survey control shall be by a State Licensed Land Surveyor. Contractor is responsible for preserving integrity of horizontal and vertical controls established by Engineer/RPR. In case of negligence on the part of the Contractor or their employees, resulting in the destruction of any horizontal and vertical control, the resulting costs will be deducted as a liquidated damage against the Contractor.

Prior to the start of construction, the Contractor will check all control points for horizontal and vertical accuracy and certify in writing to the RPR that the Contractor concurs with survey control established for the project. All lines, grades and measurements from control points necessary for the proper execution and control of the work on this project will be provided to the RPR. The Contractor is responsible to establish all layout required for the construction of the project.

Copies of survey notes will be provided to the RPR for each area of construction and for each placement of material as specified to allow the RPR to make periodic checks for conformance with plan grades,

alignments and grade tolerances required by the applicable material specifications. Surveys will be provided to the RPR prior to commencing work items that cover or disturb the survey staking. Survey(s) and notes shall be provided in the following format(s): Hard Copy and Electronic (PDF of Field Notes, AutoCAD 2024 of survey data).

Laser, GPS, String line, or other automatic control shall be checked with temporary control as necessary. In the case of error, on the part of the Contractor, their surveyor, employees or subcontractors, resulting in established grades, alignment or grade tolerances that do not concur with those specified or shown on the plans, the Contractor is solely responsible for correction, removal, replacement and all associated costs at no additional cost to the Owner.

No direct payment will be made, unless otherwise specified in contract documents, for this labor, materials, or other expenses. The cost shall be included in the price of the bid for the various items of the Contract.

50-08 AUTHORITY AND DUTIES OF QUALITY ASSURANCE (QA) INSPECTORS. QA inspectors shall be authorized to inspect all work done and all material furnished. Such QA inspection may extend to all or any part of the work and to the preparation, fabrication, or manufacture of the materials to be used. QA inspectors are not authorized to revoke, alter, or waive any provision of the contract. QA inspectors are not authorized to issue instructions contrary to the plans and specifications or to act as foreman for the Contractor.

QA Inspectors are authorized to notify the Contractor or their representatives of any failure of the work or materials to conform to the requirements of the contract, plans, or specifications and to reject such nonconforming materials in question until such issues can be referred to the RPR for a decision.

50-09 INSPECTION OF THE WORK. All materials and each part or detail of the work shall be subject to inspection. The RPR shall be allowed access to all parts of the work and shall be furnished with such information and assistance by the Contractor as is required to make a complete and detailed inspection.

If the RPR requests it, the Contractor, at any time before acceptance of the work, shall remove or uncover such portions of the finished work as may be directed. After examination, the Contractor shall restore said portions of the work to the standard required by the specifications. Should the work thus exposed or examined prove acceptable, the uncovering, or removing, and the replacing of the covering or making good of the parts removed will be paid for as extra work; but should the work so exposed or examined prove unacceptable, the uncovering, or removing, and the replacing of the covering or making good of the parts removed will be at the Contractor's expense.

Provide advance written notice to the RPR of work the Contractor plans to perform each week and each day. Any work done or materials used without written notice and allowing opportunity for inspection by the RPR may be ordered removed and replaced at the Contractor's expense.

Should the contract work include relocation, adjustment, or any other modification to existing facilities, not the property of the (contract) Owner, authorized representatives of the Owners of such facilities shall have the right to inspect such work. Such inspection shall in no sense make any facility owner a party to the contract, and shall in no way interfere with the rights of the parties to this contract.

50-10 REMOVAL OF UNACCEPTABLE AND UNAUTHORIZED WORK. All work that does not conform to the requirements of the contract, plans, and specifications will be considered unacceptable, unless otherwise determined acceptable by the RPR as provided in paragraph 50-02, *Conformity with Plans and Specifications*.

Unacceptable work, whether the result of poor workmanship, use of defective materials, damage through carelessness, or any other cause found to exist prior to the final acceptance of the work, shall be removed immediately and replaced in an acceptable manner in accordance with the provisions of Section 70, paragraph 70-14, *Contractor's Responsibility for Work*.

No removal work made under provision of this paragraph shall be done without lines and grades having been established by the RPR. Work done contrary to the instructions of the RPR, work done beyond the lines shown on the plans or as established by the RPR, except as herein specified, or any extra work done without authority, will be considered as unauthorized and will not be paid for under the provisions of the contract. Work so done may be ordered removed or replaced at the Contractor's expense.

Upon failure on the part of the Contractor to comply with any order of the RPR made under the provisions of this subsection, the RPR will have authority to cause unacceptable work to be remedied or removed and replaced; and unauthorized work to be removed and recover the resulting costs as a liquidated damage against the Contractor.

50-11 LOAD RESTRICTIONS. The Contractor shall comply with all legal load restrictions in the hauling of materials on public roads beyond the limits of the work. A special permit will not relieve the Contractor of liability for damage that may result from the moving of material or equipment.

The operation of equipment of such weight or so loaded as to cause damage to structures or to any other type of construction will not be permitted. Hauling of materials over the base course or surface course under construction shall be limited as directed. No loads will be permitted on a concrete pavement, base, or structure before the expiration of the curing period. The Contractor, at their own expense, shall be responsible for the repair to equal or better than preconstruction conditions of any damage caused by the Contractor's equipment and personnel.

50-12 MAINTENANCE DURING CONSTRUCTION. The Contractor shall maintain the work during construction and until the work is accepted. Maintenance shall constitute continuous and effective work prosecuted day by day, with adequate equipment and forces so that the work is maintained in satisfactory condition at all times.

In the case of a contract for the placing of a course upon a course or subgrade previously constructed, the Contractor shall maintain the previous course or subgrade during all construction operations.

All costs of maintenance work during construction and before the project is accepted shall be included in the unit prices bid on the various contract items, and the Contractor will not be paid an additional amount for such work.

50-13 FAILURE TO MAINTAIN THE WORK. Should the Contractor at any time fail to maintain the work as provided in paragraph 50-12, *Maintenance during Construction*, the RPR shall immediately notify the Contractor of such noncompliance. Such notification shall specify a reasonable time within which the Contractor shall be required to remedy such unsatisfactory maintenance condition. The time specified will give due consideration to the exigency that exists.

Should the Contractor fail to respond to the RPR's notification, the Owner may suspend any work necessary for the Owner to correct such unsatisfactory maintenance condition, depending on the exigency that exists. Any maintenance cost incurred by the Owner, shall be recovered as a liquidated damage against the Contractor.

50-14 PARTIAL ACCEPTANCE. If at any time during the execution of the project the Contractor substantially completes a usable unit or portion of the work, the occupancy of which will benefit the Owner, the Contractor may request the RPR to make final inspection of that unit. If the RPR finds upon inspection that the unit has been satisfactorily completed in compliance with the contract, the RPR may accept it as being complete, and the Contractor may be relieved of further responsibility for that unit. Such partial acceptance and beneficial occupancy by the Owner shall not void or alter any provision of the contract.

50-15 FINAL ACCEPTANCE. Upon due notice from the Contractor of presumptive completion of the entire project, the RPR and Owner will make an inspection. If all construction provided for and contemplated by the contract is found to be complete in accordance with the contract, plans, and

specifications, such inspection shall constitute the final inspection. The RPR shall notify the Contractor in writing of final acceptance as of the date of the final inspection.

If, however, the inspection discloses any work, in whole or in part, as being unsatisfactory, the RPR will notify the Contractor and the Contractor shall correct the unsatisfactory work. Upon correction of the work, another inspection will be made which shall constitute the final inspection, provided the work has been satisfactorily completed. In such event, the RPR will make the final acceptance and notify the Contractor in writing of this acceptance as of the date of final inspection.

50-16 CLAIMS FOR ADJUSTMENT AND DISPUTES. If for any reason the Contractor deems that additional compensation is due for work or materials not clearly provided for in the contract, plans, or specifications or previously authorized as extra work, the Contractor shall notify the RPR in writing of their intention to claim such additional compensation before the Contractor begins the work on which the Contractor bases the claim. If such notification is not given or the RPR is not afforded proper opportunity by the Contractor for keeping strict account of actual cost as required, then the Contractor hereby agrees to waive any claim for such additional compensation. Such notice by the Contractor and the fact that the RPR has kept account of the cost of the work shall not in any way be construed as proving or substantiating the validity of the claim. When the work on which the claim for additional compensation is based has been completed, the Contractor shall, within 10 calendar days, submit a written claim to the RPR who will present it to the Owner for consideration in accordance with local laws or ordinances.

Nothing in this subsection shall be construed as a waiver of the Contractor's right to dispute final payment based on differences in measurements or computations.

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SECTION 60 CONTROL OF MATERIALS

60-01 SOURCE OF SUPPLY AND QUALITY REQUIREMENTS. The materials used in the work shall conform to the requirements of the contract, plans, and specifications. Unless otherwise specified, such materials that are manufactured or processed shall be new (as compared to used or reprocessed).

In order to expedite the inspection and testing of materials, the Contractor shall furnish documentation to the RPR as to the origin, composition, and manufacture of all materials to be used in the work. Documentation shall be furnished promptly after execution of the contract but, in all cases, prior to delivery of such materials.

At the RPR's option, materials may be approved at the source of supply before delivery. If it is found after trial that sources of supply for previously approved materials do not produce specified products, the Contractor shall furnish materials from other sources.

The Contractor shall furnish airport lighting equipment that meets the requirements of the specifications; and is listed in AC 150/5345-53, *Airport Lighting Equipment Certification Program and Addendum*, that is in effect on the date of advertisement.

60-02 SAMPLES, TESTS, AND CITED SPECIFICATIONS. All materials used in the work shall be inspected, tested, and approved by the RPR before incorporation in the work unless otherwise designated. Any work in which untested materials are used without approval or written permission of the RPR shall be performed at the Contractor's risk. Materials found to be unacceptable and unauthorized will not be paid for and, if directed by the RPR, shall be removed at the Contractor's expense.

Unless otherwise designated, quality assurance tests will be made by and at the expense of the Owner in accordance with the cited standard methods of ASTM, American Association of State Highway and Transportation Officials (AASHTO), federal specifications, Commercial Item Descriptions, and all other cited methods, which are current on the date of advertisement for bids.

The testing organizations performing on-site quality assurance field tests shall have copies of all referenced standards on the construction site for use by all technicians and other personnel. Unless otherwise designated, samples for quality assurance will be taken by a qualified representative of the RPR. All materials being used are subject to inspection, test, or rejection at any time prior to or during incorporation into the work. Copies of all tests will be furnished to the Contractor's representative at their request after review and approval of the RPR.

A copy of all Contractor QC test data shall be provided to the RPR daily electronically, along with printed reports, in an approved format, on a weekly basis. After completion of the project, and prior to final payment, the Contractor shall submit a final report to the RPR showing all test data reports, plus an analysis of all results showing ranges, averages, and corrective action taken on all failing tests.

The Contractor shall employ a Quality Control (QC) testing organization to perform all Contractor required QC tests in accordance with Item C-100 Contractor Quality Control Program (CQCP).

60-03 CERTIFICATION OF COMPLIANCE/ANALYSIS (COC/COA). The RPR may permit the use, prior to sampling and testing, of certain materials or assemblies when accompanied by manufacturer's COC stating that such materials or assemblies fully comply with the requirements of the contract. The certificate shall be signed by the manufacturer. Each lot of such materials or assemblies delivered to the work must

be accompanied by a certificate of compliance in which the lot is clearly identified. The COA is the manufacturer's COC and includes all applicable test results.

Materials or assemblies used on the basis of certificates of compliance may be sampled and tested at any time and if found not to be in conformity with contract requirements will be subject to rejection whether in place or not.

The form and distribution of certificates of compliance shall be as approved by the RPR.

When a material or assembly is specified by "brand name or equal" and the Contractor elects to furnish the specified "or equal," the Contractor shall be required to furnish the manufacturer's certificate of compliance for each lot of such material or assembly delivered to the work. Such certificate of compliance shall clearly identify each lot delivered and shall certify as to:

- a. Conformance to the specified performance, testing, quality or dimensional requirements; and,
- b. Suitability of the material or assembly for the use intended in the contract work.

The RPR shall be the sole judge as to whether the proposed "or equal" is suitable for use in the work.

The RPR reserves the right to refuse permission for use of materials or assemblies on the basis of certificates of compliance.

60-04 PLANT INSPECTION. The RPR or their authorized representative may inspect, at its source, any specified material or assembly to be used in the work. Manufacturing plants may be inspected from time to time for the purpose of determining compliance with specified manufacturing methods or materials to be used in the work and to obtain samples required for acceptance of the material or assembly.

Should the RPR conduct plant inspections, the following conditions shall exist:

- a. The RPR shall have the cooperation and assistance of the Contractor and the producer with whom the Contractor has contracted for materials.
- b. The RPR shall have full entry at all reasonable times to such parts of the plant that concern the manufacture or production of the materials being furnished.
- c. If required by the RPR, the Contractor shall arrange for adequate office or working space that may be reasonably needed for conducting plant inspections. Place office or working space in a convenient location with respect to the plant.

It is understood and agreed that the Owner shall have the right to retest any material that has been tested and approved at the source of supply after it has been delivered to the site. The RPR shall have the right to reject only material which, when retested, does not meet the requirements of the contract, plans, or specifications.

60-05 ENGINEER/ RESIDENT PROJECT REPRESENTATIVE (RPR) FIELD OFFICE. See Technical Specification C-105 Mobilization.

60-06 STORAGE OF MATERIALS. Materials shall be stored to assure the preservation of their quality and fitness for the work. Stored materials, even though approved before storage, may again be inspected prior to their use in the work. Stored materials shall be located to facilitate their prompt inspection. The Contractor shall coordinate the storage of all materials with the RPR. Materials to be stored on airport property shall not create an obstruction to air navigation nor shall they interfere with the free and unobstructed movement of aircraft. Unless otherwise shown on the plans and/or CSPP, the storage of materials and the location of the Contractor's plant and parked equipment or vehicles shall be as directed by the RPR. Private property shall not be used for storage purposes without written permission of the Owner or lessee of such property. The Contractor shall make all arrangements and bear all expenses for the storage

of materials on private property. Upon request, the Contractor shall furnish the RPR a copy of the property Owner's permission.

All storage sites on private or airport property shall be restored to their original condition by the Contractor at their expense, except as otherwise agreed to (in writing) by the Owner or lessee of the property.

60-07 UNACCEPTABLE MATERIALS. Any material or assembly that does not conform to the requirements of the contract, plans, or specifications shall be considered unacceptable and shall be rejected. The Contractor shall remove any rejected material or assembly from the site of the work, unless otherwise instructed by the RPR.

Rejected material or assembly, the defects of which have been corrected by the Contractor, shall not be returned to the site of the work until such time as the RPR has approved its use in the work.

60-08 OWNER FURNISHED MATERIALS. The Contractor shall furnish all materials required to complete the work, except those specified, if any, to be furnished by the Owner. Owner-furnished materials shall be made available to the Contractor at the location specified.

All costs of handling, transportation from the specified location to the site of work, storage, and installing Owner-furnished materials shall be included in the unit price bid for the contract item in which such Owner-furnished material is used.

After any Owner-furnished material has been delivered to the location specified, the Contractor shall be responsible for any demurrage, damage, loss, or other deficiencies that may occur during the Contractor's handling, storage, or use of such Owner-furnished material. The Owner will deduct from any monies due or to become due the Contractor any cost incurred by the Owner in making good such loss due to the Contractor's handling, storage, or use of Owner-furnished materials.

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SECTION 70 LEGAL REGULATIONS AND RESPONSIBILITY TO PUBLIC

70-01 LAWS TO BE OBSERVED. The Contractor shall keep fully informed of all federal and state laws, all local laws, ordinances, and regulations and all orders and decrees of bodies or tribunals having any jurisdiction or authority, which in any manner affect those engaged or employed on the work, or which in any way affect the conduct of the work. The Contractor shall at all times observe and comply with all such laws, ordinances, regulations, orders, and decrees; and shall protect and indemnify the Owner and all their officers, agents, or servants against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order, or decree, whether by the Contractor or the Contractor's employees.

70-02 PERMITS, LICENSES, AND TAXES. The Contractor shall procure all permits and licenses, pay all charges, fees, and taxes, and give all notices necessary and incidental to the due and lawful execution of the work.

70-03 PATENTED DEVICES, MATERIALS, AND PROCESSES. If the Contractor is required or desires to use any design, device, material, or process covered by letters of patent or copyright, the Contractor shall provide for such use by suitable legal agreement with the Patentee or Owner. The Contractor and the surety shall indemnify and hold harmless the Owner, any third party, or political subdivision from any and all claims for infringement by reason of the use of any such patented design, device, material or process, or any trademark or copyright, and shall indemnify the Owner for any costs, expenses, and damages which it may be obliged to pay by reason of an infringement, at any time during the execution or after the completion of the work.

70-04 RESTORATION OF SURFACES DISTURBED BY OTHERS. The Owner reserves the right to authorize the construction, reconstruction, or maintenance of any public or private utility service, FAA or National Oceanic and Atmospheric Administration (NOAA) facility, or a utility service of another government agency at any time during the progress of the work. To the extent that such construction, reconstruction, or maintenance has been coordinated with the Owner, such authorized work (by others) must be shown on the plans and is indicated as follows:

Utility Service or Facility	Person to Contact	Owner's Emergency Contact
FAA-System Support Center Coordinator	Ken McKinney	541-225-8613
City of Eugene/EUG	Keawe Stubenberg	541-682-5944
EUG Airfield Lighting and Communication Fiber	Nate Bushnell	541-682-8354
FAA - Eugene System Support Center	Cathy Chamberlain	541-246-5944

Except as listed above, the Contractor shall not permit any individual, firm, or corporation to excavate or otherwise disturb such utility services or facilities located within the limits of the work without the written permission of the RPR.

Should the Owner of public or private utility service, FAA, or NOAA facility, or a utility service of another government agency be authorized to construct, reconstruct, or maintain such utility service or facility during the progress of the work, the Contractor shall cooperate with such Owners by arranging and performing the work in this contract to facilitate such construction, reconstruction or maintenance by others whether or not such work by others is listed above. When ordered as extra work by the RPR, the Contractor shall make all

necessary repairs to the work which are due to such authorized work by others, unless otherwise provided for in the contract, plans, or specifications. It is understood and agreed that the Contractor shall not be entitled to make any claim for damages due to such authorized work by others or for any delay to the work resulting from such authorized work.

70-05 FEDERAL PARTICIPATION. The United States Government has agreed to reimburse the Owner for some portion of the contract costs. The contract work is subject to the inspection and approval of duly authorized representatives of the FAA Administrator. No requirement of this contract shall be construed as making the United States a party to the contract nor will any such requirement interfere, in any way, with the rights of either party to the contract.

70-06 SANITARY, HEALTH, AND SAFETY PROVISIONS. The Contractor's worksite and facilities shall comply with applicable federal, state, and local requirements for health, safety and sanitary provisions.

70-07 PUBLIC CONVENIENCE AND SAFETY. The Contractor shall control their operations and those of their subcontractors and all suppliers, to assure the least inconvenience to the traveling public. Under all circumstances, safety shall be the most important consideration.

The Contractor shall maintain the free and unobstructed movement of aircraft and vehicular traffic with respect to their own operations and those of their own subcontractors and all suppliers in accordance with Section 40, paragraph 40-05, *Maintenance of Traffic*, and shall limit such operations for the convenience and safety of the traveling public as specified in Section 80, paragraph 80-04, *Limitation of Operations*.

The Contractor shall remove or control debris and rubbish resulting from its work operations at frequent intervals, and upon the order of the RPR. If the RPR determines the existence of Contractor debris in the work site represents a hazard to airport operations and the Contractor is unable to respond in a prompt and reasonable manner, the RPR reserves the right to assign the task of debris removal to a third party and recover the resulting costs as a liquidated damage against the Contractor.

70-08 CONSTRUCTION SAFETY AND PHASING PLAN (CSPP). The Contractor shall complete the work in accordance with the approved Construction Safety and Phasing Plan (CSPP) developed in accordance with AC 150/5370-2G, Operational Safety on Airports During Construction. The CSPP is located in Special Conditions.

70-09 USE OF EXPLOSIVES. The use of explosives is not permitted on this project.

70-10 PROTECTION AND RESTORATION OF PROPERTY AND LANDSCAPE. The Contractor shall be responsible for the preservation of all public and private property, and shall protect carefully from disturbance or damage all land monuments and property markers until the Engineer/RPR has witnessed or otherwise referenced their location and shall not move them until directed.

The Contractor shall be responsible for all damage or injury to property of any character, during the execution of the work, resulting from any act, omission, neglect, or misconduct in manner or method of executing the work, or at any time due to defective work or materials, and said responsibility shall not be released until the project has been completed and accepted.

When or where any direct or indirect damage or injury is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work, or in consequence of the non-execution thereof by the Contractor, the Contractor shall restore, at their expense, such property to a condition similar or equal to that existing before such damage or injury was done, by repairing, or otherwise restoring as may be directed, or the Contractor shall make good such damage or injury in an acceptable manner.

70-11 RESPONSIBILITY FOR DAMAGE CLAIMS. The Contractor shall indemnify and hold harmless the Engineer/RPR and the Owner and their officers, agents, and employees from all suits, actions, or claims, of any character, brought because of any injuries or damage received or sustained by any person, persons,

or property on account of the operations of the Contractor; or on account of or in consequence of any neglect in safeguarding the work; or through use of unacceptable materials in constructing the work; or because of any act or omission, neglect, or misconduct of said Contractor; or because of any claims or amounts recovered from any infringements of patent, trademark, or copyright; or from any claims or amounts arising or recovered under the “Workmen’s Compensation Act,” or any other law, ordinance, order, or decree. Money due the Contractor under and by virtue of their own contract considered necessary by the Owner for such purpose may be retained for the use of the Owner or, in case no money is due, their own surety may be held until such suits, actions, or claims for injuries or damages shall have been settled and suitable evidence to that effect furnished to the Owner, except that money due the Contractor will not be withheld when the Contractor produces satisfactory evidence that he or she is adequately protected by public liability and property damage insurance.

70-12 THIRD PARTY BENEFICIARY CLAUSE. It is specifically agreed between the parties executing the contract that it is not intended by any of the provisions of any part of the contract to create for the public or any member thereof, a third-party beneficiary or to authorize anyone not a party to the contract to maintain a suit for personal injuries or property damage pursuant to the terms or provisions of the contract.

70-13 OPENING SECTIONS OF THE WORK TO TRAFFIC. If it is necessary for the Contractor to complete portions of the contract work for the beneficial occupancy of the Owner prior to completion of the entire contract, such “phasing” of the work must be specified below and indicated on the approved Construction Safety and Phasing Plan (CSPP) and the project plans. When so specified, the Contractor shall complete such portions of the work on or before the date specified or as otherwise specified.

Phase or Description	Required Date or Sequence of Owner’s Beneficial Occupancy	Work Shown on Plan Sheet
Phase 1 Work Complete – Milestone 1	45 Calendar Days after NTP	C011
Phase 2 Work Complete – Milestone 2	15 Calendar Days after Milestone 1	C012
Phase 3 Work Complete- Milestone 3	15 Calendar Days after Milestone 2	C013
Project Complete – Milestone 4	75 Calendar Days after NTP	C010

Upon completion of any portion of work listed above, such portion shall be accepted by the Owner in accordance with Section 50, paragraph 50-14, *Partial Acceptance*.

No portion of the work may be opened by the Contractor until directed by the Owner in writing. Should it become necessary to open a portion of the work to traffic on a temporary or intermittent basis, such openings shall be made when, in the opinion of the RPR, such portion of the work is in an acceptable condition to support the intended traffic. Temporary or intermittent openings are considered to be inherent in the work and shall not constitute either acceptance of the portion of the work so opened or a waiver of any provision of the contract. Any damage to the portion of the work so opened that is not attributable to traffic which is permitted by the Owner shall be repaired by the Contractor at their expense.

The Contractor shall make their own estimate of the inherent difficulties involved in completing the work under the conditions herein described and shall not claim any added compensation by reason of delay or increased cost due to opening a portion of the contract work.

The Contractor must conform to safety standards contained AC 150/5370-2 and the approved CSPP.

Contractor shall refer to the plans, specifications, and the approved CSPP to identify barricade requirements, temporary and/or permanent markings, airfield lighting, guidance signs and other safety requirements prior to opening up sections of work to traffic.

70-14 CONTRACTOR'S RESPONSIBILITY FOR WORK. Until the RPR's final written acceptance of the entire completed work, excepting only those portions of the work accepted in accordance with Section 50, paragraph 50-14, *Partial Acceptance*, the Contractor shall have the charge and care thereof and shall take every precaution against injury or damage to any part due to the action of the elements or from any other cause, whether arising from the execution or from the non-execution of the work. The Contractor shall rebuild, repair, restore, and make good all injuries or damages to any portion of the work occasioned by any of the above causes before final acceptance and shall bear the expense thereof except damage to the work due to unforeseeable causes beyond the control of and without the fault or negligence of the Contractor, including but not restricted to acts of God such as earthquake, tidal wave, tornado, hurricane or other cataclysmic phenomenon of nature, or acts of the public enemy or of government authorities.

If the work is suspended for any cause whatever, the Contractor shall be responsible for the work and shall take such precautions necessary to prevent damage to the work. The Contractor shall provide for normal drainage and shall erect necessary temporary structures, signs, or other facilities at their own expense. During such period of suspension of work, the Contractor shall properly and continuously maintain in an acceptable growing condition all living material in newly established planting, seeding, and sodding furnished under the contract, and shall take adequate precautions to protect new tree growth and other important vegetative growth against injury.

70-15 CONTRACTOR'S RESPONSIBILITY FOR UTILITY SERVICE AND FACILITIES OF OTHERS. As provided in paragraph 70-04, *Restoration of Surfaces Disturbed by Others*, the Contractor shall cooperate with the owner of any public or private utility service, FAA or NOAA, or a utility service of another government agency that may be authorized by the Owner to construct, reconstruct or maintain such utility services or facilities during the progress of the work. In addition, the Contractor shall control their operations to prevent the unscheduled interruption of such utility services and facilities.

To the extent that such public or private utility services, FAA, or NOAA facilities, or utility services of another governmental agency are known to exist within the limits of the contract work, the approximate locations have been indicated on the plans and/or in the contract documents.

Utility Service or Facility	Person to Contact	Owner's Emergency Contact
FAA-System Support Center Coordinator	Ken McKinney	541-225-8613
City of Eugene/EUG	Keawe Stubenberg	541-682-5944
EUG Airfield Lighting and Communication Fiber	Nate Bushnell	541-682-8354
FAA - Eugene System Support Center	Cathy Chamberlain	541-246-5944

It is understood and agreed that the Owner does not guarantee the accuracy or the completeness of the location information relating to existing utility services, facilities, or structures that may be shown on the plans or encountered in the work. Any inaccuracy or omission in such information shall not relieve the Contractor of the responsibility to protect such existing features from damage or unscheduled interruption of service.

It is further understood and agreed that the Contractor shall, upon execution of the contract, notify the Owners of all utility services or other facilities of their plan of operations. Such notification shall be in writing addressed to "The Person to Contact" as provided in this paragraph and paragraph 70-04, *Restoration of Surfaces Disturbed By Others*. A copy of each notification shall be given to the RPR.

In addition to the general written notification provided, it shall be the responsibility of the Contractor to keep such individual Owners advised of changes in their plan of operations that would affect such Owners.

Prior to beginning the work in the general vicinity of an existing utility service or facility, the Contractor shall again notify each such Owner of their plan of operation. If, in the Contractor's opinion, the Owner's assistance is needed to locate the utility service or facility or the presence of a representative of the Owner is desirable to observe the work, such advice should be included in the notification. Such notification shall be given by the most expeditious means to reach the utility owner's "Person to Contact" no later than two normal business days prior to the Contractor's commencement of operations in such general vicinity. The Contractor shall furnish a written summary of the notification to the RPR.

The Contractor's failure to give the two days' notice shall be cause for the Owner to suspend the Contractor's operations in the general vicinity of a utility service or facility.

Where the outside limits of an underground utility service have been located and staked on the ground, the Contractor shall be required to use hand excavation methods within 3 feet (1 m) of such outside limits at such points as may be required to ensure protection from damage due to the Contractor's operations.

Should the Contractor damage or interrupt the operation of a utility service or facility by accident or otherwise, the Contractor shall immediately notify the proper authority and the RPR and shall take all reasonable measures to prevent further damage or interruption of service. The Contractor, in such events, shall cooperate with the utility service or facility owner and the RPR continuously until such damage has been repaired and service restored to the satisfaction of the utility or facility owner.

The Contractor shall bear all costs of damage and restoration of service to any utility service or facility due to their operations whether due to negligence or accident. The Owner reserves the right to deduct such costs from any monies due or which may become due the Contractor, or their own surety.

70-15.1 FAA FACILITIES AND CABLE RUNS. The Contractor is hereby advised that the construction limits of the project include existing facilities and buried cable runs that are owned, operated and maintained by the FAA. The Contractor, during the execution of the project work, shall comply with the following:

a. The Contractor shall permit FAA maintenance personnel the right of access to the project work site for purposes of inspecting and maintaining all existing FAA owned facilities.

b. The Contractor shall provide notice to the FAA Air Traffic Organization (ATO)/Technical Operations/System Support Center (SSC) Point-of-Contact through the Airport Operations a minimum of seven (7) calendar days prior to commencement of construction activities in order to permit sufficient time to locate and mark existing buried cables and to schedule any required facility outages.

c. If execution of the project work requires a facility outage, the Contractor shall contact the FAA Point-of-Contact a minimum of 72 hours prior to the time of the required outage.

d. Any damage to FAA cables, access roads, or FAA facilities during construction caused by the Contractor's equipment or personnel whether by negligence or accident will require the Contractor to repair or replace the damaged cables, access road, or FAA facilities to FAA requirements. The Contractor shall not bear the cost to repair damage to underground facilities or utilities improperly located by the FAA.

e. If the project work requires the cutting or splicing of FAA owned cables, the FAA Point-of-Contact shall be contacted a minimum of 72 hours prior to the time the cable work commences. The FAA reserves the right to have a FAA representative on site to observe the splicing of the cables as a condition of acceptance. All cable splices are to be accomplished in accordance with FAA specifications and require approval by the FAA Point-of-Contact as a condition of acceptance by the Owner. The Contractor is hereby advised that FAA restricts the location of where splices may be installed. If a cable splice is required in a location that is not permitted by FAA, the Contractor shall furnish and install a sufficient length of new cable that eliminates the need for any splice.

70-16 FURNISHING RIGHTS-OF-WAY. The Owner will be responsible for furnishing all rights-of-way upon which the work is to be constructed in advance of the Contractor's operations.

70-17 PERSONAL LIABILITY OF PUBLIC OFFICIALS. In carrying out any of the contract provisions or in exercising any power or authority granted by this contract, there shall be no liability upon the Engineer, RPR, their authorized representatives, or any officials of the Owner either personally or as an official of the Owner. It is understood that in such matters they act solely as agents and representatives of the Owner.

70-18 NO WAIVER OF LEGAL RIGHTS. Upon completion of the work, the Owner will expeditiously make final inspection and notify the Contractor of final acceptance. Such final acceptance, however, shall not preclude or stop the Owner from correcting any measurement, estimate, or certificate made before or after completion of the work, nor shall the Owner be precluded or stopped from recovering from the Contractor or their surety, or both, such overpayment as may be sustained, or by failure on the part of the Contractor to fulfill their obligations under the contract. A waiver on the part of the Owner of any breach of any part of the contract shall not be held to be a waiver of any other or subsequent breach.

The Contractor, without prejudice to the terms of the contract, shall be liable to the Owner for latent defects, fraud, or such gross mistakes as may amount to fraud, or as regards the Owner's rights under any warranty or guaranty.

70-19 ENVIRONMENTAL PROTECTION. The Contractor shall comply with all federal, state, and local laws and regulations controlling pollution of the environment. The Contractor shall take necessary precautions to prevent pollution of streams, lakes, ponds, and reservoirs with fuels, oils, asphalts, chemicals, or other harmful materials and to prevent pollution of the atmosphere from particulate and gaseous matter.

- A. STREAKED HORNED LARK.** A threatened species, the streaked horned lark, is located within the project site. During construction, a biologist will be on site to performing weekly field surveys. The contractor is to take reasonable precautions to reduce harm to the bird. If a bird is injured or killed, the contractor is to immediately notify the RPR.
- B. WETLANDS.** The Eugene Airport contains areas of wetlands outside the project area. The contractor shall not dispose of any material on airport property.

70-20 ARCHAEOLOGICAL AND HISTORICAL FINDINGS. Unless otherwise specified in this subsection, the Contractor is advised that the site of the work is not within any property, district, or site, and does not contain any building, structure, or object listed in the current National Register of Historic Places published by the United States Department of Interior.

Should the Contractor encounter, during their operations, any building, part of a building, structure, or object that is incongruous with its surroundings, the Contractor shall immediately cease operations in that location and notify the RPR. The RPR will immediately investigate the Contractor's finding and the Owner will direct the Contractor to either resume operations or to suspend operations as directed.

Should the Owner order suspension of the Contractor's operations in order to protect an archaeological or historical finding, or order the Contractor to perform extra work, such shall be covered by an appropriate contract change order or supplemental agreement as provided in Section 40, paragraph 40-04, *Extra Work*, and Section 90, paragraph 90-05, *Payment for Extra Work*. If appropriate, the contract change order or supplemental agreement shall include an extension of contract time in accordance with Section 80, paragraph 80-07, *Determination and Extension of Contract Time*.

70-21 INSURANCE REQUIREMENTS. See Invitation to Bid.

END OF SECTION 70

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SECTION 80 EXECUTION AND PROGRESS

80-01 SUBLETTING OF CONTRACT. The Owner will not recognize any subcontractor on the work. The Contractor shall at all times when work is in progress be represented either in person, by a qualified superintendent, or by other designated, qualified representative who is duly authorized to receive and execute orders of the Resident Project Representative (RPR).

The Contractor shall perform, with his organization, an amount of work equal to at least **30** percent of the total contract cost.

Should the Contractor elect to assign their contract, said assignment shall be concurred in by the surety, shall be presented for the consideration and approval of the Owner, and shall be consummated only on the written approval of the Owner.

The Contractor shall provide copies of all subcontracts to the RPR 14 days prior to being utilized on the project. As a minimum, the information shall include the following:

- Subcontractor's legal company name.
- Subcontractor's legal company address, including County name.
- Principal contact person's name, telephone and fax number.
- Complete narrative description, and dollar value of the work to be performed by the subcontractor.
- Copies of required insurance certificates in accordance with the specifications.
- Minority/ non-minority status.

80-02 NOTICE TO PROCEED (NTP). The Owners notice to proceed will state the date on which contract time commences. The Contractor is expected to commence project operations within 10 days of the NTP date. The Contractor shall notify the RPR at least 24 hours in advance of the time contract operations begins. The Contractor shall not commence any actual operations prior to the date on which the notice to proceed is issued by the Owner.

80-03 EXECUTION AND PROGRESS. Unless otherwise specified, the Contractor shall submit their coordinated construction schedule showing all work activities for the RPR's review and acceptance at least 10 days prior to the start of work. The Contractor's progress schedule, once accepted by the RPR, will represent the Contractor's baseline plan to accomplish the project in accordance with the terms and conditions of the Contract. The RPR will compare actual Contractor progress against the baseline schedule to determine that status of the Contractor's performance. The Contractor shall provide sufficient materials, equipment, and labor to guarantee the completion of the project in accordance with the plans and specifications within the time set forth in the proposal.

If the Contractor falls significantly behind the submitted schedule, the Contractor shall, upon the RPR's request, submit a revised schedule for completion of the work within the contract time and modify their operations to provide such additional materials, equipment, and labor necessary to meet the revised schedule. Should the execution of the work be discontinued for any reason, the Contractor shall notify the RPR at least 24 hours in advance of resuming operations.

The Contractor shall not commence any actual construction prior to the date on which the NTP is issued by the Owner.

The project schedule shall be prepared as a network diagram in Critical Path Method (CPM), Program Evaluation and Review Technique (PERT), or other format, or as otherwise specified. It shall include information on the sequence of work activities, milestone dates, and activity duration. The schedule shall show all work items identified in the project proposal for each work area and shall include the project start date and end date.

The Contractor shall maintain the work schedule and provide an update and analysis of the progress schedule on a twice monthly basis, or as otherwise specified in the contract. Submission of the work schedule shall not relieve the Contractor of overall responsibility for scheduling, sequencing, and coordinating all work to comply with the requirements of the contract.

80-04 LIMITATION OF OPERATIONS. The Contractor shall control their operations and the operations of their subcontractors and all suppliers to provide for the free and unobstructed movement of aircraft in the air operations areas (AOA) of the airport.

When the work requires the Contractor to conduct their operations within an AOA of the airport, the work shall be coordinated with airport operations (through the RPR) at least 48 hours prior to commencement of such work. The Contractor shall not close an AOA until so authorized by the RPR and until the necessary temporary marking, signage and associated lighting is in place as provided in Section 70, paragraph 70-08, *Construction Safety and Phasing Plan (CSPP)*.

When the contract work requires the Contractor to work within an AOA of the airport on an intermittent basis (intermittent opening and closing of the AOA), the Contractor shall maintain constant communications as specified; immediately obey all instructions to vacate the AOA; and immediately obey all instructions to resume work in such AOA. Failure to maintain the specified communications or to obey instructions shall be cause for suspension of the Contractor's operations in the AOA until satisfactory conditions are provided. The areas of the AOA identified in the Construction Safety Phasing Plan (CSPP) and as listed below, cannot be closed to operating aircraft to permit the Contractor's operations on a continuous basis and will therefore be closed to aircraft operations intermittently as follows: Refer to CSPP.

The Contractor shall be required to conform to safety standards contained in AC 150/5370-2, Operational Safety on Airports During Construction and the approved CSPP.

80-04.1 OPERATIONAL SAFETY ON AIRPORT DURING CONSTRUCTION. All Contractors' operations shall be conducted in accordance with the approved project Construction Safety and Phasing Plan (CSPP) and the Safety Plan Compliance Document (SPCD) and the provisions set forth within the current version of AC 150/5370-2, Operational Safety on Airports During Construction. The CSPP included within the contract documents conveys minimum requirements for operational safety on the airport during construction activities. The Contractor shall prepare and submit a SPCD that details how it proposes to comply with the requirements presented within the CSPP.

The Contractor shall implement all necessary safety plan measures prior to commencement of any work activity. The Contractor shall conduct routine checks to assure compliance with the safety plan measures.

The Contractor is responsible to the Owner for the conduct of all subcontractors it employs on the project. The Contractor shall assure that all subcontractors are made aware of the requirements of the CSPP and SPCD and that they implement and maintain all necessary measures.

No deviation or modifications may be made to the approved CSPP and SPCD unless approved in writing by the Owner. The necessary coordination actions to review Contractor proposed modifications to an approved CSPP or approved SPCD can require a significant amount of time.

80-05 CHARACTER OF WORKERS, METHODS, AND EQUIPMENT. The Contractor shall, at all times, employ sufficient labor and equipment for prosecuting the work to full completion in the manner and time required by the contract, plans, and specifications.

All workers shall have sufficient skill and experience to perform properly the work assigned to them. Workers engaged in special work or skilled work shall have sufficient experience in such work and in the operation of the equipment required to perform the work satisfactorily.

Any person employed by the Contractor or by any subcontractor who violates any operational regulations or operational safety requirements and, in the opinion of the RPR, does not perform his work in a proper and skillful manner or is intemperate or disorderly shall, at the written request of the RPR, be removed immediately by the Contractor or subcontractor employing such person, and shall not be employed again in any portion of the work without approval of the RPR.

Should the Contractor fail to remove such person or persons, or fail to furnish suitable and sufficient personnel for the proper execution of the work, the RPR may suspend the work by written notice until compliance with such orders.

All equipment that is proposed to be used on the work shall be of sufficient size and in such mechanical condition as to meet requirements of the work and to produce a satisfactory quality of work. Equipment used on any portion of the work shall not cause injury to previously completed work, adjacent property, or existing airport facilities due to its use.

When the methods and equipment to be used by the Contractor in accomplishing the work are not prescribed in the contract, the Contractor is free to use any methods or equipment that will accomplish the work in conformity with the requirements of the contract, plans, and specifications.

When the contract specifies the use of certain methods and equipment, such methods and equipment shall be used unless otherwise authorized by the RPR. If the Contractor desires to use a method or type of equipment other than specified in the contract, the Contractor may request authority from the RPR to do so. The request shall be in writing and shall include a full description of the methods and equipment proposed and of the reasons for desiring to make the change. If approval is given, it will be on the condition that the Contractor will be fully responsible for producing work in conformity with contract requirements. If, after trial use of the substituted methods or equipment, the RPR determines that the work produced does not meet contract requirements, the Contractor shall discontinue the use of the substitute method or equipment and shall complete the remaining work with the specified methods and equipment. The Contractor shall remove any deficient work and replace it with work of specified quality, or take such other corrective action as the RPR may direct. No change will be made in basis of payment for the contract items involved nor in contract time as a result of authorizing a change in methods or equipment under this paragraph.

80-06 TEMPORARY SUSPENSION OF THE WORK. The Owner shall have the authority to suspend the work wholly, or in part, for such period or periods the Owner may deem necessary, due to unsuitable weather, or other conditions considered unfavorable for the execution of the work, or for such time necessary due to the failure on the part of the Contractor to carry out orders given or perform any or all provisions of the contract.

In the event that the Contractor is ordered by the Owner, in writing, to suspend work for some unforeseen cause not otherwise provided for in the contract and over which the Contractor has no control, the Contractor may be reimbursed for actual money expended on the work during the period of shutdown. No allowance will be made for anticipated profits. The period of shutdown shall be computed from the effective date of the written order to suspend work to the effective date of the written order to resume the work. Claims for such compensation shall be filed with the RPR within the time period stated in the RPR's order to resume work. The Contractor shall submit with their own claim information substantiating the amount shown on the claim. The RPR will forward the Contractor's claim to the Owner for consideration in

accordance with local laws or ordinances. No provision of this article shall be construed as entitling the Contractor to compensation for delays due to inclement weather or for any other delay provided for in the contract, plans, or specifications.

If it becomes necessary to suspend work for an indefinite period, the Contractor shall store all materials in such manner that they will not become an obstruction nor become damaged in any way. The Contractor shall take every precaution to prevent damage or deterioration of the work performed and provide for normal drainage of the work. The Contractor shall erect temporary structures where necessary to provide for traffic on, to, or from the airport.

80-07 DETERMINATION AND EXTENSION OF CONTRACT TIME. The number of calendar days or shall be stated in the proposal and contract and shall be known as the Contract Time.

If the contract time requires extension for reasons beyond the Contractor's control, it shall be adjusted as follows:

80-07.1 CONTRACT TIME BASED ON CALENDAR DAYS. Contract Time based on calendar days shall consist of the number of calendar days stated in the contract counting from the effective date of the Notice to Proceed and including all Saturdays, Sundays, holidays, and non-work days. All calendar days elapsing between the effective dates of the Owner's orders to suspend and resume all work, due to causes not the fault of the Contractor, shall be excluded.

At the time of final payment, the contract time shall be increased in the same proportion as the cost of the actually completed quantities bears to the cost of the originally estimated quantities in the proposal. Such increase in the contract time shall not consider either cost of work or the extension of contract time that has been covered by a change order or supplemental agreement. Charges against the contract time will cease as of the date of final acceptance.

80-08 FAILURE TO COMPLETE ON TIME. For each calendar day, as specified in the contract, that any work remains uncompleted after the contract time (including all extensions and adjustments as provided in paragraph 80-07, *Determination and Extension of Contract Time*) the sum specified in the contract and proposal as liquidated damages (LD) will be deducted from any money due or to become due the Contractor or their own surety. Such deducted sums shall not be deducted as a penalty but shall be considered as liquidation of a reasonable portion of damages including but not limited to additional engineering services that will be incurred by the Owner should the Contractor fail to complete the work in the time provided in their contract.

Milestone/Phase	Liquidated Damages Cost	Allowed Construction Time
Phase 1 Work Complete – Milestone 1	\$1,000/Day	45 Calendar Days
Phase 2 Work Complete – Milestone 2	\$1,000/Day	15 Calendar Days
Phase 3 Work Complete – Milestone 3	\$1,000/Day	15 Calendar Days
Project Complete – Milestone 4	\$1,000/Day	75 Calendar Days

The maximum construction time allowed shall not be more than **75** calendar days. Permitting the Contractor to continue and finish the work or any part of it after the time fixed for its completion, or after the date to which the time for completion may have been extended, will in no way operate as a waiver on the part of the Owner of any of its rights under the contract.

80-09 DEFAULT AND TERMINATION OF CONTRACT. The Contractor shall be considered in default of their contract and such default will be considered as cause for the Owner to terminate the contract for any of the following reasons, if the Contractor:

- a. Fails to begin the work under the contract within the time specified in the Notice to Proceed, or
- b. Fails to perform the work or fails to provide sufficient workers, equipment and/or materials to assure completion of work in accordance with the terms of the contract, or
- c. Performs the work unsuitably or neglects or refuses to remove materials or to perform anew such work as may be rejected as unacceptable and unsuitable, or
- d. Discontinues the execution of the work, or
- e. Fails to resume work which has been discontinued within a reasonable time after notice to do so, or
- f. Becomes insolvent or is declared bankrupt, or commits any act of bankruptcy or insolvency, or
- g. Allows any final judgment to stand against the Contractor unsatisfied for a period of 10 days, or
- h. Makes an assignment for the benefit of creditors, or
- i. For any other cause whatsoever, fails to carry on the work in an acceptable manner.

Should the Owner consider the Contractor in default of the contract for any reason above, the Owner shall immediately give written notice to the Contractor and the Contractor's surety as to the reasons for considering the Contractor in default and the Owner's intentions to terminate the contract.

If the Contractor or surety, within a period of 10 days after such notice, does not proceed in accordance therewith, then the Owner will, upon written notification from the RPR of the facts of such delay, neglect, or default and the Contractor's failure to comply with such notice, have full power and authority without violating the contract, to take the execution of the work out of the hands of the Contractor. The Owner may appropriate or use any or all materials and equipment that have been mobilized for use in the work and are acceptable and may enter into an agreement for the completion of said contract according to the terms and provisions thereof, or use such other methods as in the opinion of the RPR will be required for the completion of said contract in an acceptable manner.

All costs and charges incurred by the Owner, together with the cost of completing the work under contract, will be deducted from any monies due or which may become due the Contractor. If such expense exceeds the sum which would have been payable under the contract, then the Contractor and the surety shall be liable and shall pay to the Owner the amount of such excess.

80-10 TERMINATION FOR NATIONAL EMERGENCIES. The Owner shall terminate the contract or portion thereof by written notice when the Contractor is prevented from proceeding with the construction contract as a direct result of an Executive Order of the President with respect to the execution of war or in the interest of national defense.

When the contract, or any portion thereof, is terminated before completion of all items of work in the contract, payment will be made for the actual number of units or items of work completed at the contract price or as mutually agreed for items of work partially completed or not started. No claims or loss of anticipated profits shall be considered.

Reimbursement for organization of the work, and other overhead expenses, (when not otherwise included in the contract) and moving equipment and materials to and from the job will be considered, the intent being that an equitable settlement will be made with the Contractor.

Acceptable materials, obtained or ordered by the Contractor for the work and that are not incorporated in the work shall, at the option of the Contractor, be purchased from the Contractor at actual cost as shown by receipted bills and actual cost records at such points of delivery as may be designated by the RPR.

Termination of the contract or a portion thereof shall neither relieve the Contractor of their responsibilities for the completed work nor shall it relieve their surety of its obligation for and concerning any just claim arising out of the work performed.

80-11 WORK AREA, STORAGE AREA AND SEQUENCE OF OPERATIONS. The Contractor shall obtain approval from the RPR prior to beginning any work in all areas of the airport. No operating runway, taxiway, or air operations area (AOA) shall be crossed, entered, or obstructed while it is operational. The Contractor shall plan and coordinate work in accordance with the approved CSPP and SPCD.

END OF SECTION 80

SECTION 90 MEASUREMENT AND PAYMENT

90-01 MEASUREMENT OF QUANTITIES. All work completed under the contract will be measured by the RPR, or their authorized representatives, using United States Customary Units of Measurement.

The method of measurement and computations to be used in determination of quantities of material furnished and of work performed under the contract will be those methods generally recognized as conforming to good engineering practice.

Unless otherwise specified, longitudinal measurements for area computations will be made horizontally, and no deductions will be made for individual fixtures (or leave-outs) having an area of 9 square feet or less. Unless otherwise specified, transverse measurements for area computations will be the neat dimensions shown on the plans or ordered in writing by the RPR.

Unless otherwise specified, all contract items which are measured by the linear foot such as electrical ducts, conduits, pipe culverts, underdrains, and similar items shall be measured parallel to the base or foundation upon which such items are placed.

The term “lump sum” when used as an item of payment will mean complete payment for the work described in the contract. When a complete structure or structural unit (in effect, “lump sum” work) is specified as the unit of measurement, the unit will be construed to include all necessary fittings and accessories.

When requested by the Contractor and approved by the RPR in writing, material specified to be measured by the cubic yard may be weighed, and such weights will be converted to cubic yards for payment purposes. Factors for conversion from weight measurement to volume measurement will be determined by the RPR and shall be agreed to by the Contractor before such method of measurement of pay quantities is used. The following is for reference only. Refer to each specification for Method of Measurement and Basis of Payment for each item.

Measurement and Payment Terms

Term	Description
Excavation and Embankment Volume	In computing volumes of excavation, the average end area method will be used unless otherwise specified.
Measurement and Proportion by Weight	The term “ton” will mean the short ton consisting of 2,000 pounds avoirdupois. All materials that are measured or proportioned by weights shall be weighed on accurate, independently certified scales by competent, qualified personnel at locations designated by the RPR. If material is shipped by rail, the car weight may be accepted provided that only the actual weight of material is paid for. However, car weights will not be acceptable for material to be passed through mixing plants. Trucks used to haul material being paid for by weight shall be weighed empty daily at such times as the RPR directs, and each truck shall bear a plainly legible identification mark.

Term	Description
Measurement by Volume	Materials to be measured by volume in the hauling vehicle shall be hauled in approved vehicles and measured therein at the point of delivery. Vehicles for this purpose may be of any size or type acceptable for the materials hauled, provided that the body is of such shape that the actual contents may be readily and accurately determined. All vehicles shall be loaded to at least their water level capacity, and all loads shall be leveled when the vehicles arrive at the point of delivery.
Asphalt Material	Asphalt materials will be measured by the gallon or ton. When measured by volume, such volumes will be measured at 60°F or will be corrected to the volume at 60°F using ASTM D1250 for asphalts. Net certified scale weights or weights based on certified volumes in the case of rail shipments will be used as a basis of measurement, subject to correction when asphalt material has been lost from the car or the distributor, wasted, or otherwise not incorporated in the work. When asphalt materials are shipped by truck or transport, net certified weights by volume, subject to correction for loss or foaming, will be used for computing quantities.
Cement	Cement will be measured by the ton or hundredweight.
Structure	Structures will be measured according to neat lines shown on the plans or as altered to fit field conditions.
Timber	Timber will be measured by the thousand feet board measure (MFBM) actually incorporated in the structure. Measurement will be based on nominal widths and thicknesses and the extreme length of each piece.
Plates and Sheets	The thickness of plates and galvanized sheet used in the manufacture of corrugated metal pipe, metal plate pipe culverts and arches, and metal cribbing will be specified and measured in decimal fraction of inch.
Miscellaneous Items	When standard manufactured items are specified such as fence, wire, plates, rolled shapes, pipe conduit, etc., and these items are identified by gauge, unit weight, section dimensions, etc., such identification will be considered to be nominal weights or dimensions. Unless more stringently controlled by tolerances in cited specifications, manufacturing tolerances established by the industries involved will be accepted.
Scales	Scales must be tested for accuracy and serviced before use. Scales for weighing materials which are required to be proportioned or measured and paid for by weight shall be furnished, erected, and maintained by the Contractor, or be certified permanently installed commercial scales. Platform scales shall be installed and maintained with the platform level and rigid bulkheads at each end. Scales shall be accurate within 0.5% of the correct weight throughout the range of use. The Contractor shall have the scales checked under the observation of the RPR before beginning work and at such other times as requested. The intervals shall be uniform in spacing throughout the graduated or marked length of the beam or dial and shall not exceed 0.1% of the nominal rated capacity of the

Term	Description
	scale, but not less than one pound. The use of spring balances will not be permitted. In the event inspection reveals the scales have been “overweighing” (indicating more than correct weight) they will be immediately adjusted. All materials received subsequent to the last previous correct weighting-accuracy test will be reduced by the percentage of error in excess of 0.5%. In the event inspection reveals the scales have been under-weighing (indicating less than correct weight), they shall be immediately adjusted. No additional payment to the Contractor will be allowed for materials previously weighed and recorded. Beams, dials, platforms, and other scale equipment shall be so arranged that the operator and the RPR can safely and conveniently view them. Scale installations shall have available ten standard 50-pound weights for testing the weighing equipment or suitable weights and devices for other approved equipment. All costs in connection with furnishing, installing, certifying, testing, and maintaining scales; for furnishing check weights and scale house; and for all other items specified in this subsection, for the weighing of materials for proportioning or payment, shall be included in the unit contract prices for the various items of the project.
Rental Equipment	Rental of equipment will be measured by time in hours of actual working time and necessary traveling time of the equipment within the limits of the work. Special equipment ordered in connection with extra work will be measured as agreed in the change order or supplemental agreement authorizing such work as provided in paragraph 90-05 <i>Payment for Extra Work</i>.
Pay Quantities	When the estimated quantities for a specific portion of the work are designated as the pay quantities in the contract, they shall be the final quantities for which payment for such specific portion of the work will be made, unless the dimensions of said portions of the work shown on the plans are revised by the RPR. If revised dimensions result in an increase or decrease in the quantities of such work, the final quantities for payment will be revised in the amount represented by the authorized changes in the dimensions.

90-02 SCOPE OF PAYMENT. The Contractor shall receive and accept compensation provided for in the contract as full payment for furnishing all materials, for performing all work under the contract in a complete and acceptable manner, and for all risk, loss, damage, or expense of whatever character arising out of the nature of the work or the execution thereof, subject to the provisions of Section 70, paragraph 70-18, *No Waiver of Legal Rights*.

When the “basis of payment” subsection of a technical specification requires that the contract price (price bid) include compensation for certain work or material essential to the item, this same work or material will not also be measured for payment under any other contract item which may appear elsewhere in the contract, plans, or specifications.

90-03 COMPENSATION FOR ALTERED QUANTITIES. When the accepted quantities of work vary from the quantities in the proposal, the Contractor shall accept as payment in full, so far as contract items are concerned, payment at the original contract price for the accepted quantities of work actually completed and accepted. No allowance, except as provided for in Section 40, paragraph 40-02, *Alteration of Work and Quantities*, will be made for any increased expense, loss of expected reimbursement, or loss of anticipated profits suffered or claimed by the Contractor which results directly from such alterations or indirectly from their own unbalanced allocation of overhead and profit among the contract items, or from any other cause.

90-04 PAYMENT FOR OMITTED ITEMS. As specified in Section 40, paragraph 40-03, *Omitted Items*, the RPR shall have the right to omit from the work (order nonperformance) any contract item, except major contract items, in the best interest of the Owner.

Should the RPR omit or order nonperformance of a contract item or portion of such item from the work, the Contractor shall accept payment in full at the contract prices for any work actually completed and acceptable prior to the RPR's order to omit or non-perform such contract item.

Acceptable materials ordered by the Contractor or delivered on the work prior to the date of the RPR's order will be paid for at the actual cost to the Contractor and shall thereupon become the property of the Owner.

In addition to the reimbursement hereinbefore provided, the Contractor shall be reimbursed for all actual costs incurred for the purpose of performing the omitted contract item prior to the date of the RPR's order. Such additional costs incurred by the Contractor must be directly related to the deleted contract item and shall be supported by certified statements by the Contractor as to the nature the amount of such costs.

90-05 PAYMENT FOR EXTRA WORK. Extra work, performed in accordance with Section 40, paragraph 40-04, *Extra Work*, will be paid for at the contract prices or agreed prices specified in the change order or supplemental agreement authorizing the extra work.

90-06 PARTIAL PAYMENTS. Partial payments will be made to the Contractor at least once each month as the work progresses. Said payments will be based upon estimates, prepared by the RPR, of the value of the work performed and materials complete and in place, in accordance with the contract, plans, and specifications. Such partial payments may also include the delivered actual cost of those materials stockpiled and stored in accordance with paragraph 90-07, *Payment for Materials on Hand*. No partial payment will be made when the amount due to the Contractor since the last estimate amounts to less than five hundred dollars.

a. From the total of the amount determined to be payable on a partial payment, ten (10) percent of such total amount will be deducted and retained by the Owner for protection of the Owner's interests. Unless otherwise instructed by the Owner, the amount retained by the Owner will be in effect until the final payment is made except as follows:

1. Contractor may request release of retainage on work that has been partially accepted by the Owner in accordance with Section 50-03. Contractor must provide a certified invoice to the RPR that supports the value of retainage held by the Owner for partially accepted work.

2. In lieu of retainage, the Contractor may exercise at its option the establishment of an escrow account per paragraph 90-08.

b. The Contractor is required to pay all subcontractors for satisfactory performance of their contracts no later than 30 days after the Contractor has received a partial payment. Contractor must provide the Owner evidence of prompt and full payment of retainage held by the prime Contractor to the subcontractor within 30 days after the subcontractor's work is satisfactorily completed. A subcontractor's work is satisfactorily completed when all the tasks called for

in the subcontract have been accomplished and documented as required by the Owner. When the Owner has made an incremental acceptance of a portion of a prime contract, the work of a subcontractor covered by that acceptance is deemed to be satisfactorily completed.

c. When at least 95% of the work has been completed to the satisfaction of the RPR, the RPR shall, at the Owner's discretion and with the consent of the surety, prepare estimates of both the contract value and the cost of the remaining work to be done. The Owner may retain an amount not less than twice the contract value or estimated cost, whichever is greater, of the work remaining to be done. The remainder, less all previous payments and deductions, will then be certified for payment to the Contractor.

It is understood and agreed that the Contractor shall not be entitled to demand or receive partial payment based on quantities of work in excess of those provided in the proposal or covered by approved change orders or supplemental agreements, except when such excess quantities have been determined by the RPR to be a part of the final quantity for the item of work in question.

No partial payment shall bind the Owner to the acceptance of any materials or work in place as to quality or quantity. All partial payments are subject to correction at the time of final payment as provided in paragraph 90-09, *Acceptance and Final Payment*.

The Contractor shall deliver to the Owner a complete release of all claims for labor and material arising out of this contract before the final payment is made. If any subcontractor or supplier fails to furnish such a release in full, the Contractor may furnish a bond or other collateral satisfactory to the Owner to indemnify the Owner against any potential lien or other such claim. The bond or collateral shall include all costs, expenses, and attorney fees the Owner may be compelled to pay in discharging any such lien or claim.

90-07 PAYMENT FOR MATERIALS ON HAND. Partial payments may be made to the extent of the delivered cost of materials to be incorporated in the work, provided that such materials meet the requirements of the contract, plans, and specifications and are delivered to acceptable sites on the airport property or at other sites in the vicinity that are acceptable to the Owner. Such delivered costs of stored or stockpiled materials may be included in the next partial payment after the following conditions are met:

- a. The material has been stored or stockpiled in a manner acceptable to the RPR at or on an approved site.
- b. The Contractor has furnished the RPR with acceptable evidence of the quantity and quality of such stored or stockpiled materials.
- c. The Contractor has furnished the RPR with satisfactory evidence that the material and transportation costs have been paid.
- d. The Contractor has furnished the Owner legal title (free of liens or encumbrances of any kind) to the material stored or stockpiled.
- e. The Contractor has furnished the Owner evidence that the material stored or stockpiled is insured against loss by damage to or disappearance of such materials at any time prior to use in the work.

It is understood and agreed that the transfer of title and the Owner's payment for such stored or stockpiled materials shall in no way relieve the Contractor of their responsibility for furnishing and placing such materials in accordance with the requirements of the contract, plans, and specifications.

In no case will the amount of partial payments for materials on hand exceed the contract price for such materials or the contract price for the contract item in which the material is intended to be used.

No partial payment will be made for stored or stockpiled living or perishable plant materials.

The Contractor shall bear all costs associated with the partial payment of stored or stockpiled materials in accordance with the provisions of this paragraph.

90-08 PAYMENT OF WITHHELD FUNDS. At the Contractor's option, if an Owner withholds retainage in accordance with the methods described in paragraph 90-06 *Partial Payments*, the Contractor may request that the Owner deposit the retainage into an escrow account. The Owner's deposit of retainage into an escrow account is subject to the following conditions:

- a. The Contractor shall bear all expenses of establishing and maintaining an escrow account and escrow agreement acceptable to the Owner.
- b. The Contractor shall deposit to and maintain in such escrow only those securities or bank certificates of deposit as are acceptable to the Owner and having a value not less than the retainage that would otherwise be withheld from partial payment.
- c. The Contractor shall enter into an escrow agreement satisfactory to the Owner.
- d. The Contractor shall obtain the written consent of the surety to such agreement.

90-09 ACCEPTANCE AND FINAL PAYMENT. When the contract work has been accepted in accordance with the requirements of Section 50, paragraph 50-15, *Final Acceptance*, the RPR will prepare the final estimate of the items of work actually performed. The Contractor shall approve the RPR's final estimate or advise the RPR of the Contractor's objections to the final estimate which are based on disputes in measurements or computations of the final quantities to be paid under the contract as amended by change order or supplemental agreement. The Contractor and the RPR shall resolve all disputes (if any) in the measurement and computation of final quantities to be paid within 30 calendar days of the Contractor's receipt of the RPR's final estimate. If, after such 30-day period, a dispute still exists, the Contractor may approve the RPR's estimate under protest of the quantities in dispute, and such disputed quantities shall be considered by the Owner as a claim in accordance with Section 50, paragraph 50-16, *Claims for Adjustment and Disputes*.

After the Contractor has approved, or approved under protest, the RPR's final estimate, and after the RPR's receipt of the project closeout documentation required in paragraph 90-11, *Contractor Final Project Documentation*, final payment will be processed based on the entire sum, or the undisputed sum in case of approval under protest, determined to be due the Contractor less all previous payments and all amounts to be deducted under the provisions of the contract. All prior partial estimates and payments shall be subject to correction in the final estimate and payment.

If the Contractor has filed a claim for additional compensation under the provisions of Section 50, paragraph 50-16, *Claims for Adjustments and Disputes*, or under the provisions of this paragraph, such claims will be considered by the Owner in accordance with local laws or ordinances. Upon final adjudication of such claims, any additional payment determined to be due the Contractor will be paid pursuant to a supplemental final estimate.

90-10 CONSTRUCTION WARRANTY.

- a. In addition to any other warranties in this contract, the Contractor warrants that work performed under this contract conforms to the contract requirements and is free of any defect in equipment, material, workmanship, or design furnished, or performed by the Contractor or any subcontractor or supplier at any tier.
- b. This warranty shall continue for a period of one year from the date of final acceptance of the work, except as noted. If the Owner takes possession of any part of the work before final acceptance, this warranty shall continue for a period of one year from the date the Owner takes possession. However, this will not relieve the Contractor from corrective items required by the final acceptance of the project work. Light Emitting Diode emitting diode (LED) light fixtures with the exception of

obstruction lighting, must be warranted by the manufacturer for a minimum of four (4) years after date of installation inclusive of all electronics.

c. The Contractor shall remedy at the Contractor's expense any failure to conform, or any defect. In addition, the Contractor shall remedy at the Contractor's expense any damage to Owner real or personal property, when that damage is the result of the Contractor's failure to conform to contract requirements; or any defect of equipment, material, workmanship, or design furnished by the Contractor.

d. The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause. The Contractor's warranty with respect to work repaired or replaced will run for one year from the date of repair or replacement.

e. The Owner will notify the Contractor, in writing, within seven (7) days after the discovery of any failure, defect, or damage.

f. If the Contractor fails to remedy any failure, defect, or damage within 14 days after receipt of notice, the Owner shall have the right to replace, repair, or otherwise remedy the failure, defect, or damage at the Contractor's expense.

g. With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall: (1) Obtain all warranties that would be given in normal commercial practice; (2) Require all warranties to be executed, in writing, for the benefit of the Owner, as directed by the Owner, and (3) Enforce all warranties for the benefit of the Owner.

h. This warranty shall not limit the Owner's rights with respect to latent defects, gross mistakes, or fraud.

90-11 Contractor Final Project Documentation. Approval of final payment to the Contractor is contingent upon completion and submittal of the items listed below. The final payment will not be approved until the RPR approves the Contractor's final submittal. The Contractor shall:

a. Provide two (2) copies of all manufacturers warranties specified for materials, equipment, and installations.

b. Provide weekly payroll records (not previously received) from the general Contractor and all subcontractors.

c. Complete final cleanup in accordance with Section 40, paragraph 40-08, *Final Cleanup*.

d. Complete all punch list items identified during the Final Inspection.

e. Provide complete release of all claims for labor and material arising out of the Contract.

f. Provide a certified statement signed by the subcontractors, indicating actual amounts paid to the Disadvantaged Business Enterprise (DBE) subcontractors and/or suppliers associated with the project.

g. When applicable per state requirements, return copies of sales tax completion forms.

h. Manufacturer's certifications for all items incorporated in the work.

i. All required record drawings, as-built drawings or as-constructed drawings.

j. Project Operation and Maintenance (O&M) Manual(s).

k. Security for Construction Warranty.

l. Equipment commissioning documentation submitted, if required.

END OF SECTION 90

SPECIAL CONDITIONS

SECTION 1

AIRPORT SECURITY

1-01 This project takes place within the restricted areas of the Eugene Airport. The airport is required under Federal law to control access to the restricted areas of the airport by issuing security access media (Identification Badges). Specifically, this project takes place within the Security Identification Display Area (SIDA) and Secured SIDA badges will be required.

Upon receiving the notification of award for the project, the Contractor is encouraged to immediately start the badging process by contacting Airport Credentialing Office (541) 682-6636. The contractor can designate up to three representatives to be a (signatory authority) who will authorize the issuance of badges to employees for unescorted access to restricted areas. Signature Authority Training will have to be completed before the process can begin for any other employees.

Fingerprint Submission forms and Badge Application will be completed via AirBadge. See Badging & Credentialing page on Eugene Airport website for additional information.

1-02 SECURITY PROGRAM

- a) The Transportation Security Administration (TSA) requires EUG to control access and prevent unauthorized persons from entering Air Operations Area (AOA) or the SIDA (Security Identification Display Area). In compliance with this requirement, EUG has established procedures to authorize or deny access to the AOA and SIDA and to identify and control persons while in these areas.
- b) The Contractor and subcontractors shall designate at the Pre-construction conference those individuals requiring Secured SIDA identification badges. Only those individuals issued badges will be authorized to use them.

1-03 VEHICLE INSPECTIONS

- a) All vehicles entering the AOA and/or SIDA shall be inspected by Airport Operations prior to entry. Call 954-6584 for inspection.

1-04 AIR OPERATIONS AREA (AOA) ENTRY CONTROL

- a) The Contractor is responsible for preventing unauthorized access to the AOA in conjunction with any activities conducted as a part this project. This includes maintaining gates allowing access to EUG's AOA in either a locked condition or attended by appropriately badged persons who ensure that only authorized personnel or vehicles are admitted through them into the AOA.
- b) Those persons designated to control access points into the AOA shall be instructed in the proper procedures of identification requirements for persons and vehicles. The Contractor shall provide these persons with the capability to communicate directly with Airport Operations and/or dispatch.
- c) Any opening of the AOA security fence requires prior coordination with Airport Operations. The Contractor is responsible for providing an appropriately badged person at any unsecured AOA access gate or opening.

- d) The TSA requires the EUG to control access and prevent unauthorized vehicles from entering the AOA. In compliance with this requirement, the EUG has established procedures to authorize or deny access to the AOA and to identify and control vehicles while in the AOA.
- e) Proper individual identification, operator's licenses, and vehicle permits must be obtained through Airport Operations before attempting to enter an Air Operations Area.

1-05 VEHICLE IDENTIFICATION STANDARDS

- a) All Contractor vehicles requiring access to the AOA and/or SIDA shall display the company insignia on each side of the vehicle on the driver and passenger doors. Vehicle permits shall be displayed as required by Airport Operations. All permit requests must come through Contractor's Badge Control Officer.

1-06 AREA OF AUTHORIZATION ON AOA AND SIDA

- a) Contractor vehicles are only authorized in the areas where their contract work is being performed and on the access routes to and from that area.

1-07 AUTHORIZED VEHICLES ON AOA AND SIDA

- a) Any Contractor vehicle is authorized onto the AOA and SIDA when it is within its area of authorization, the company insignia is properly displayed, and all occupants have the required airport identification properly displayed unless being escorted.

- b) Motor Vehicles on AOA/SIDA

- 1. Authorization of Vehicles

- i. All drivers authorized to access the AOA/SIDA shall display an AOA/SIDA identification badge issued by Eugene Airport or shall be under the escort of an authorized individual with an Airport-issued AOA/SIDA identification badge.

- 2. Prohibited Vehicles

- i. No privately owned vehicles shall be operated in the AOA/SIDA unless approved by the Airport Manager or his/her representative.
 - ii. Any vehicle found to be mechanically unsafe by a member of the airport staff will not be used in the AOA/SIDA until the vehicle has been properly repaired and authorized to return to service by the Airport Manager or his/her representative.

- 3. Night or Low Visibility Operations

- i. No vehicles shall be operated within the AOA/SIDA at night or during periods of low visibility operations without written authorization by Airport Operations.
 - ii. All motor vehicles shall be equipped with two headlights and one or more red taillights.
 - iii. All motorized vehicles operated by the Contractor on the airport shall be equipped with either:

1. A 3-foot square flag, consisting of a checker of International Orange and White squares of not less than 1-foot on each side, displayed in full view above the vehicles and/or;
 2. A flashing yellow light unit satisfactory to Airport Operations. For periods of limited visibility or darkness, these vehicles shall also be equipped with flashing yellow light units satisfactory to the Airport Operations.
 3. Flashing yellow light mounted on the top of the vehicle cab is required during low visibility or night conditions
4. Vehicle Speed
- i. Motor vehicles shall not operate at a speed that endangers property or persons in the area.
 - ii. Motor vehicles shall not exceed 15 mph on the aircraft parking ramps or 25 mph on the perimeter/service roads. All vehicles are restricted to 5 mph when in close proximity to aircraft.
5. Involvement in Vehicle Accidents
- i. Any persons damaging any airfield light fixture or other airport facility shall report such damage to the Airport Operations (541) 954-6584 immediately and shall be responsible for his or her share of any costs required to repair or replace the damaged fixture or facility.
6. Parking Vehicles
- i. Areas designated for vehicle parking and staging of equipment must obtain approval by Airport Operations.
 - ii. No motor vehicles of any type shall be allowed to park overnight or unattended without prior authorization by the Airport Manager or his/her representative.

1-08 BADGE ISSUANCE PROCEDURES

- a) All workers who will require access to the designated project limits must apply for and be granted a security clearance by the Eugene Airport before commencing with the Work of this contract. Workers who successfully pass a threat assessment and training will be issued an identification badge. All badging forms are contained within AirBadge. Contact credentialling office for more information
- b) Within 48 hours of receiving written notice of intent to award contract, the Contractor shall submit completed originals of all required background investigation applications for Contractor's own workers including the proposed Full-Time Superintendent and back-up Full-Time Superintendent. Contractor shall submit all required background investigation applications for the workers of all subcontractors within 10 working days of notice of intent to award contract.
- c) Failure to apply for and/or obtain security. clearances for an adequate number of workers shall not be grounds for a contract time extension.

- d) All badging requests must be channeled through the Contractor. The Contractor shall designate one or more badge control officer(s) to act as the point of contact for coordination in matters of badge program administration and security matters.
- e) Each person requiring an Airport Identification Badge must submit to a Security Threat Assessment as required by 49 CFR Part 1542. Up to four (4) weeks should be allowed for this process to take place.
- f) All personnel requiring unescorted driving privileges in the Airport Operations Area (AOA) are required to complete an airport sponsored driving course prior to obtaining a badge.
- g) Any falsifications can result in revocation of the badges by the party in question, and any fines incurred from the violations will be passed to the responsible party.
- h) Upon issuing an Airport Identification Badge, each badged employee will be issued a set of airport rules and regulations they shall be held responsible for while working in restricted areas of the airport.
- i) A badge fee will be assessed for each badge. Payment is required at time of service for each. All fees shall be paid by the Contractor at time of application. Fees are non-refundable. Additional information on fees for badging process can be found on the Badging & Credentialing portion of the Eugene Airport website. <https://www.eugene-or.gov/1065/Badging-Credentialing>
- j) The Contractor shall be responsible for the maintenance of records necessary to ensure the retrieval of badges from employees and contractor(s).
 - 1. Whenever a badged person's employment authorized by the Contractor is terminated, the Contractor is responsible for immediately recovering the Airport Identification Badge and returning it to the Airport Badge office. The Airport Identification Badge shall be returned to Airport Operations within 24 hours of employee termination.
 - 2. When employee employed in the execution of the project terminates employment, the Contractor shall immediately notify the Airport Operations so the badge can be deactivated.
 - 3. A fee will be levied against the Contractor for each badge not recovered and turned into the Airport Badge Office from a terminated employee. All badges must be returned to the Badge Office within 24 hours of an employee's termination date or the completion of the project, whichever is sooner. Refer to Badging & Credentialing portion of the Eugene Airport website for additional information.
- k) Any person holding an Airport Identification Badge shall immediately notify the Contractor if he or she loses Airport Identification Badge. In such case, the Contractor shall immediately notify the Airport Operations during normal business hours or (541) 954-6584 after normal business hours. The employment status of any person losing a badge will be confirmed by the Badge Office prior to the reactivation their badge. A replacement request letter and a lost badge fee is required for a replacement Airport Identification Badge. Refer to Badging & Credentialing portion of the Eugene Airport website for additional information.
- l) EUG requires each Contractor and badge holder to agree to abide by the provisions of this identification program.

1-09 INSPECTIONS AND FINES

- a) The Contractor shall be liable for any fines levied against EUG, by the Transportation Security Administration (TSA), resulting from actions by the Contractor, or those whom the Contractor is responsible for, that cause a failure in maintaining security in the area of construction, to include any points of entry into the Air Operations Area (AOA) utilized for the construction project. Failure to maintain security will also include failure to abide by the identification program or other requirements pertaining to the security of the AOA or SIDA.
- b) Contractor personnel are subject to random checks for compliance with the badging and permit regulations. These checks may be conducted by either by Airport staff, Airport Operations, or the TSA.
- c) In order to maintain accountability for all Airport Identification Badges issued, the Contractor is responsible for physically collecting and returning to the Airport Badge Office all outstanding badges no longer used for the construction project. Proof of return is a receipt issued by the Airport or by the Airports Project Manager.
- d) A fine will be levied against the Contractor for each unreturned badge. All badges shall be returned to Airport Operations prior to the submission of the Final Application for Payment. Final payment will not be made until all badges are returned or badges are deactivated and Contractor has paid costs associated with unreturned badges.

1-10 DAILY SITE REVIEW

- a) 30 minutes prior to departing the site for the day, notify Airport Operations (541-954-6584) to conduct a site inspection. Make adjustments and perform additional work as required by Airport Operations.

1-11 WORKERS

In addition, the following requirements shall apply concerning all workers utilized on the project:

- a) The Contractor shall provide and maintain, continually on the project site of the work during its progress, adequate and competent superintendence of all operations for and in connection with the work. The Contractor shall provide a capable superintendent acceptable to the Owner. Such representative shall be able to read, write and speak English fluently and shall be authorized to receive instructions from the Engineer or his authorized representative. Said superintendent shall have authority to see that the work is carried out in accordance with the Contract Documents and in a first class, thorough and workmanlike manner in every respect.
- b) Incompetent, disorderly, intemperate or incorrigible employees of any authority level shall be dismissed from the project by the Contractor or his representative when requested by the Engineer or the Owner, and such persons shall not again be permitted to return to the work without the written consent of the Owner.
- c) The Contractor agrees to indemnify and hold the Owner harmless from any and all loss or damages arising out of jurisdictional labor disputes or other labor troubles of any kind that may occur during the construction and performance of the Contract.

- d) The Contractor shall provide at the request of the Owner such reasonable information about his employees as may be necessary, including in part, name, address and social security number.
- e) Any employee of the Contractor or any subcontractors who violate the badging requirements or leaves unbadged individuals in the Airport Operations Area without properly badged individuals will be removed from the Airport and not be allowed back onto the Airport without prior approval by the Owner.

END OF SPECIAL CONDITIONS - SECTION 1

SPECIAL CONDITIONS

SECTION 2

MISCELLANEOUS

2-01 PROVISIONS REQUIRED BY LAW DEEMED INSERTED. Each and every provision of law and clause required by law to be inserted in the Contract Documents shall be deemed to be inserted herein and the Contract shall be read and enforced as though it were included herein. If, for any reason, any such provision is not inserted in the Contract, or is not correctly inserted, then upon application of either party, the Contract shall forthwith be physically amended to make such insertion or correction.

2-02 PERMITS. The Contractor is required to prepare, obtain and pay for all documentation, fees, services, permits and approvals from any and all local, state and federal regulatory agencies as it pertains to required environmental protection for this project. An Electrical permit is required by the City of Eugene. The Airport is not be responsible for the failure of any contractor, subcontractor, vendor, or other project participant, to fulfill contractual responsibilities to comply with federal, state or local laws, regulations, and codes; or procuring permits, certificates and licenses required for any construction unless such procurement responsibilities. Contractor to meet requirements of City of Eugene NPDES Permit included in the Appendix.

END OF SPECIAL CONDITIONS - SECTION 2

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SPECIAL CONDITIONS**SECTION 3****CONSTRUCTION SAFETY AND PHASING PLAN (CSPP)
EUGENE AIRPORT
GATE A6 RELOCATION****1. PURPOSE**

The Construction Safety and Phasing Plan (CSPP) sets forth guidelines and requirements for the project to help ensure the highest levels of safety, security and efficiency at the airport at the time of construction. Guidelines and requirements for the CSPP are developed from FAA Advisory Circular No. 150/5370-2G *Operational Safety on Airports During Construction*, except as modified herein.

The CSPP is a single document to be used by all personnel involved in the project. The CSPP covers the actions of not only the construction personnel and equipment, but also the action of inspection personnel and airport staff.

Additionally, The Contractor shall develop and submit, for review and approval, a Safety Plan Compliance Document (SPCD), prior to the issuance of a Notice-to-Proceed (NTP). The SPCD shall comply with the provisions and requirements outlined in the CSPP and with those requirements outlined in FAA Advisory Circular 150/5370-2G *Operational Safety on Airports During Construction*. The SPCD must also include a certified statement by the Contractor that indicates its understanding of those operational, safety and security requirements outlined in the CSPP. The certified statement must also assert that the Contractor will not deviate from the approved CSPP and SPCD unless written approval is granted by the Airport.

Implementation of the CSPP and SPCD will minimize interruptions to airport operations, reduce construction costs, and maximize the performance and safety of construction activity. Strict adherence to the provisions of the CSPP and SPCD by all personnel assigned to or visiting the construction site is mandatory for AIP funded construction projects. In the event Contractor activities are found in non-compliance with the provisions of the CSPP and/or the SPCD, the Resident Project Representative will direct the Contractor, in writing, to immediately cease operations in violation. In addition, a safety meeting will be conducted for the purpose of reviewing those provisions in the CSPP and/or SPCD which were violated. The Contractor will not be allowed to resume any construction operations until the safety meeting has been conducted and the issue has been addressed and corrected or resolved.

The CSPP is specifically made a part of this contract and included with the bidding documents.

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Item 01 11 00 Summary of Work

01 11 00-1.1 PROJECT DESCRIPTION

The purpose of this project is to relocate Gate A6 at Eugene Airport. The scope of work for this project includes the following:

- Erosion control.
- Demolition of existing asphalt and concrete pavement around new Passenger Boarding Bridge (PBB) foundations.
- Construct new concrete PBB foundations.
- Construct asphalt pavement around new PBB foundations.
- Install new PBB, including associated electrical and communications.
- Refresh existing pavement markings where indicated in the plans.
- Install new pavement markings.
- Existing utilities must be protected in place unless directed otherwise in the plans.
- The project has been phased to minimize disruptions to Airport Operations. Refer to the Construction Safety and Phasing Plan (CSPP) for detailed phasing plan and requirements.
- The Contractor will be responsible for traffic control along haul routes.

Refer to FAA General Provisions Section 80, Execution and Progress, for the overall project duration.

01 11 00-1.2 OWNER-PROVIDED OR SALVAGED ITEMS

The following items will be provided to the Contractor by the Owner or salvaged from existing infrastructure and installed by the Contractor per the contract documents. All other materials required to complete the contract must be procured and installed by the Contractor per the contract documents. Coordinate salvage and reinstallation work with the RPR.

1. The Contractor must salvage the existing Gate A6 PC Air Unit and reinstall for the new Gate A6 PBB.
2. The Contractor must salvage the existing Gate A5 PC Air Unit and reinstall for the new Gate A5 PBB.
3. The Contractor must salvage the existing Gate A6 GPU and reinstall for the new Gate A6 PBB.
4. The Contractor must salvage the existing Gate A6 bag slide and reinstall for the new Gate A6 PBB.

END OF ITEM 01 11 00

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Item C-100 Contractor Quality Control Program (CQCP)

100-1 General. Quality is more than test results. Quality is the combination of proper materials, testing, workmanship, equipment, inspection, and documentation of the project. Establishing and maintaining a culture of quality is key to achieving a quality project. The Contractor shall establish, provide, and maintain an effective Contractor Quality Control Program (CQCP) that details the methods and procedures that will be taken to assure that all materials and completed construction required by this contract conform to contract plans, technical specifications and other requirements, whether manufactured by the Contractor, or procured from subcontractors or vendors. Although guidelines are established and certain minimum requirements are specified here and elsewhere in the contract technical specifications, the Contractor shall assume full responsibility for accomplishing the stated purpose.

The Contractor shall establish a CQCP that will:

- a. Provide qualified personnel to develop and implement the CQCP.
- b. Provide for the production of acceptable quality materials.
- c. Provide sufficient information to assure that the specification requirements can be met.
- d. Document the CQCP process.

The Contractor shall not begin any construction or production of materials to be incorporated into the completed work until the CQCP has been reviewed and approved by the Resident Project Representative (RPR). No partial payment will be made for materials subject to specific quality control (QC) requirements until the CQCP has been reviewed and approved.

The QC requirements contained in this section and elsewhere in the contract technical specifications are in addition to and separate from the quality assurance (QA) testing requirements. QA testing requirements are the responsibility of the RPR or Contractor as specified in the specifications.

A Quality Control (QC)/Quality Assurance (QA) workshop with the Engineer, Resident Project Representative (RPR), Contractor, subcontractors, testing laboratories, and Owner's representative must be held prior to start of construction. The QC/QA workshop will be facilitated by the Contractor. The Contractor shall coordinate with the Airport and the RPR on time and location of the QC/QA workshop. Items to be addressed, at a minimum, will include:

- a. Review of the CQCP including submittals, QC Testing, Action & Suspension Limits for Production, Corrective Action Plans, Distribution of QC reports, and Control Charts.
- b. Discussion of the QA program.
- c. Discussion of the QC and QA Organization and authority including coordination and information exchange between QC and QA.
- d. Establish regular meetings to discuss control of materials, methods and testing.
- e. Establishment of the overall QC culture.

100-2 Description of program.

a. General description. The Contractor shall establish a CQCP to perform QC inspection and testing of all items of work required by the technical specifications, including those performed by subcontractors. The CQCP shall ensure conformance to applicable specifications and plans with respect to materials, off-

site fabrication, workmanship, construction, finish, and functional performance. The CQCP shall be effective for control of all construction work performed under this Contract and shall specifically include surveillance and tests required by the technical specifications, in addition to other requirements of this section and any other activities deemed necessary by the Contractor to establish an effective level of QC.

b. Contractor Quality Control Program (CQCP). The Contractor shall describe the CQCP in a written document that shall be reviewed and approved by the RPR prior to the start of any production, construction, or off-site fabrication. The written CQCP shall be submitted to the RPR for review and approval at least 10 calendar days before the CQCP Workshop. The Contractor's CQCP and QC testing laboratory must be approved in writing by the RPR prior to the Notice to Proceed (NTP).

The CQCP shall be organized to address, as a minimum, the following:

1. QC organization and resumes of key staff
2. Project progress schedule
3. Submittals schedule
4. Inspection requirements
5. QC testing plan
6. Documentation of QC activities and distribution of QC reports
7. Requirements for corrective action when QC and/or QA acceptance criteria are not met
8. Material quality and construction means and methods. Address all elements applicable to the project that affect the quality of the pavement structure including subgrade, subbase, base, and surface course. Some elements that must be addressed include, but is not limited to mix design, aggregate grading, stockpile management, mixing and transporting, placing and finishing, quality control testing and inspection, smoothness, laydown plan, equipment, and temperature management plan.

The Contractor must add any additional elements to the CQCP that is necessary to adequately control all production and/or construction processes required by this contract.

100-3 CQCP organization. The CQCP shall be implemented by the establishment of a QC organization. An organizational chart shall be developed to show all QC personnel, their authority, and how these personnel integrate with other management/production and construction functions and personnel.

The organizational chart shall identify all QC staff by name and function, and shall indicate the total staff required to implement all elements of the CQCP, including inspection and testing for each item of work. If necessary, different technicians can be used for specific inspection and testing functions for different items of work. If an outside organization or independent testing laboratory is used for implementation of all or part of the CQCP, the personnel assigned shall be subject to the qualification requirements of paragraphs 100-03a and 100-03b. The organizational chart shall indicate which personnel are Contractor employees and which are provided by an outside organization.

The QC organization shall, as a minimum, consist of the following personnel:

a. Program Administrator. The Contractor Quality Control Program Administrator (CQCPA) must be a full-time employee of the Contractor, or a consultant engaged by the Contractor. The CQCPA must have a minimum of five (5) years of experience in QC pavement construction with prior QC experience on a project of comparable size and scope as the contract.

Included in the five (5) years of paving/QC experience, the CQCPA must meet at least one of the following requirements:

- (1) Professional Engineer with one (1) year of airport paving experience.
- (2) Engineer-in-training with two (2) years of airport paving experience.
- (3) National Institute for Certification in Engineering Technologies (NICET) Civil Engineering Technology Level IV with three (3) years of airport paving experience.
- (4) An individual with four (4) years of airport paving experience, with a Bachelor of Science Degree in Civil Engineering, Civil Engineering Technology or Construction.

The CQCPA must have full authority to institute any and all actions necessary for the successful implementation of the CQCP to ensure compliance with the contract plans and technical specifications. The CQCPA authority must include the ability to immediately stop production until materials and/or processes are in compliance with contract specifications. The CQCPA must report directly to a principal officer of the construction firm. The CQCPA may supervise the Quality Control Program on more than one project provided that person can be at the job site within two (2) hours after being notified of a problem.

b. QC technicians. A sufficient number of QC technicians necessary to adequately implement the CQCP must be provided. These personnel must be either Engineers, engineering technicians, or experienced craftsman with qualifications in the appropriate field equivalent to NICET Level II in Civil Engineering Technology or higher, and shall have a minimum of two (2) years of experience in their area of expertise.

The QC technicians must report directly to the CQCPA and shall perform the following functions:

- (1) Inspection of all materials, construction, plant, and equipment for conformance to the technical specifications, and as required by paragraph 100-6.
- (2) Performance of all QC tests as required by the technical specifications and paragraph 100-8.
- (3) Performance of tests for the RPR when required by the technical specifications.

Certification at an equivalent level of qualification and experience by a state or nationally recognized organization will be acceptable in lieu of NICET certification.

c. Staffing levels. The Contractor shall provide sufficient qualified QC personnel to monitor each work activity at all times. Where material is being produced in a plant for incorporation into the work, separate plant and field technicians shall be provided at each plant and field placement location. The scheduling and coordinating of all inspection and testing must match the type and pace of work activity. The CQCP shall state where different technicians will be required for different work elements.

100-4 Project progress schedule. Critical QC activities must be shown on the project schedule as required by Section 80, paragraph 80-03, *Execution and Progress*.

100-5 Submittals schedule. The Contractor shall submit a detailed listing of all submittals (for example, mix designs, material certifications) and shop drawings required by the technical specifications. The listing can be developed in a spreadsheet format and shall include as a minimum:

- a. Specification item number
- b. Item description
- c. Description of submittal
- d. Specification paragraph requiring submittal
- e. Scheduled date of submittal

100-6 Inspection requirements. QC inspection functions shall be organized to provide inspections for all definable features of work, as detailed below. All inspections shall be documented by the Contractor as specified by paragraph 100-9.

Inspections shall be performed as needed to ensure continuing compliance with contract requirements until completion of the particular feature of work. Inspections shall include the following minimum requirements:

a. During plant operation for material production, QC test results and periodic inspections shall be used to ensure the quality of aggregates and other mix components, and to adjust and control mix proportioning to meet the approved mix design and other requirements of the technical specifications. All equipment used in proportioning and mixing shall be inspected to ensure its proper operating condition. The CQCP shall detail how these and other QC functions will be accomplished and used.

b. During field operations, QC test results and periodic inspections shall be used to ensure the quality of all materials and workmanship. All equipment used in placing, finishing, and compacting shall be inspected to ensure its proper operating condition and to ensure that all such operations are in conformance to the technical specifications and are within the plan dimensions, lines, grades, and tolerances specified. The CQCP shall document how these and other QC functions will be accomplished and used.

100-7 Contractor QC testing facility.

a. For projects that include Item P-401, Item P-403, and Item P-404, the Contractor shall ensure facilities, including all necessary equipment, materials, and current reference standards, are provided that meet requirements in the following paragraphs of ASTM D3666, *Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials*:

- 8.1.3 Equipment Calibration and Checks;
- 8.1.9 Equipment Calibration, Standardization, and Check Records;
- 8.1.12 Test Methods and Procedures

b. For projects that include P-501, the Contractor shall ensure facilities, including all necessary equipment, materials, and current reference standards, are provided that meet requirements in the following paragraphs of ASTM C1077, *Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation*:

- 7 Test Methods and Procedures
- 8 Facilities, Equipment, and Supplemental Procedures

100-8 QC testing plan. As a part of the overall CQCP, the Contractor shall implement a QC testing plan, as required by the technical specifications. The testing plan shall include the minimum tests and test frequencies required by each technical specification Item, as well as any additional QC tests that the Contractor deems necessary to adequately control production and/or construction processes.

The QC testing plan can be developed in a spreadsheet fashion and shall, as a minimum, include the following:

- a.** Specification item number (e.g., P-401)
- b.** Item description (e.g., Hot Mix Asphalt Pavements)
- c.** Test type (e.g., gradation, grade, asphalt content)
- d.** Test standard (e.g., ASTM or American Association of State Highway and Transportation Officials (AASHTO) test number, as applicable)

e. Test frequency (e.g., as required by technical specifications or minimum frequency when requirements are not stated)

f. Responsibility (e.g., plant technician)

g. Control requirements (e.g., target, permissible deviations)

The QC testing plan shall contain a statistically-based procedure of random sampling for acquiring test samples in accordance with ASTM D3665. The RPR shall be provided the opportunity to witness QC sampling and testing.

All QC test results shall be documented by the Contractor as required by paragraph 100-9.

100-9 Documentation. The Contractor shall maintain current QC records of all inspections and tests performed. These records shall include factual evidence that the required QC inspections or tests have been performed, including type and number of inspections or tests involved; results of inspections or tests; nature of defects, deviations, causes for rejection, etc.; proposed remedial action; and corrective actions taken.

These records must cover both conforming and defective or deficient features, and must include a statement that all supplies and materials incorporated in the work are in full compliance with the terms of the contract. Legible copies of these records shall be furnished to the RPR daily. The records shall cover all work placed subsequent to the previously furnished records and shall be verified and signed by the CQCPA.

Contractor QC records required for the contract shall include, but are not necessarily limited to, the following records:

a. Daily inspection reports. Each Contractor QC technician shall maintain a daily log of all inspections performed for both Contractor and subcontractor operations. These technician's daily reports shall provide factual evidence that continuous QC inspections have been performed and shall, as a minimum, include the following:

- (1) Technical specification item number and description
- (2) Compliance with approved submittals
- (3) Proper storage of materials and equipment
- (4) Proper operation of all equipment
- (5) Adherence to plans and technical specifications
- (6) Summary of any necessary corrective actions
- (7) Safety inspection.
- (8) Photographs and/or video

The daily inspection reports shall identify all QC inspections and QC tests conducted, results of inspections, location and nature of defects found, causes for rejection, and remedial or corrective actions taken or proposed.

The daily inspection reports shall be signed by the responsible QC technician and the CQCPA. The RPR shall be provided at least one copy of each daily inspection report on the work day following the day of record. When QC inspection and test results are recorded and transmitted electronically, the results must be archived.

b. Daily test reports. The Contractor shall be responsible for establishing a system that will record all QC test results. Daily test reports shall document the following information:

- (1) Technical specification item number and description

- (2) Test designation
- (3) Location
- (4) Date of test
- (5) Control requirements
- (6) Test results
- (7) Causes for rejection
- (8) Recommended remedial actions
- (9) Retests

Test results from each day's work period shall be submitted to the RPR prior to the start of the next day's work period. When required by the technical specifications, the Contractor shall maintain statistical QC charts. When QC daily test results are recorded and transmitted electronically, the results must be archived.

100-10 Corrective action requirements. The CQCP shall indicate the appropriate action to be taken when a process is deemed, or believed, to be out of control (out of tolerance) and detail what action will be taken to bring the process into control. The requirements for corrective action shall include both general requirements for operation of the CQCP as a whole, and for individual items of work contained in the technical specifications.

The CQCP shall detail how the results of QC inspections and tests will be used for determining the need for corrective action and shall contain clear rules to gauge when a process is out of control and the type of correction to be taken to regain process control.

When applicable or required by the technical specifications, the Contractor shall establish and use statistical QC charts for individual QC tests. The requirements for corrective action shall be linked to the control charts.

100-11 Inspection and/or observations by the RPR. All items of material and equipment are subject to inspection and/or observation by the RPR at the point of production, manufacture or shipment to determine if the Contractor, producer, manufacturer or shipper maintains an adequate QC system in conformance with the requirements detailed here and the applicable technical specifications and plans. In addition, all items of materials, equipment and work in place shall be subject to inspection and/or observation by the RPR at the site for the same purpose.

Inspection and/or observations by the RPR does not relieve the Contractor of performing QC inspections of either on-site or off-site Contractor's or subcontractor's work.

100-12 Noncompliance.

a. The Resident Project Representative (RPR) will provide written notice to the Contractor of any noncompliance with their CQCP. After receipt of such notice, the Contractor must take corrective action.

b. When QC activities do not comply with either the CQCP or the contract provisions or when the Contractor fails to properly operate and maintain an effective CQCP, and no effective corrective actions have been taken after notification of non-compliance, the RPR will recommend the Owner take the following actions:

- (1) Order the Contractor to replace ineffective or unqualified QC personnel or subcontractors and/or
- (2) Order the Contractor to stop operations until appropriate corrective actions are taken.

METHOD OF MEASUREMENT

100-13 Basis of measurement and payment. There will be no direct measurement for this section.

BASIS OF PAYMENT

100-14 Payment will be made under: Payment will be remitted per the contract lump sum.

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

National Institute for Certification in Engineering Technologies (NICET)

ASTM International (ASTM)

ASTM C1077	Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
ASTM D3665	Standard Practice for Random Sampling of Construction Materials
ASTM D3666	Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials

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Item C-102 Temporary Air and Water Pollution, Soil Erosion, and Siltation Control

DESCRIPTION

102-1. This item shall consist of temporary control measures as shown on the plans or as ordered by the Resident Project Representative (RPR) during the life of a contract to control pollution of air and water, soil erosion, and siltation through the use of silt fences, berms, dikes, dams, sediment basins, fiber mats, gravel, mulches, grasses, slope drains, and other erosion control devices or methods.

Temporary erosion control shall be in accordance with the approved erosion control plan; the approved Construction Safety and Phasing Plan (CSPP) and AC 150/5370-2, *Operational Safety on Airports During Construction*. The temporary erosion control measures contained herein shall be coordinated with the permanent erosion control measures specified as part of this contract to the extent practical to assure economical, effective, and continuous erosion control throughout the construction period.

Temporary control may include work outside the construction limits such as borrow pit operations, equipment and material storage sites, waste areas, and temporary plant sites.

Temporary control measures shall be designed, installed and maintained to minimize the creation of wildlife attractants that have the potential to attract hazardous wildlife on or near public-use airports.

MATERIALS

102-2.1 Grass. Grass that will not compete with the grasses sown later for permanent cover per Item T-901 shall be a quick-growing species (such as ryegrass, Italian ryegrass, or cereal grasses) suitable to the area providing a temporary cover. Selected grass species shall not create a wildlife attractant.

102-2.2 Mulches. Mulches may be hay, straw, fiber mats, netting, bark, wood chips, or other suitable material reasonably clean and free of noxious weeds and deleterious materials per Item T-908. Mulches shall not create a wildlife attractant.

102-2.3 Fertilizer. Fertilizer shall be a standard commercial grade and shall conform to all federal and state regulations and to the standards of the Association of Official Agricultural Chemists.

102-2.4 Slope drains. Slope drains may be constructed of pipe, fiber mats, rubble, concrete, asphalt, or other materials that will adequately control erosion.

102-2.5 Silt fence. Silt fence shall consist of polymeric filaments which are formed into a stable network such that filaments retain their relative positions. Synthetic filter fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life. Silt fence shall meet the requirements of ASTM D6461.

102-2.6 Other. All other materials shall meet commercial grade standards and shall be approved by the RPR before being incorporated into the project.

CONSTRUCTION REQUIREMENTS

102-3.1 General. In the event of conflict between these requirements and pollution control laws, rules, or regulations of other federal, state, or local agencies, the more restrictive laws, rules, or regulations shall apply.

The RPR shall be responsible for assuring compliance to the extent that construction practices, construction operations, and construction work are involved.

102-3.2 Schedule. Prior to the start of construction, the Contractor shall submit schedules in accordance with the approved Construction Safety and Phasing Plan (CSPP) and the plans for accomplishment of temporary and permanent erosion control work for clearing and grubbing; grading; construction; paving; and structures at watercourses. The Contractor shall also submit a proposed method of erosion and dust control on haul roads and borrow pits and a plan for disposal of waste materials. Work shall not be started until the erosion control schedules and methods of operation for the applicable construction have been accepted by the RPR.

102-3.3 Construction details. The Contractor will be required to incorporate all permanent erosion control features into the project at the earliest practicable time as outlined in the plans and approved CSPP. Except where future construction operations will damage slopes, the Contractor shall perform the permanent seeding and mulching and other specified slope protection work in stages, as soon as substantial areas of exposed slopes can be made available. Temporary erosion and pollution control measures will be used to correct conditions that develop during construction that were not foreseen during the design stage; that are needed prior to installation of permanent control features; or that are needed temporarily to control erosion that develops during normal construction practices, but are not associated with permanent control features on the project.

Where erosion may be a problem, schedule and perform clearing and grubbing operations so that grading operations and permanent erosion control features can follow immediately if project conditions permit. Temporary erosion control measures are required if permanent measures cannot immediately follow grading operations. The RPR shall limit the area of clearing and grubbing, excavation, borrow, and embankment operations in progress, commensurate with the Contractor's capability and progress in keeping the finish grading, mulching, seeding, and other such permanent control measures current with the accepted schedule. If seasonal limitations make such coordination unrealistic, temporary erosion control measures shall be taken immediately to the extent feasible and justified as directed by the RPR.

The Contractor shall provide immediate permanent or temporary pollution control measures to minimize contamination of adjacent streams or other watercourses, lakes, ponds, or other areas of water impoundment as directed by the RPR. If temporary erosion and pollution control measures are required due to the Contractor's negligence, carelessness, or failure to install permanent controls as a part of the work as scheduled or directed by the RPR, the work shall be performed by the Contractor and the cost shall be incidental to this item.

The RPR may increase or decrease the area of erodible earth material that can be exposed at any time based on an analysis of project conditions.

The erosion control features installed by the Contractor shall be maintained by the Contractor during the construction period.

Provide temporary structures whenever construction equipment must cross watercourses at frequent intervals. Pollutants such as fuels, lubricants, bitumen, raw sewage, wash water from concrete mixing operations, and other harmful materials shall not be discharged into any waterways, impoundments or into natural or manmade channels.

102-3.4 Installation, maintenance and removal of silt fence. Silt fences shall extend a minimum of 16 inches (41 cm) and a maximum of 34 inches (86 cm) above the ground surface. Posts shall be set no more than 10 feet (3 m) on center. Filter fabric shall be cut from a continuous roll to the length required minimizing joints where possible. When joints are necessary, the fabric shall be spliced at a support post with a minimum 12-inch (300-mm) overlap and securely sealed. A trench shall be excavated approximately 4 inches (100 mm) deep by 4 inches (100 mm) wide on the upslope side of the silt fence. The trench shall be backfilled and the soil compacted over the silt fence fabric. The Contractor shall

remove and dispose of silt that accumulates during construction and prior to establishment of permanent erosion control. The fence shall be maintained in good working condition until permanent erosion control is established. Silt fence shall be removed upon approval of the RPR.

102-3.5 Oregon Department of Environmental Quality (DEQ) 1200-CA Permit Requirements. Not Applicable.

METHOD OF MEASUREMENT

102-4.1 There will be no direct measurement for this section.

BASIS OF PAYMENT

102-5.1 Payment will be remitted per the contract lump sum.

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

Advisory Circulars (AC)

AC 150/5200-33 *Hazardous Wildlife Attractants on or Near Airports*

AC 150/5370-2 *Operational Safety on Airports During Construction*

ASTM International (ASTM)

ASTM D6461 *Standard Specification for Silt Fence Materials*

United States Department of Agriculture (USDA)

FAA/USDA Wildlife Hazard Management at Airports, A Manual for Airport Personnel

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Item C-105 Mobilization

105-1 Description. This item of work shall consist of, but is not limited to, work and operations necessary for the movement of personnel, equipment, material and supplies to and from the project site for work on the project except as provided in the contract as separate pay items.

105-2 Mobilization limit. Mobilization shall be limited to 10 percent of the total project cost.

105-3 Posted notices. Prior to commencement of construction activities, the Contractor must post the following documents in a prominent and accessible place where they may be easily viewed by all employees of the prime Contractor and by all employees of subcontractors engaged by the prime Contractor: Equal Employment Opportunity (EEO) Poster “Equal Employment Opportunity is the Law” in accordance with the Office of Federal Contract Compliance Programs Executive Order 11246, as amended; Davis Bacon Wage Poster (WH 1321) - DOL “Notice to All Employees” Poster; and Applicable Davis-Bacon Wage Rate Determination. These notices must remain posted until final acceptance of the work by the Owner.

105-4 Engineer/RPR field office. The Contractor shall provide dedicated space for the use of the field RPR and inspectors, as a field office for the duration of the project. This space shall be located conveniently near the construction and shall be separate from any space used by the Contractor. The Contractor shall furnish water, sanitary facilities, heat, air conditioning, and electricity in accordance with local building codes.

The Contractor shall furnish for the duration of the project one building for the use of the field Engineers and inspectors, as a field office. This building shall be located conveniently near to the construction as shown on the plans and shall be separate from any building used by the Contractor. The Contractor shall furnish high speed internet, commercial color copier capable of 8.5”x11” and 11”x17” copies and pdf scans in color. (Provide all paper and replacement toner cartridges as required for the duration of the contract), water, sanitary facilities, heat, air conditioning, and electricity. The contractor is to provide generator power to the trailer, if required. The Contractor and the Contractor’s superintendent shall provide all reasonable facilities to enable the Engineer to inspect the workmanship and materials used into the work.

Additionally, the office shall have the following minimum requirements:

- a. Field offices shall consist of a weatherproof, insulated, temporary office type trailer, constructed to the uniform building code series. It shall meet or exceed the following requirements:
 1. Dimensions: 50 ft. long x 12 ft. wide outside, 7 ft. - 6 in. height inside.
 2. Desks: One 30 in. x full inside width x 30 in. high, at each end of the trailer, supported by a legal size 2 drawer metal file center pedestal.
 3. Drafting Tables: One 38 in. x 96 in. hinged board with double storage below. Slope board 12:1 down to 37 in. height at front edge.
 4. Work Tables: Three 72” x 36” tables for meetings.
 5. Furniture: Four chairs with rollers and one drafting stool. Each of appropriate height. All chairs shall be ergonomically built. Additional folding chairs as required for meetings.
 6. Closet: A locked storage area of 15 sq. ft.

7. Drinking Water Supply: Drinking water dispensed from an acceptable water cooling device.
8. Fire Extinguisher: Two, dry chemical 10 lbs. Class ABC, Underwriters Laboratories, Inc. approved.
9. Trash Cans: three, 13 gal. (min) size.
10. Microwave and small refrigerator
- b. Sanitary facilities with a sanitary sewer holding tank that will be emptied weekly at the Contractor's expense (for sole use by RPR).
- c. Field equipment consisting of two 12-foot aluminum straight edges and one digital smart level. The digital smart level will be, at a minimum, 48-inch long and report measurements in degrees, percent, and in/ft.

METHOD OF MEASUREMENT

105-5 Basis of measurement and payment. There will be no direct measurement for this section.

BASIS OF PAYMENT

105-6 Payment will be made under: Payment will be remitted per the contract lump sum.

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

Office of Federal Contract Compliance Programs (OFCCP)

Executive Order 11246, as amended

EEOC-P/E-1 – Equal Employment Opportunity is the Law Poster

United States Department of Labor, Wage and Hour Division (WHD)

WH 1321 – Employee Rights under the Davis-Bacon Act Poster

END OF ITEM C-105

ITEM G-100 SAFETY, SECURITY AND TEMPORARY ITEMS

GENERAL

100-1.1 Safety And Security. This item shall include furnishing items, preparing documents and all other requirements to comply with the safety and security requirements on the airport. A complete understanding of all procedures and requirements contained herein, and throughout the project documents, is required to ensure safety during construction.

Required reference material associated with this safety plan includes:

FAA AC 150/5200-18D, Airport Safety Self-Inspection

FAA AC 150/5210-5D, Painting, Marking and Lighting of Vehicles Used on an Airport

FAA AC 150/5370-2G, Operational Safety on Airports During Construction

Construction Safety and Phasing Plan (CSPP)

Safety Plan Compliance Document (SPCD)

Copies of the FAA AC documents are available at www.faa.gov.

100-1.2 Temporary Items. This item consists of furnishing all labor, materials and equipment for temporary construction items necessary for the safe and proper execution of work and not otherwise included in other contract bid items. The Contractor will be expected to supply and utilize the items listed below and other items contained in the plans and specifications. Temporary construction items to be provided include, but are not limited to the following: gate guard shack, temporary fencing and gates, sanitary facilities, flaggers, portable floodlighting, construction barricades, test pitting, and equipment as needed to keep all areas free of debris including pavement areas immediately adjacent to the project site.

SECURITY

100-2.1 Develop Safety Plan Compliance Document. The SPCD shall, as a minimum, be a detailed outline of the procedures to be followed showing how the Contractor will comply with the CSPP. The SPCD shall detail, but not be limited to, how the Contractor plans to maintain safety and security of both Contractor operations and the integrity of airport landside and airside operations during the prosecution of contract work and the procedures to be followed in the event of an emergency or accident. These procedures shall be subject to the approval of the Engineer and reflect any change as may be deemed necessary.

A primary and alternate responsible Contractor's representative shall be designated by the Contractor. The Contractor's representatives shall be available locally on a 24-hour basis. Names of the primary and alternate, including phone number, shall be made available to the Engineer by the Contractor. The Contractor shall insure that the names and phone numbers are kept current and made available to the Engineer.

100-2.2 Airport Security. See Special Conditions Section 1.

TEMPORARY ITEMS

100-3.1 Construction Barricades. Construction barricades shall be provided in accordance with the details shown in the plans and shall be placed in accordance with the phasing plans and phasing notes drawings. Barricades shall be placed around each phase of the work in accordance with the phasing plans

and shall remain in place until completion of work in each phase. Barricades shall be maintained throughout the duration of the contract. Contractor is responsible for providing all barricades for the project and moving the barricades to the project location.

100-3.2 Flaggers, Haul Route Monitors & Gate Guards. Flaggers, Haul Route Monitors and Gate Guards shall be provided, as necessary, to control the Contractor's traffic during the prosecution of work. All Contractor vehicles or equipment that are required to cross active airfield pavement or safety areas shall do so under the direct control of a competent flagger. The Contractor will provide security at each access gate and provide a full time gate guard while the gate is open and unlocked. The Contractor will be required to provide haul route monitors to assist with directing traffic and to act as the start of escort operations when visual escort procedures are in effect as shown on the plans.

100-3.3 Portable Floodlighting. Portable floodlighting shall be provided, as required, for construction that must occur during nighttime operations. The Contractor shall provide sufficient units so that all work areas are illuminated to a level of 5 horizontal foot-candles. The lighting levels shall be calculated and measured in accordance with the current standards of the Illumination Engineering Society.

100-3.4 Vehicle Road Signage. Not used.

100-3.5 Temporary Haul Roads. Not used.

100-3.6 Other Miscellaneous Items. Any other items not listed herein but which are associated directly or indirectly with temporary construction related work shall, by reference, be included in the requirements of this specification. No additional payment will be made for any temporary construction related item not specifically listed herein. The Contractor shall be responsible for providing any and all items necessary to ensure a safe, secure and functioning project construction site.

METHOD OF MEASUREMENT

100-4.1 Safety, Security, and Temporary Items. There will be no direct measurement for this section.

BASIS OF PAYMENT

100-5.1 Payment will be remitted per the contract lump sum.

TESTING REQUIREMENTS

100-11.1 None.

END OF ITEM G-100

Item P-101 Preparation/Removal of Existing Pavements

DESCRIPTION

101-1 This item shall consist of preparation of existing pavement surfaces for overlay, surface treatments, removal of existing pavement, and other miscellaneous items. The work shall be accomplished in accordance with these specifications and the applicable plans.

EQUIPMENT AND MATERIALS

101-2 All equipment and materials shall be specified here and in the following paragraphs or approved by the Resident Project Representative (RPR). The equipment shall not cause damage to the pavement to remain in place.

CONSTRUCTION

101-3.1 Removal of existing pavement.

The Contractor's removal operation shall be controlled to not damage adjacent pavement structure, and base material, cables, utility ducts, pipelines, or drainage structures which are to remain under the pavement.

a. Concrete pavement removal. Full depth saw cuts shall be made perpendicular to the slab surface. The Contractor shall saw through the full depth of the slab including any dowels at the joint, removing the pavement and installing new dowels as shown on the plans and per the specifications. Where the perimeter of the removal limits is not located on the joint and there are no dowels present, the perimeter shall be saw cut the full depth of the pavement, including all underlying base and/or subbase layers also designated for removal. The pavement inside the saw cut shall be removed by methods which will not cause distress in the pavement which is to remain in place. All material shall be legally exported and disposed of off-site. Concrete slabs that are damaged by under breaking shall be repaired or removed and replaced as directed by the RPR.

The edge of existing concrete pavement against which new pavement abuts shall be protected from damage at all times. Spall and underbreak repair shall be in accordance with the plans. Any underlying material that is to remain in place, shall be recompact and/or replaced as shown on the plans. Adjacent areas damaged during repair shall be repaired or replaced at the Contractor's expense.

b. Asphalt pavement removal. Asphalt pavement to be removed shall be sawcut to the full depth of the asphalt pavement around the perimeter of the area to be removed, as shown in the plans.

c. Repair or removal of Base, Subbase, and/or Subgrade. All failed material including surface, base course, subbase course, and subgrade shall be removed and repaired as shown on the plans or as directed by the RPR. Materials and methods of construction shall comply with the applicable sections of these specifications. Any damage caused by Contractor's removal process shall be repaired at the Contractor's expense.

101-3.2 Preparation of joints and cracks prior to overlay/surface treatment. Remove all vegetation and debris from cracks to a minimum depth of 1 inch. If extensive vegetation exists, treat the specific area with a concentrated solution of a water-based herbicide approved by the RPR. Fill all cracks greater than

1/4 inch wide) with a crack sealant per ASTM D6690. The crack sealant, preparation, and application shall be compatible with the surface treatment/overlay to be used. To minimize contamination of the asphalt with the crack sealant, underfill the crack sealant a minimum of 1/8 inch, not to exceed ¼ inch. Any excess joint or crack sealer shall be removed from the pavement surface.

101-3.3 Removal of Foreign Substances/contaminates prior to overlay or remarking. Removal of foreign substances/contaminates from existing pavement that will affect the bond of the new treatment shall consist of removal of rubber, fuel spills, oil, crack sealer, at least 90% of paint, and other foreign substances from the surface of the pavement. Areas that require removal are designated on the plans and as directed by the RPR in the field during construction.

High-pressure water may be used. Removal methods used shall not cause major damage to the pavement, or to any structure or utility within or adjacent to the work area. Major damage is defined as changing the properties of the pavement, removal of asphalt causing the aggregate to ravel, or removing pavement over 1/8 inch (3 mm) deep. If it is deemed by the RPR that damage to the existing pavement is caused by operational error, such as permitting the application method to dwell in one location for too long, the Contractor shall repair the damaged area without compensation and as directed by the RPR.

Removal of foreign substances shall not proceed until approved by the RPR. Water used for high-pressure water equipment shall be provided by the Contractor at the Contractor's expense. No material shall be deposited on the pavement shoulders. All wastes shall be disposed of legally off-site.

Additional requirements for removing existing markings are as noted in Item P-620, Runway and Taxiway Marking.

101-3.4 Concrete spall or failed asphaltic concrete pavement repair.

a. Repair of concrete spalls in areas to be overlaid with asphalt. Not Used.

b. Asphalt pavement repair. The Contractor shall repair all spalled concrete as shown on the plans or as directed by the RPR. The failed areas shall be removed as specified in paragraph 101-3.1b. All failed material including surface, base course, subbase course, and subgrade shall be removed. Materials and methods of construction shall comply with the applicable sections of these specifications. Prior to overlay, existing base material to be recompacted and tack coat applied in accordance with P-603.

101-3.5 Cold milling. Cold milling is not a required method of removal of pavements. The notes of this section only apply if the Contractor elects to utilize cold milling operations as a method of removal of existing pavements. Milling shall be performed with a power-operated milling machine or grinder, capable of producing a uniform finished surface. The milling machine or grinder shall operate without tearing or gouging the underlaying surface. The milling machine or grinder shall be equipped with grade and slope controls, and a positive means of dust control. All millings shall be removed and legally disposed of off Airport property. If the Contractor mills or grinds deeper or wider than the plans specify, the Contractor shall replace the material removed with new material at the Contractor's Expense.

a. Patching. The milling machine shall be capable of cutting a vertical edge without chipping or spalling the edges of the remaining pavement and it shall have a positive method of controlling the depth of cut. The RPR shall layout the area to be milled with a straightedge in increments of 1-foot widths. The area to be milled shall cover only the failed area. Any excessive area that is milled because the Contractor doesn't have the appropriate milling machine, or areas that are damaged because of his negligence, shall be repaired by the Contractor at the Contractor's Expense.

b. Profiling, grade correction, or surface correction. The milling machine shall have a minimum width of 7 feet and it shall be equipped with electronic grade control devices that will cut the surface to the grade specified. The tolerances shall be maintained within +0 inch and -1/4 inch of the specified grade. The machine must cut vertical edges and have a positive method of dust control. The machine

must have the ability to remove the millings or cuttings from the pavement and load them into a truck. All millings shall be removed and legally disposed of off the airport.

c. Clean-up. The Contractor shall sweep the milled surface daily and immediately after the milling until all residual materials are removed from the pavement surface. Prior to paving, the Contractor shall wet down the milled pavement and thoroughly sweep and/or blow the surface to remove loose residual material. Waste materials shall be collected and removed from the pavement surface and adjacent areas by sweeping or vacuuming. Waste materials shall be removed and legally disposed of off Airport property.

101-3.6. Preparation of asphalt pavement surfaces prior to surface treatment. Existing asphalt pavements to be treated with a surface treatment shall be prepared as follows:

a. Patch asphalt pavement surfaces that have been softened by petroleum derivatives or have failed due to any other cause. Remove damaged pavement to the full depth of the damage and replace with new asphalt pavement similar to that of the existing pavement in accordance with paragraph 101-3.4b.

b. Repair joints and cracks in accordance with paragraph 101-3.2.

c. Remove oil or grease that has not penetrated the asphalt pavement by scrubbing with a detergent and washing thoroughly with clean water. After cleaning, treat these areas with an oil spot primer.

d. Clean pavement surface immediately prior to placing the surface treatment so that it is free of dust, dirt, grease, vegetation, oil or any type of objectionable surface film.

101-3.7 Maintenance. The Contractor shall perform all maintenance work necessary to keep the pavement in a satisfactory condition until the full section is complete and accepted by the RPR. The surface shall be kept clean and free from foreign material. The pavement shall be properly drained at all times. If cleaning is necessary or if the pavement becomes disturbed, any work repairs necessary shall be performed at the Contractor's expense.

101-3.8 Preparation of Joints in Rigid Pavement prior to resealing. Not Used.

101-3.9 Preparation of Cracks in Flexible Pavement prior to sealing. Prior to application of sealant material, clean and dry the joints of all scale, dirt, dust, old sealant, curing compound, moisture and other foreign matter. The Contractor shall demonstrate, in the presence of the RPR, that the method used cleans the cracks and does not damage the pavement.

101-3.9.1 Preparation of Crack. Widen crack with router by removing a minimum of 1/16 inch from each side of crack. Immediately before sealing, cracks will be blown out with a hot air lance combined with oil and water-free compressed air.

101-3.9.2 Removal of Existing Crack Sealant. Existing sealants will be removed by routing. Following routing any remaining debris will be removed by use of a hot lance combined with oil and water-free compressed air.

101-3.9.3 Crack Sealant. Crack sealant material and installation will be in accordance with Item P-605.

101-3.10 Removal of Pipe and other Buried Structures.

a. Removal of Existing Pipe Material. Remove the types of pipe as indicated on the plans. The pipe material shall be legally disposed of off-site in a timely manner following removal. Trenches shall be backfilled with material equal to or better in quality than adjacent embankment. Trenches under paved areas must be compacted to 95% of ASTM D1557. Remaining pipe segments shall be capped or plugged.

b. Removal of Inlets/Manholes/Cleanouts/Inspection Pits. Where indicated on the plans or as directed by the RPR, inlets and/or manholes shall be removed and legally disposed of off-site in a timely fashion after removal. Excavations after removal shall be backfilled with material equal or better in

quality than adjacent embankment. When under paved areas must be compacted to 95% of ASTM D1557, when outside of paved areas must be compacted to 95% of ASTM D698.

METHOD OF MEASUREMENT

101-4.1 Measurement. There will be no direct measurement for this section.

BASIS OF PAYMENT

101-5.1 Payment. Payment will be remitted per the contact lump sum.

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

Advisory Circulars (AC)

AC 150/5380-6 Guidelines and Procedures for Maintenance of Airport Pavements.

ASTM International (ASTM)

ASTM D6690 Standard Specification for Joint and Crack Sealants, Hot Applied, for
Concrete and Asphalt Pavements

END OF ITEM P-101

Item P-152 Excavation, Subgrade, and Embankment

DESCRIPTION

152-1.1 This item covers excavation, disposal, placement, and compaction of all materials within the limits of the work required to construct safety areas, runways, taxiways, aprons, and intermediate areas as well as other areas for drainage, building construction, parking, or other purposes in accordance with these specifications and in conformity to the dimensions and typical sections shown on the plans.

152-1.2 Classification. All material excavated shall be classified as defined below:

- a. Unclassified excavation.** Unclassified excavation shall consist of the excavation and disposal of all material, regardless of its nature which is not otherwise classified and paid for under one of the following items.
- b. Over-Excavation.** Over-excavation shall consist of the removal and disposal of deposits of mixtures of soils and organic matter not suitable for subgrade material. This shall also include excavation and disposal of material from soft spots encountered in the subgrade. Such over-excavation shall not include material created by the Contractors failure to properly drain the grade or due to over application of water during subgrade preparation. Material, suitable for topsoil may be used on the embankment slope when approved by the RPR. Material that is high in moisture content and which yields under proof rolling does not necessarily constitute an unsuitable material. The Contractor is required to manipulate and dry the material. If the material is classified as unsuitable material by the RPR, then the Contractor shall remove the material to the depth directed by the RPR. The backfill of such areas shall not begin until the volume of the unsuitable excavation is determined by cross sections or other means acceptable to the RPR. The backfill shall be accomplished in accordance with the embankment requirements contained in this specification. The backfill may consist of unclassified excavation or P-154 or other materials acceptable to the RPR.

152-1.3 Unsuitable excavation. Unsuitable material shall be disposed legally off-site. Materials containing vegetable or organic matter, such as muck, peat, organic silt, or sod shall be considered unsuitable for use in embankment construction. Material suitable for topsoil may be used on the embankment slope when approved by the RPR.

CONSTRUCTION METHODS

152-2.1 General. Before beginning excavation, grading, and embankment operations in any area, the topsoil in the area shall be stripped in accordance with Item T-905.

The suitability of material to be placed in embankments shall be subject to approval by the RPR. All unsuitable material shall be disposed legally off of Airport property, unless otherwise noted. All waste areas shall be graded to allow positive drainage of the area and adjacent areas. The surface elevation of waste areas shall be specified on the plans or approved by the RPR.

When the Contractor's excavating operations encounter artifacts of historical or archaeological significance, the operations shall be temporarily discontinued and the RPR notified per FAA General Contract Provisions Section 70, paragraph 70-20. At the direction of the RPR, the Contractor shall

excavate the site in such a manner as to preserve the artifacts encountered and allow for their removal. Such excavation will be paid for as extra work.

Areas outside the limits of the pavement areas where the top layer of soil has become compacted by hauling or other Contractor activities shall be scarified and disked to a depth of 4 inches, to loosen and pulverize the soil. Stones or rock fragments larger than 4 inches in their greatest dimension will not be permitted in the top 6 inches of the subgrade.

If it is necessary to interrupt existing surface drainage, sewers or under-drainage, conduits, utilities, or similar underground structures, the Contractor shall be responsible for and shall take all necessary precautions to preserve them or provide temporary services at no additional cost to the Owner. When such facilities are encountered, the Contractor shall notify the RPR, who shall arrange for their removal if necessary. The Contractor, at their own expense, shall satisfactorily repair or pay the cost of all damage to such facilities or structures that may result from any of the Contractor's operations during the period of the contract.

a. Blasting. Blasting shall not be allowed.

152-2.2 Excavation. No excavation shall be started until the work has been staked out by the Contractor and the RPR has obtained from the Contractor, the survey notes of the elevations and measurements of the ground surface. The Contractor and RPR shall agree that the original ground lines shown on the original topographic mapping are accurate, or agree to any adjustments made to the original ground lines.

Digital terrain model (DTM) files of the existing surfaces, finished surfaces and other various surfaces were used to develop the design plans.

Existing grades on the design cross sections or DTM's, where they do not match the locations of actual spot elevations shown on the topographic map, were developed by computer interpolation from those spot elevations. Prior to disturbing original grade, Contractor shall verify the accuracy of the existing ground surface by verifying spot elevations at the same locations where original field survey data was obtained as indicated on the topographic map. Contractor shall recognize that, due to the interpolation process, the actual ground surface at any particular location may differ somewhat from the interpolated surface shown on the design cross sections or obtained from the DTM's. Contractor's verification of original ground surface, however, shall be limited to verification of spot elevations as indicated herein, and no adjustments will be made to the original ground surface unless the Contractor demonstrates that spot elevations shown are incorrect. For this purpose, spot elevations which are within 0.1 foot of the stated elevations for ground surfaces, or within 0.04 foot for hard surfaces (pavements, buildings, foundations, structures, etc.) shall be considered "no change". Only deviations in excess of these will be considered for adjustment of the original ground surface. If Contractor's verification identifies discrepancies in the topographic map, Contractor shall notify the RPR in writing at least two weeks before disturbance of existing grade to allow sufficient time to verify the submitted information and make adjustments to the design cross sections or DTM's. Disturbance of existing grade in any area shall constitute acceptance by the Contractor of the accuracy of the original elevations shown on the topographic map for that area.

All areas to be excavated shall be stripped of vegetation and topsoil. Topsoil shall be stockpiled for future use in areas designated on the plans or by the RPR. All suitable excavated material shall be used in the formation of embankment, subgrade, or other purposes as shown on the plans. All unsuitable material shall be disposed of as shown on the plans.

The grade shall be maintained so that the surface is well drained at all times.

When the volume of the excavation exceeds that required to construct the embankments to the grades as indicated on the plans, the excess shall be used to grade the areas of ultimate development or disposed as directed by the RPR. When the volume of excavation is not sufficient for constructing the embankments to the grades indicated, the deficiency shall be obtained from borrow areas.

a. Selective grading. When selective grading is indicated on the plans, the more suitable material designated by the RPR shall be used in constructing the embankment or in capping the pavement subgrade. If, at the time of excavation, it is not possible to place this material in its final location, it shall be stockpiled in approved areas until it can be placed. The more suitable material shall then be placed and compacted as specified. Selective grading shall be considered incidental to the work involved. The cost of stockpiling and placing the material shall be included in the various pay items of work involved.

b. Undercutting. Rock, shale, hardpan, loose rock, boulders, or other material unsatisfactory for safety areas, subgrades, roads, shoulders, or any areas intended for turf shall be excavated to a minimum depth of 12 inches below the subgrade or to the depth specified by the RPR. Muck, peat, matted roots, or other yielding material, unsatisfactory for subgrade foundation, shall be removed to the depth specified. Unsuitable materials shall be legally disposed of off the airport. The cost is incidental to this item. This excavated material shall be paid for per the Contract lump sum. The excavated area shall be backfilled with suitable material obtained from the grading operations or borrow areas and compacted to specified densities. The necessary backfill will constitute a part of the embankment. Where rock cuts are made, backfill with select material. Any pockets created in the rock surface shall be drained in accordance with the details shown on the plans. Undercutting will be paid for per the contract lump sum.

c. Over-break. Over-break, including slides, is that portion of any material displaced or loosened beyond the finished work as planned or authorized by the RPR. All over-break shall be graded or removed by the Contractor and disposed of as directed by the RPR. The RPR shall determine if the displacement of such material was unavoidable and their own decision shall be final. Payment will not be made for the removal and disposal of over-break that the RPR determines as avoidable. Unavoidable over-break will be classified as "Unclassified Excavation."

d. Removal of utilities. The removal of existing structures and utilities required to permit the orderly progress of work will be accomplished by the Contractor as indicated on the plans. All existing foundations shall be excavated at least 2 feet (60 cm) below the top of subgrade or as indicated on the plans, and the material disposed of as directed by the RPR. All foundations thus excavated shall be backfilled with suitable material and compacted as specified for embankment or as shown on the plans.

152-2.3 Borrow excavation. Borrow areas are not required.

152-2.4 Drainage excavation. Drainage excavation shall consist of excavating drainage ditches including intercepting, inlet, or outlet ditches; or other types as shown on the plans. The work shall be performed in sequence with the other construction. Ditches shall be constructed prior to starting adjacent excavation operations. All satisfactory material shall be placed in embankment fills; unsuitable material shall be placed in designated waste areas or as directed by the RPR. All necessary work shall be performed true to final line, elevation, and cross-section. The Contractor shall maintain ditches constructed on the project to the required cross-section and shall keep them free of debris or obstructions until the project is accepted.

152-2.5 Preparation of cut areas or areas where existing pavement has been removed. In those areas on which a subbase or base course is to be placed, the top 12 inches of subgrade shall be compacted to not less than 100% of maximum density for non-cohesive soils, and 95% of maximum density for cohesive soils as determined by ASTM D1557. As used in this specification, "non-cohesive" shall mean those soils having a plasticity index (PI) of less than 3 as determined by ASTM D4318.

152-2.6 Preparation of embankment area. All sod and vegetative matter shall be removed from the surface upon which the embankment is to be placed. The cleared surface shall be broken up by plowing or scarifying to a minimum depth of 6 inches (150 mm) and shall then be compacted per paragraph 152-2.10.

Sloped surfaces steeper than one (1) vertical to four (4) horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When the subgrade is part fill and

part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 12 inches and compacted as specified for the adjacent fill.

No direct payment shall be made for the work performed under this section. The necessary clearing and grubbing and the quantity of excavation removed will be paid for under the respective items of work.

152-2.7 Control Strip. The first half-day of construction of subgrade and/or embankment shall be considered as a control strip for the Contractor to demonstrate, in the presence of the RPR, that the materials, equipment, and construction processes meet the requirements of this specification. The sequence and manner of rolling necessary to obtain specified density requirements shall be determined. The maximum compacted thickness may be increased to a maximum of 12 inches upon the Contractor's demonstration that approved equipment and operations will uniformly compact the lift to the specified density. The RPR must witness this demonstration and approve the lift thickness prior to full production.

Control strips that do not meet specification requirements shall be reworked, re-compacted, or removed and replaced at the Contractor's expense. Full operations shall not begin until the control strip has been accepted by the RPR. The Contractor shall use the same equipment, materials, and construction methods for the remainder of construction, unless adjustments made by the Contractor are approved in advance by the RPR.

152-2.8 Formation of embankments. The material shall be constructed in lifts as established in the control strip, but not less than 6 inches nor more than 12 inches of compacted thickness.

When more than one lift is required to establish the layer thickness shown on the plans, the construction procedure described here shall apply to each lift. No lift shall be covered by subsequent lifts until tests verify that compaction requirements have been met. The Contractor shall rework, re-compact and retest any material placed which does not meet the specifications.

The lifts shall be placed, to produce a soil structure as shown on the typical cross-section or as directed by the RPR. Materials such as brush, hedge, roots, stumps, grass and other organic matter, shall not be incorporated or buried in the embankment.

Earthwork operations shall be suspended at any time when satisfactory results cannot be obtained due to rain, freezing, or other unsatisfactory weather conditions in the field. Frozen material shall not be placed in the embankment nor shall embankment be placed upon frozen material. Material shall not be placed on surfaces that are muddy, frozen, or contain frost. The Contractor shall drag, blade, or slope the embankment to provide surface drainage at all times.

The material in each lift shall be within $\pm 2\%$ of optimum moisture content before rolling to obtain the prescribed compaction. The material shall be moistened or aerated as necessary to achieve a uniform moisture content throughout the lift. Natural drying may be accelerated by blending in dry material or manipulation alone to increase the rate of evaporation.

The Contractor shall make the necessary corrections and adjustments in methods, materials or moisture content to achieve the specified embankment density.

The contractor will take samples of excavated materials which will be used in embankment for testing and develop a Moisture-Density Relations of Soils Report (Proctor) in accordance with D1557. A new Proctor shall be developed for each soil type based on visual classification.

Density tests will be taken by the contractor for every 3,000 square yards of compacted embankment for each lift which is required to be compacted, or other appropriate frequencies as determined by the RPR.

If the material has greater than 30% retained on the 3/4-inch sieve, follow AASHTO T-180 Annex Correction of maximum dry density and optimum moisture for oversized particles.

Rolling operations shall be continued until the embankment is compacted to not less than 100% of maximum density for non-cohesive soils, and 95% of maximum density for cohesive soils as determined by ASTM D1557. Under all areas to be paved, the embankments shall be compacted to a depth of 12 inches and to a density of not less than 95 percent of the maximum density as determined by ASTM D1557. As used in this specification, "non-cohesive" shall mean those soils having a plasticity index (PI) of less than 3 as determined by ASTM D4318.

On all areas outside of the pavement areas, no compaction will be required on the top 6 inches which shall be prepared for a seedbed in accordance with Item T-901.

The in-place field density shall be determined in accordance with ASTM 6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938. The Contractor's laboratory shall perform all density tests in the RPR's presence and provide the test results upon completion to the RPR for acceptance. If the specified density is not attained, the area represented by the test or as designated by the RPR shall be reworked and/or re-compacted and additional random tests made. This procedure shall be followed until the specified density is reached.

Compaction areas shall be kept separate, and no lift shall be covered by another lift until the proper density is obtained.

During construction of the embankment, the Contractor shall route all construction equipment evenly over the entire width of the embankment as each lift is placed. Lift placement shall begin in the deepest portion of the embankment fill. As placement progresses, the lifts shall be constructed approximately parallel to the finished pavement grade line.

When rock, concrete pavement, asphalt pavement, and other embankment material are excavated at approximately the same time as the subgrade, the material shall be incorporated into the outer portion of the embankment and the subgrade material shall be incorporated under the future paved areas. Stones, fragmentary rock, and recycled pavement larger than 4 inches in their greatest dimensions will not be allowed in the top 12 inches of the subgrade. Rockfill shall be brought up in lifts as specified or as directed by the RPR and the finer material shall be used to fill the voids forming a dense, compact mass. Rock, cement concrete pavement, asphalt pavement, and other embankment material shall not be disposed of except at places and in the manner designated on the plans or by the RPR.

When the excavated material consists predominantly of rock fragments of such size that the material cannot be placed in lifts of the prescribed thickness without crushing, pulverizing or further breaking down the pieces, such material may be placed in the embankment as directed in lifts not exceeding 2 feet in thickness. Each lift shall be leveled and smoothed with suitable equipment by distribution of spalls and finer fragments of rock. The lift shall not be constructed above an elevation 4 feet below the finished subgrade.

There will be no separate measurement of payment for compacted embankment. All costs incidental to placing in lifts, compacting, discing, watering, mixing, sloping, and other operations necessary for construction of embankments will be included in the contract lump sum.

152-2.9 Proof rolling. Not Used.

152-2.10 Compaction requirements. The subgrade under areas to be paved shall be compacted to a depth of 12 inches and to a density of not less than 95 percent of the maximum dry density as determined by ASTM D1557. The subgrade in areas outside the limits of the pavement areas shall be compacted to a depth of 12 inches and to a density of not less than 95 percent of the maximum density as determined by ASTM D698.

The material to be compacted shall be within $\pm 2\%$ of optimum moisture content before being rolled to obtain the prescribed compaction (except for expansive soils). When the material has greater than 30 percent retained on the $\frac{3}{4}$ inch sieve, follow the ASTM D1557. Tests for moisture content and compaction will be taken at a minimum of 500 square yards of subgrade and at least once per drainage structure base. All quality assurance testing shall be done by the Contractor's laboratory in the presence of the RPR, and density test results shall be furnished upon completion to the RPR for acceptance determination.

The in-place field density shall be determined in accordance with ASTM D6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938 within 12 months prior to its use on this contract. The gage shall be field standardized daily.

Maximum density refers to maximum dry density at optimum moisture content unless otherwise specified.

If the specified density is not attained, the entire lot shall be reworked and/or re-compacted and additional random tests made. This procedure shall be followed until the specified density is reached.

All cut-and-fill slopes shall be uniformly dressed to the slope, cross-section, and alignment shown on the plans or as directed by the RPR and the finished subgrade shall be maintained.

152-2.11 Finishing and protection of subgrade. Finishing and protection of the subgrade is incidental to this item. Grading and compacting of the subgrade shall be performed so that it will drain readily. All low areas, holes or depressions in the subgrade shall be brought to grade. Scarifying, blading, rolling and other methods shall be performed to provide a thoroughly compacted subgrade shaped to the lines and grades shown on the plans. All ruts or rough places that develop in the completed subgrade shall be graded, re-compacted, and retested. The Contractor shall protect the subgrade from damage and limit hauling over the finished subgrade to only traffic essential for construction purposes.

The Contractor shall maintain the completed course in satisfactory condition throughout placement of subsequent layers. No subbase, base, or surface course shall be placed on the subgrade until the subgrade has been accepted by the RPR.

152-2.12 Haul. All hauling will be considered a necessary and incidental part of the work. The Contractor shall include the cost in the contract unit price for the pay of items of work involved. No payment will be made separately or directly for hauling on any part of the work.

The Contractor's equipment shall not cause damage to any excavated surface, compacted lift or to the subgrade as a result of hauling operations. Any damage caused as a result of the Contractor's hauling operations shall be repaired at the Contractor's expense.

The Contractor shall be responsible for providing, maintaining and removing, and disposing of any haul roads or routes within or outside of the work area, and shall return the affected areas to their former condition, unless otherwise authorized in writing by the Owner. No separate payment will be made for any work or materials associated with providing, maintaining and removing, and disposing of haul roads or routes.

152-2.13 Surface Tolerances. In those areas on which a subbase or base course is to be placed, the surface shall be tested for smoothness and accuracy of grade and crown. Any portion lacking the required smoothness or failing in accuracy of grade or crown shall be scarified to a depth of at least 3 inches (75 mm), reshaped and re-compacted to grade until the required smoothness and accuracy are obtained and approved by the RPR. The Contractor shall perform all final smoothness and grade checks in the presence of the RPR. Any deviation in surface tolerances shall be corrected by the Contractor at the Contractor's expense.

- a. **Smoothness.** The finished surface shall not vary more than $\pm \frac{1}{2}$ inch when tested with a 12-foot straightedge applied parallel with and at right angles to the centerline. The straightedge shall be moved continuously forward at half the length of the 12-foot straightedge for the full length of each line on a 50-foot grid.
- b. **Grade.** The grade and crown shall be measured on a 50-foot grid and shall be within ± 0.05 feet of the specified grade.

On safety areas, turfed areas and other designated areas within the grading limits where no subbase or base is to be placed, grade shall not vary more than 0.10 feet from specified grade. Any deviation in excess of this amount shall be corrected by loosening, adding or removing materials, and reshaping.

152-2.14 Topsoil. When topsoil is specified or required as shown on the plans or under Item T-905, it shall be salvaged from stripping or other grading operations. The topsoil shall meet the requirements of Item T-905. If, at the time of excavation or stripping, the topsoil cannot be placed in its final section of finished construction, the material shall be stockpiled at approved locations. Stockpiles shall be located as shown on the plans and the approved CSPP, and shall not be placed on areas that subsequently will require any excavation or embankment fill. If, in the judgment of the RPR, it is practical to place the salvaged topsoil at the time of excavation or stripping, the material shall be placed in its final position without stockpiling or further re-handling.

Upon completion of grading operations, stockpiled topsoil shall be handled and placed as shown on the plans and as required in Item T-905. Topsoil shall be paid for as provided in Item T-905. No direct payment will be made for topsoil under Item P-152.

152.2.15 Materials Not Accepted for Use. Any materials not accepted by the RPR for use in the project or any excess materials not used by the Contractor must be removed and legally disposed of off of Airport property. No material may be wasted on the Airport site unless approved by the Owner or RPR.

METHOD OF MEASUREMENT

152-3.1 There will be no direct measurement for this section.

BASIS OF PAYMENT

152-4.1 Payment will be remitted per the contract lump sum.

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

American Association of State Highway and Transportation Officials (AASHTO)

AASHTO T-180	Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop

ASTM International (ASTM)

ASTM D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft ³ (600 kN-m/m ³))

ASTM D1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

ASTM D1557	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft ³ (2700 kN-m/m ³))
ASTM D6938	Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
Advisory Circulars (AC)	
AC 150/5370-2	Operational Safety on Airports During Construction Software
Software	
FAARFIELD – FAA Rigid and Flexible Iterative Elastic Layered Design	
U.S. Department of Transportation	
FAA RD-76-66	Design and Construction of Airport Pavements on Expansive Soils

END OF ITEM P-152

Item P-154 Subbase Course

DESCRIPTION

154-1.1 This item shall consist of a subbase course composed of granular materials constructed on a prepared subgrade or underlying course in accordance with these specifications, and in conformity with the dimensions and typical cross-section shown on the plans.

MATERIALS

154-2.1 Materials. The subbase material shall consist of hard durable particles or fragments of granular aggregates, recycled asphalt pavement (RAP). The material may be obtained from gravel pits, stockpiles, or may be produced from a crushing and screening plant with proper blending. The materials from these sources shall meet the requirements for gradation, quality, and consistency. The material shall be free from vegetative matter, excessive amounts of clay, and other objectionable substances; uniformly blended; and be capable of being compacted into a dense, stable subbase.

The subbase material shall exhibit a California Bearing Ratio (CBR) value of at least 20 when tested in accordance with ASTM D1883. The subbase material shall meet the gradation specified in the table below.

Subbase Gradation Requirements

Sieve designation	Percentage by weight passing sieves		Contractor's Final Gradation	Job Control Grading Band Tolerances ¹ (Percent)
	Subbase Aggregate	Recycled pavement (RAP or RCO)		
3 inch (75 mm)	100			0
1 1/2 inch (37.5 mm)		100		0
3/4 inch (19.0 mm)	70-100	70-100		±10
No. 10 (2.00 mm)	20-100	20-100		±10
No. 40 (425 µm)	5-60	5-60		±5
No. 200 (75 µm)	0-15	0-15		±5

¹The "Job Control Grading Band Tolerances" shall be applied to "Contractor's Final Gradation" to establish the job control grading band.

The portion of the material passing the No. 40 sieve shall have a liquid limit of not more than 25 and a plasticity index of not more than six (6) when tested in accordance with ASTM D4318.

154-2.2 Sampling and testing.

a. Aggregate base materials. Samples shall be taken by the Contractor per ASTM D75 for initial aggregate subbase requirements and gradation. Material shall meet the requirements in paragraphs 154-2.1. The Contractor shall submit to the Resident Project Representative (RPR) certified test results showing that the aggregate meets the Material requirements of this section. Tests shall be representative of the material to be used for the project.

b. Gradation requirements. The Contractor shall take at least one aggregate subbase sample per day in the presence of the RPR to check the final gradation. Samples shall be taken from the in-place, un-compacted material at sampling locations determined by the RPR on a random basis per ASTM D3665. Sampling shall be per ASTM D75 and tested per ASTM C136 and ASTM C117. Results shall be furnished to the RPR by the Contractor each day during construction. Material shall meet the requirements in paragraph 154-2.1.

154-2.3 Separation Geotextile. Separation geotextile shall be Class 2; 0.02 sec-1 permittivity per ASTM D4491; Apparent opening size per ASTM D4751 with maximum average roll value.

154-2.4 Geogrid. The fabric used as a stabilization material between subgrade, subbase or base material applications shall be constructed of a integrally formed biaxial polypropylene, shall be resistant to chemical attack, mildew and rot, and shall meet the following physical requirements:

a. Tensile Strength	1,400 lb/ft.(Min.)	ASTM D 6637-10
b. Junction Efficiency	93% (Min.)	ASTM D 7737-11
c. Flexural Stiffness	750,000 mg-cm (Min.)	ASTM D 7748-12
d. Aperture Dimensions	1.3 in. (Max.)	

The Contractor shall submit to the Engineer for approval, prior to ordering, the manufacturer's certification for each material supplied verifying the material to be used meets the requirements of this specification. Certified test results for each lot produced shall be delivered to the job site prior to use.

The subgrade for placement of stabilization geogrid shall be inspected prior to installation of the fabric to insure it is smooth of any depressions or bumps.

Geogrid shall be placed over the entire subgrade surface in order to provide a uniform stabilization. The placement of geogrid shall be in congruence with Over-Excavation in order to provide a stable platform to facilitate further pavement section construction. The contractor shall coordinate with the RPR to determine areas requiring geogrid.

CONSTRUCTION METHODS

154-3.1 General. The subbase course shall be placed where designated on the plans or as directed by the RPR. The material shall be shaped and thoroughly compacted within the tolerances specified.

Granular subbases which, due to grain sizes or shapes, are not sufficiently stable to support the construction equipment without movement, shall be mechanically modified to the depth necessary to provide stability as directed by the RPR. The mechanical modification shall include the addition of a fine-grained medium to bind the particles of the subbase material sufficiently to furnish a bearing strength, so the course will not deform under construction equipment traffic.

154-3.2 Preparing underlying course. Prior to constructing the subbase course, clean the underlying course or subgrade of all foreign substances. The surface of the underlying course or subgrade shall meet specified compaction and surface tolerances in accordance with Item P-152. Correct ruts, soft yielding spots in the underlying courses, and subgrade areas having inadequate compaction and/or deviations of the surface from the specified requirements, by loosening and removing soft or unsatisfactory material, adding approved material, reshaping to line and grade, and recompacting to specified density requirements. For cohesionless underlying courses or subgrades containing sands or gravels, as defined in ASTM D2487, the surface shall be stabilized prior to placement of the overlying course by mixing the overlying course material into the underlying course, and compacting by approved methods. The stabilized material shall be considered as part of the underlying course and shall meet all requirements for the underlying course. The finished underlying course shall not be disturbed by traffic or other operations and shall be maintained in a satisfactory condition until the overlying course is placed. The underlying course shall be checked and accepted by the RPR before placing and spreading operations are started.

To protect the subgrade and to ensure proper drainage, spreading of the subbase shall begin along the centerline of the pavement on a crowned section or on the high side of pavements with a one-way slope.

154-3.3 Control Strip. Not applicable.

154-3.4 Placement. The material shall be placed and spread on the prepared underlying layer by spreader boxes or other devices as approved by the RPR, to a uniform thickness and width. The equipment shall have positive thickness controls to minimize the need for additional manipulation of the material. Dumping from vehicles that require re-handling shall not be permitted. Hauling over the uncompacted base course shall not be permitted. The material shall not be placed when the underlying course is soft or yielding.

The material shall meet gradation and moisture requirements prior to compaction. Material may be free-draining and the minimum moisture content shall be established for placement and compaction of the material.

The material shall be constructed in lifts as established in the control strip, but not less than 4 inches nor more than 12 inches of compacted thickness.

When more than one lift is required to establish the layer thickness shown on the plans, the construction procedure described here shall apply to each lift. No lift shall be covered by subsequent lifts until tests verify that compaction requirements have been met. The Contractor shall rework, re-compact and retest any material placed which does not meet the specifications.

154-3.5 Compaction. The subbase material shall be compacted, adjusting moisture as necessary, to be within $\pm 2\%$ of optimum moisture. The field density of the compacted material shall be at least 100% of the maximum density as specified in paragraph 154-3.9a. If the specified density is not attained, the area of the lift represented by the test shall be reworked and/or re-compact and additional random tests made. This procedure shall be followed until the specified density is reached. Maximum density refers to maximum dry density at optimum moisture content unless otherwise specified.

154-3.6 Weather limitation. Material shall not be placed unless the ambient air temperature is at least 40°F and rising. Work on subbase course shall not be conducted when the subgrade is wet or frozen or the subbase material contains frozen material.

154-3.7 Maintenance. No base or surface course shall be placed on the subbase until the subbase has been accepted by the RPR. The Contractor shall maintain the completed course in satisfactory condition throughout placement of subsequent layers. When material has been exposed to excessive rain, snow, or freeze-thaw conditions, the Contractor shall verify that materials still meet all specification requirements before placement of additional material. Equipment may be routed over completed sections of subbase course, provided the equipment does not damage the subbase course and the equipment is routed over the

full width of the completed subbase course. Any damage to the subbase course from routing equipment over the subbase course shall be repaired by the Contractor at their expense.

154-3.8 Surface tolerance. In those areas on which a subbase or base course is to be placed, the surface shall be tested for smoothness and accuracy of grade and crown. Any portion lacking the required smoothness or failing in accuracy of grade or crown shall be scarified to a depth of at least 3 inches, reshaped and re-compacted to grade until the required smoothness and accuracy are obtained and approved by the RPR. The Contractor shall perform all final smoothness and grade checks in the presence of the RPR. Any deviation in surface tolerances shall be corrected by the Contractor at the Contractor's expense.

a. Smoothness. The finished surface shall not vary more than $\pm \frac{1}{2}$ inch when tested with a 12-foot straightedge applied parallel with and at right angles to the centerline. The straightedge shall be moved continuously forward at half the length of the 12-foot straightedge for the full length of each line on a 50-foot grid.

b. Grade. The grade and crown shall be measured on a 50-foot grid and shall be within ± 0.05 feet of the specified grade.

154-3.9 Acceptance sampling and testing. The aggregate base course shall be accepted for density and thickness on an area basis. Two tests shall be made for density and thickness for each manhole base. Sampling locations will be determined on a random basis per ASTM D3665.

a. Density. The Contractor's laboratory shall perform all density tests in the RPR's presence and provide the test results upon completion to the RPR for acceptance.

Each area shall be accepted for density when the field density is at least 100% of the maximum density of laboratory specimens compacted and tested per ASTM D1557. The in-place field density shall be determined per ASTM D6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938. If the specified density is not attained, the area represented by the failed test shall be reworked and/or recompacted and two additional random tests made. This procedure shall be followed until the specified density is reached. Maximum density refers to maximum dry density at optimum moisture content unless otherwise specified.

When the material has greater than 30 percent retained on the $\frac{3}{4}$ inch sieve, use methods in ASTM D1557 and the procedures in AASHTO T180 Annex for correction of maximum dry density and optimum moisture for oversized particles.

b. Thickness. The thickness of the base course shall be within ± 0 and $\pm \frac{1}{2}$ inch of the specified thickness as determined by survey on a 50-foot grid of surface before and after placement of base. Where the thickness is deficient by more than $\frac{1}{2}$ -inch, the Contractor shall correct such areas at no additional cost by scarifying to a depth of at least 3 inches, adding new material of proper gradation, and the material shall be blended and recompacted to grade. The Contractor shall replace, at his expense, base material where depth tests have been taken.

METHOD OF MEASUREMENT

154-4.1 There will be no direct measurement for this section.

BASIS OF PAYMENT

154-5.1 Payment will be remitted per the contract lump sum.

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM International (ASTM)

ASTM C117	Standard Test Method for Materials Finer than 75- μ m (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D75	Standard Practice for Sampling Aggregates
ASTM D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft ³ (600 kN-m/m ³))
ASTM D1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D1557	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft ³ (2,700 kN-m/m ³))
ASTM D2487	Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D4253	Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
ASTM D4759	Practice for Determining the Specification Conformance of Geosynthetics
ASTM D4318	Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D6938	Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

American Association of State Highway and Transportation Officials (AASHTO)

M 288	Geotextile Specification for Highway Applications

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Item P-209 Crushed Aggregate Base Course

DESCRIPTION

209-1.1 This item consists of a base course composed of crushed aggregate base constructed on a prepared course in accordance with these specifications and in conformity to the dimensions and typical cross-sections shown on the plans.

MATERIALS

209-2.1 Crushed aggregate base. Crushed aggregate shall consist of clean, sound, durable particles of crushed stone, crushed gravel, and shall be free from coatings of clay, silt, organic material, clay lumps or balls or other deleterious materials or coatings. The method used to produce the crushed gravel shall result in the fractured particles in the finished product as consistent and uniform as practicable. Fine aggregate portion, defined as the portion passing the No. 4 sieve shall consist of fines from the coarse aggregate crushing operation. The fine aggregate shall be produced by crushing stone, gravel, that meet the coarse aggregate requirements for wear and soundness. Aggregate base material requirements are listed in the following table.

Crushed Aggregate Base Material Requirements

Material Test	Requirement	Standard
Coarse Aggregate		
Resistance to Degradation	Loss: 45% maximum	ASTM C131
Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate	Loss after 5 cycles: 12% maximum using Sodium sulfate - or - 18% maximum using magnesium sulfate	ASTM C88
Percentage of Fractured Particles	Minimum 90% by weight of particles with at least two fractured faces and 98% with at least one fractured face ¹	ASTM D5821
Flat Particles, Elongated Particles, or Flat and Elongated Particles	10% maximum, by weight, of flat, elongated, or flat and elongated particles ²	ASTM D4791
Fine Aggregate		
Liquid limit	Less than or equal to 25	ASTM D4318
Plasticity Index	Not more than five (5)	ASTM D4318

¹ The area of each face shall be equal to at least 75% of the smallest mid-sectional area of the piece. When two fractured faces are contiguous, the angle between the planes of fractures shall be at least 30 degrees to count as two fractured faces.

² A flat particle is one having a ratio of width to thickness greater than five (5); an elongated particle is one having a ratio of length to width greater than five (5).

209-2.2 Gradation requirements. The gradation of the aggregate base material shall meet the requirements of the gradation given in the following table when tested per ASTM C117 and ASTM C136.

The gradation shall be well graded from coarse to fine and shall not vary from the lower limit on one sieve to the high limit on an adjacent sieve or vice versa.

Gradation of Aggregate Base

Sieve Size	Design Range Percentage by Weight passing	Contractor's Final Gradation	Job Control Grading Band Tolerances ¹ (Percent)
2 inch (50 mm)	100		0
1-1/2 inch (37.5 mm)	95-100		±5
1 inch (25.0 mm)	70-95		±8
3/4 inch (19.0 mm)	55-85		±8
No. 4 (4.75 mm)	30-60		±8
No. 40 ² (425 µm)	10-30		±5
No. 200 ² (75 µm)	0-10		±3

¹ The "Job Control Grading Band Tolerances for Contractor's Final Gradation" in the table shall be applied to "Contractor's Final Gradation" to establish a job control grading band. The full tolerance still applies if application of the tolerances results in a job control grading band outside the design range.

² The fraction of material passing the No 200 sieve shall not exceed two-thirds the fraction passing the No 40 sieve.

209-2.3 Sampling and Testing.

a. Aggregate base materials. The Contractor shall take samples of the aggregate base in accordance with ASTM D75 to verify initial aggregate base requirements and gradation. Material shall meet the requirements in paragraph 209-2.1. This sampling and testing will be the basis for approval of the aggregate base quality requirements.

b. Gradation requirements. The Contractor shall take at least two aggregate base samples per day in the presence of the Resident Project Representative (RPR) to check the final gradation. Sampling shall be per ASTM D75. Material shall meet the requirements in paragraph 209-2.2. The samples shall be taken from the in-place, un-compacted material at sampling points and intervals designated by the RPR.

209-2.4 Separation Geotextile. Separation geotextile shall be Class 2, 0.02 sec-1 permittivity per ASTM D4491, Apparent opening size per ASTM D4751 with 0.60 mm maximum average roll value.

CONSTRUCTION METHODS

209-3.1 Control strip. The first half-day of construction shall be considered the control strip. The Contractor shall demonstrate, in the presence of the RPR, that the materials, equipment, and construction processes meet the requirements of the specification. The sequence and manner of rolling necessary to obtain specified density requirements shall be determined. The maximum compacted thickness may be increased to a maximum of 12 inches upon the Contractor's demonstration that approved equipment and

operations will uniformly compact the lift to the specified density. The RPR must witness this demonstration and approve the lift thickness prior to full production.

Control strips that do not meet specification requirements shall be reworked, re-compacted or removed and replaced at the Contractor's expense. Full operations shall not continue until the control strip has been accepted by the RPR. The Contractor shall use the same equipment, materials, and construction methods for the remainder of construction, unless adjustments made by the Contractor are approved by the RPR.

209-3.2 Preparing underlying subgrade and/or subbase. The underlying subgrade and/or subbase shall be checked and accepted by the RPR before base course placing and spreading operations begin. Re-proof rolling of the subgrade or proof rolling of the subbase in accordance with Item P-152, at the Contractor's expense, may be required by the RPR if the Contractor fails to ensure proper drainage or protect the subgrade and/or subbase. Any ruts or soft, yielding areas due to improper drainage conditions, hauling, or any other cause, shall be corrected before the base course is placed. To ensure proper drainage, the spreading of the base shall begin along the centerline of the pavement on a crowned section or on the high side of the pavement with a one-way slope.

209-3.3 Production. The aggregate shall be uniformly blended and, when at a satisfactory moisture content per paragraph 209-3.5, the approved material may be transported directly to the placement.

209-3.4 Placement. The aggregate shall be placed and spread on the prepared underlying layer by spreader boxes or other devices as approved by the RPR, to a uniform thickness and width. The equipment shall have positive thickness controls to minimize the need for additional manipulation of the material. Dumping from vehicles that require re-handling shall not be permitted. Hauling over the uncompacted base course shall not be permitted.

The aggregate shall meet gradation and moisture requirements prior to compaction. The base course shall be constructed in lifts as established in the control strip, but not less than 4 inches nor more than 12 inches of compacted thickness.

When more than one lift is required to establish the layer thickness shown on the plans, the construction procedure described here shall apply to each lift. No lift shall be covered by subsequent lifts until tests verify that compaction requirements have been met. The Contractor shall rework, re-compact and retest any material placed which does not meet the specifications at the Contractor's expense.

209-3.5 Compaction. Immediately after completion of the spreading operations, compact each layer of the base course, as specified, with approved compaction equipment. The number, type, and weight of rollers shall be sufficient to compact the material to the required density within the same day that the aggregate is placed on the subgrade.

The field density of each compacted lift of material shall be at least 100% of the maximum density of laboratory specimens prepared from samples of the base material delivered to the jobsite. The laboratory specimens shall be compacted and tested in accordance with ASTM D1557. The moisture content of the material during placing operations shall be within ± 2 percentage points of the optimum moisture content as determined by ASTM 1557. Maximum density refers to maximum dry density at optimum moisture content unless otherwise specified.

209-3.6 Weather limitations. Material shall not be placed unless the ambient air temperature is at least 40°F and rising. Work on base course shall not be conducted when the subgrade or subbase is wet or frozen or the base material contains frozen material.

209-3.7 Maintenance. The base course shall be maintained in a condition that will meet all specification requirements. When material has been exposed to excessive rain, snow, or freeze-thaw conditions, prior to placement of additional material, the Contractor shall verify that materials still meet all specification

requirements. Equipment may be routed over completed sections of base course, provided that no damage results and the equipment is routed over the full width of the completed base course. Any damage resulting to the base course from routing equipment over the base course shall be repaired by the Contractor at the Contractor's expense.

209-3.8 Surface tolerances. After the course has been compacted, the surface shall be tested for smoothness and accuracy of grade and crown. Any portion lacking the required smoothness or failing in accuracy of grade or crown shall be scarified to a depth of at least 3 inches, reshaped and recompacted to grade until the required smoothness and accuracy are obtained and approved by the RPR. Any deviation in surface tolerances shall be corrected by the Contractor at the Contractor's expense. The smoothness and accuracy requirements specified here apply only to the top layer when base course is constructed in more than one layer.

a. Smoothness. The finished surface shall not vary more than 3/8-inch when tested with a 12-foot straightedge applied parallel with and at right angles to the centerline. The straightedge shall be moved continuously forward at half the length of the 12-foot straightedge for the full length of each line on a 50-foot grid.

b. Grade. The grade and crown shall be measured on a 50-foot grid and shall be within +0 and -1/2 inch of the specified grade.

209-3.9 Acceptance sampling and testing. Crushed aggregate base course shall be accepted for density and thickness on an area basis. Two tests shall be made for density and thickness for each 1200 square yds. Sampling locations will be determined on a random basis per ASTM D3665.

a. Density. The Contractor's laboratory shall perform all density tests in the RPR's presence and provide the test results upon completion to the RPR for acceptance.

Each area shall be accepted for density when the field density is at least 100% of the maximum density of laboratory specimens compacted and tested per ASTM D1557. The in-place field density shall be determined per ASTM D1557 or ASTM D6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938. If the specified density is not attained, the area represented by the failed test must be reworked and/or recompacted and two additional random tests made. This procedure shall be followed until the specified density is reached. Maximum density refers to maximum dry density at optimum moisture content unless otherwise specified.

b. Thickness. The thickness of the base course shall be within +0 and -1/2 inch of the specified thickness as determined by survey on a 50-foot grid of surface before and after placement of base. Where the thickness is deficient by more than 1/2-inch, the Contractor shall correct such areas at no additional cost by scarifying to a depth of at least 3 inches, adding new material of proper gradation, and the material shall be blended and recompacted to grade. The Contractor shall replace, at his expense, base material where depth tests have been taken.

METHOD OF MEASUREMENT

209-4.1 There will be no direct measurement for this section.

BASIS OF PAYMENT

209-5.1 Payment will be remitted per the contract lump sum.

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM International (ASTM)

ASTM C29	Standard Test Method for Bulk Density (“Unit Weight”) and Voids in Aggregate
ASTM C88	Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C117	Standard Test Method for Materials Finer than 75- μm (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C131	Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136	Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates
ASTM C142	Standard Test Method for Clay Lumps and Friable Particles in Aggregates
ASTM D75	Standard Practice for Sampling Aggregates
ASTM D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft ³ (600 kN-m/m ³))
ASTM D1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D1557	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft ³ (2700 kN-m/m ³))
ASTM D2167	Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D2419	Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate
ASTM D3665	Standard Practice for Random Sampling of Construction Materials
ASTM D4318	Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D4491	Standard Test Methods for Water Permeability of Geotextiles by Permittivity
ASTM D4643	Standard Test Method for Determination of Water Content of Soil and Rock by Microwave Oven Heating
ASTM D4751	Standard Test Methods for Determining Apparent Opening Size of a Geotextile
ASTM D4791	Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D5821	Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate
ASTM D6938	Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM D7928	Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis

American Association of State Highway and Transportation Officials (AASHTO)

M288 Standard Specification for Geosynthetic Specification for Highway Applications

END OF ITEM P-209

Item P-403 Asphalt Mix Pavement (Base, Leveling, Surface Course)

DESCRIPTION

403-1.1 This item shall consist of pavement courses composed of mineral aggregate and asphalt binder mixed in a central mixing plant and placed on a prepared course in accordance with these specifications and shall conform to the lines, grades, thicknesses, and typical cross-sections shown on the plans. Each course shall be constructed to the depth, typical section, and elevation required by the plans and shall be rolled, finished, and approved before the placement of the next course.

MATERIALS

403-2.1 Aggregate. Aggregates shall consist of crushed stone, crushed gravel, crushed slag, screenings, natural sand and mineral filler, as required. The aggregates should have no known history of detrimental pavement staining due to ferrous sulfides, such as pyrite. Coarse aggregate is the material retained on the No. 4 sieve. Fine aggregate is the material passing the No. 4 sieve.

a. Coarse aggregate. Coarse aggregate shall consist of sound, tough, durable particles, free from films of matter that would prevent thorough coating and bonding with the asphalt material and free from organic matter and other deleterious substances. Coarse aggregate material requirements are given in the table below.

Coarse Aggregate Material Requirements

Material Test	Requirement	Standard
Resistance to Degradation	Loss: 40% maximum for surface, asphalt binder, and leveling course Loss: 50% maximum for base course	ASTM C131
Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate	Loss after 5 cycles: 12% maximum using Sodium sulfate - or - 18% maximum using magnesium sulfate	ASTM C88
Clay lumps and friable particles	1.0 % maximum	ASTM C142
Percentage of Fractured Particles	For pavements designed for aircraft gross weights of 60,000 pounds or more: Minimum 75% by weight of particles with at least two fractured faces and 85% with at least one fractured face ¹	ASTM D5821
	For pavements designed for aircraft gross weights less than 60,000 pounds: Minimum 50% by weight of particles with at least two fractured faces and 65% with at least one fractured face ¹	
Flat, Elongated, or Flat and Elongated Particles	8% maximum, by weight, of flat, elongated, or flat and elongated particles with a value of 5:1 ²	ASTM D4791
Bulk density of slag ³	Weigh not less than 70 pounds per cubic foot	ASTM C29.

¹ The area of each face shall be equal to at least 75% of the smallest mid-sectional area of the piece. When two fractured faces are contiguous, the angle between the planes of fractures shall be at least 30 degrees to count as two fractured faces.

² A flat particle is one having a ratio of width to thickness greater than five (5); an elongated particle is one having a ratio of length to width greater than five (5).

³ Only required if slag is specified.

b. Fine aggregate. Fine aggregate shall consist of clean, sound, tough, durable, angular shaped particles produced by crushing stone, slag, or gravel and shall be free from coatings of clay, silt, or other objectionable matter. Natural (non-manufactured) sand may be used to obtain the gradation of the aggregate blend or to improve the workability of the mix. Fine aggregate material requirements are listed in the table below.

Fine Aggregate Material Requirements

Material Test	Requirement	Standard
Liquid limit	25 maximum	ASTM D4318
Plasticity Index	4 maximum	ASTM D4318
Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate	Loss after 5 cycles: 10% maximum using Sodium sulfate - or - 15% maximum using magnesium sulfate	ASTM C88
Clay lumps and friable particles	1.0 % maximum	ASTM C142
Sand equivalent	45 minimum	ASTM D2419

c. Sampling. ASTM D75 shall be used in sampling coarse and fine aggregate, and ASTM C183 shall be used in sampling mineral filler.

403-2.2 Mineral filler. Mineral filler (baghouse fines) may be added in addition to material naturally present in the aggregate. Mineral filler shall meet the requirements of ASTM D242.

Mineral filler Requirements

Material Test	Requirement	Standard
Plasticity Index	4 maximum	ASTM D4318

403-2.3 Asphalt binder. Asphalt binder shall conform to ASTM D6373 Performance Grade (PG) 64-22.

403-2.4 Anti-stripping agent. Any anti-stripping agent or additive (anti-strip) shall be heat stable and shall not change the asphalt binder grade beyond specifications. Anti-strip shall be an approved material of the Department of Transportation of the State in which the project is located.

403-2.5 Bond Breaker. Not Used.

COMPOSITION

403-3.1 Composition of mixture. The asphalt plant mix shall be composed of a mixture of well-graded aggregate, filler and anti-strip agent if required, and asphalt binder. The several aggregate fractions shall be sized, handled in separate size groups, and combined in such proportions that the resulting mixture meets the grading requirements of the job mix formula (JMF).

403-3.2 Job mix formula (JMF) laboratory. The laboratory used to develop the JMF shall possess a current certificate of accreditation, listing D3666 from a national accrediting authority and all test methods required for developing the JMF, and listed on the accrediting authority's website. A copy of the laboratory's current accreditation and accredited test methods shall be submitted to the RPR prior to start of construction.

403-3.3 Job mix formula (JMF). No asphalt mixture shall be placed until an acceptable mix design has been submitted to the RPR for review and accepted in writing. The RPR's review shall not relieve the Contractor of the responsibility to select and proportion the materials to comply with this section.

When the project requires asphalt mixtures of differing aggregate gradations and/or binders, a separate JMF shall be submitted for each mix. Add anti-stripping agent to meet tensile strength requirements.

The JMF shall be prepared by an accredited laboratory that meets the requirements of paragraph 403-3.2. The asphalt mixture shall be designed using procedures contained in Asphalt Institute MS-2 Mix Design Manual, 7th Edition. Samples shall be prepared and compacted using the gyratory compactor in accordance with ASTM D6925.

Should a change in sources of materials be made, a new JMF must be submitted to the RPR for review and accepted in writing before the new material is used. After the initial production JMF has been approved by the RPR and a new or modified JMF is required for whatever reason, the subsequent cost of the new or modified JMF, including a new control strip when required by the RPR, will be borne by the Contractor.

The RPR may request samples at any time for testing, prior to and during production, to verify the quality of the materials and to ensure conformance with the applicable specifications.

The JMF shall be submitted in writing by the Contractor at least 30 days prior to the start of paving operations. The JMF shall be developed within the same construction season using aggregates proposed for project use.

The submitted JMF shall be dated, and stamped or sealed by the responsible professional Engineer of the laboratory and shall include the following items as a minimum:

- Manufacturer's Certificate of Analysis (COA) for the asphalt binder used in the JMF in accordance with paragraph 403-2.3. Certificate of asphalt performance grade is with modifier already added, if used and must indicate compliance with ASTM D6373. For plant modified asphalt binder, certified test report indicating grade certification of modified asphalt binder.
- Manufacturer's Certificate of Analysis (COA) for the anti-stripping agent if used in the JMF in accordance with paragraph 403-2.4.
- Certified material test reports for the course and fine aggregate and mineral filler in accordance with paragraphs 403-2.1 and 403-2.2.
- Percent passing each sieve size for individual gradation of each aggregate cold feed and/or hot bin; percent by weight of each cold feed and/or hot bin used; and the total combined gradation in the JMF.
- Specific Gravity and absorption of each course and fine aggregate.
- Percent natural sand.
- Percent fractured faces.
- Percent by weight of flat particles, elongated particles, and flat and elongated particles (and criteria).
- Percent of asphalt.
- Number of blows or gyrations.
- Laboratory mixing and compaction temperatures.
- Supplier recommended mixing and compaction temperatures.
- Plot of the combined gradation on the 0.45 power gradation curve.
- Graphical plots of air voids, voids in the mineral aggregate (VMA), and unit weight versus asphalt content. To achieve minimum VMA during production, the mix design needs to account for material breakdown during production.

- Tensile Strength Ratio (TSR).
- Type and amount of Anti-strip agent when used.
- Asphalt Pavement Analyzer (APA) results.
- Date the JMF was developed. Mix designs that are not dated or which are from a prior construction season shall not be accepted.
- Percentage and properties (asphalt content, asphalt binder properties, and aggregate properties) of reclaimed asphalt pavement (RAP) in accordance with paragraph 403-3.4, Reclaimed Hot-Mix Asphalt, if RAP is used.

Table 1. Asphalt Design Criteria

Test Property	Value	Test Method
Number of blows/gyrations	75	
Air voids (%)	3.5	ASTM D3203
Percent voids in mineral aggregate (VMA), minimum	See Table 2	ASTM D6995
TSR ¹	not less than 80 at a saturation of 70-80%	ASTM D4867
[Asphalt Pavement Analyzer (APA) ^{2,3}]	Less than 10 mm @ 4000 passes	[AASHTO T 340 at 250 psi hose pressure at 64°C test temperature]

¹ Test specimens for TSR shall be compacted at 7 ± 1.0 % air voids. In areas subject to freeze-thaw, use freeze-thaw conditioning in lieu of moisture conditioning per ASTM D4867.

² AASHTO T340 at 100 psi hose pressure at 64°C test temperature may be used in the interim. If this method is used the required Value shall be less than 5 mm @ 8000 passes

³ Where APA not available, use Hamburg wheel test (AASHTO T 324) 10 mm@ 20,000 passes at 50°C.

The mineral aggregate shall be of such size that the percentage composition by weight, as determined by laboratory sieves, will conform to the gradation or gradations specified in Table 2 when tested in accordance with ASTM C136 and ASTM C117.

The gradations in Table 2 represent the limits that shall determine the suitability of aggregate for use from the sources of supply, be well graded from coarse to fine and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve, or vice versa.

Table 2. Aggregate - Asphalt Pavements

Sieve Size	Percentage by Weight Passing Sieve
1 inch (25.0 mm)	--
3/4 inch (19.0 mm)	100
1/2 inch (12.5 mm)	90-100
3/8 inch (9.5 mm)	72-88
No. 4 (4.75 mm)	53-73
No. 8 (2.36 mm)	38-60
No. 16 (1.18 mm)	26-48
No. 30 (600 µm)	18-38
No. 50 (300 µm)	11-27
No. 100 (150 µm)	6-18
No. 200 (75 µm)	3-6
Voids in Mineral Aggregate (VMA)¹	15
Asphalt Percent:	
Stone or gravel	5.0-7.5
Slag	6.5-9.5
Recommended Minimum Construction Lift Thickness	2 inch

¹To achieve minimum VMA during production, the mix design needs to account for material breakdown during production.

The aggregate gradations shown are based on aggregates of uniform specific gravity. The percentages passing the various sieves shall be corrected when aggregates of varying specific gravities are used, as indicated in the Asphalt Institute MS-2 Mix Design Manual, 7th Edition.

403-3.4 Reclaimed Asphalt Pavement (RAP). Reclaimed asphalt pavement shall consist of reclaimed asphalt pavement (RAP), coarse aggregate, fine aggregate, mineral filler, and asphalt. Recycled asphalt shingles (RAS) shall not be allowed. The RAP shall be of a consistent gradation and asphalt content and properties. When RAP is fed into the plant, the maximum RAP chunk size shall not exceed 1-1/2 inches (38 mm). The reclaimed asphalt mix shall be designed using procedures contained in the Asphalt Institute MS-2 Mix Design Manual, 7th Edition. The percentage of asphalt in the RAP shall be established for the mixture design according to ASTM D2172 using the appropriate dust correction procedure. The JMF shall meet the requirements of paragraph 403-3.3. RAP should only be used for shoulder surface course mixes and for any intermediate courses. The use of RAP containing Coal Tar shall not be allowed. Coal Tar surface treatments must be removed prior to recycling underlying asphalt material. The amount of RAP shall be limited to 20 percent.

In addition to the requirements of paragraph 403-3.3, the JMF shall indicate the percent of reclaimed asphalt pavement and the percent and grade of new asphalt binder.

For the PG graded asphalt binder selected in paragraph 403-2.3, adjust as follows:

- a. For 0-20% RAP, there is no change in virgin asphalt binder content.
- b. For >20 to 30% RAP, select asphalt binder one grade softer, i.e., PG 64-22 would soften to PG 58-28.

403-3.5 Control strip. Full production shall not begin until an acceptable control strip has been constructed and accepted in writing by the RPR. The Contractor shall prepare and place a quantity of asphalt according to the JMF. The underlying grade or pavement structure upon which the control strip is to be constructed shall be the same as the remainder of the course represented by the control strip.

The Contractor will not be allowed to place the control strip until the Contractor quality control program (CQCP), showing conformance with the requirements of paragraph 403-5.1, has been accepted, in writing, by the RPR.

The control strip will consist of at least 250 tons or 1/2 subplot, whichever is greater. The control strip shall be placed in two lanes of the same width and depth to be used in production with a longitudinal cold joint. The cold joint must be cut back in accordance with paragraph 403-4.13 using the same procedure that will be used during production. The cold joint for the control strip will be an exposed construction joint at least four (4) hours old or when the mat has cooled to less than 160°F (71°C). The equipment used in construction of the control strip shall be the same type, configuration and weight to be used on the project.

The control strip shall be evaluated for acceptance as a single lot in accordance with the acceptance criteria in paragraph 403-6.1 and 403-6.2.

The control strip will be considered acceptable by the RPR if the gradation, asphalt content, and VMA are within the action limits specified in paragraph 403-5.5a; and Mat density greater than or equal to 94%, air voids 3.5% +/- 1%, and joint density greater than or equal to 92%.

If the control strip is unacceptable, necessary adjustments to the JMF, plant operation, placing procedures, and/or rolling procedures shall be made and another control strip shall be placed. Unacceptable control strips shall be removed at the Contractor's expense.

The control strip will be considered one lot for payment based upon the average of a minimum of 3 samples (no sublots required for control strip). Payment will only be made for an acceptable control strip in accordance with paragraph 403-8.1.

CONSTRUCTION METHODS

403-4.1 Weather limitations. The asphalt shall not be placed upon a wet surface or when the surface temperature of the underlying course is less than specified in Table 4. The temperature requirements may be waived by the RPR, if requested; however, all other requirements including compaction shall be met.

Table 4. Surface Temperature Limitations of Underlying Course

Mat Thickness	Base Temperature (Minimum)	
	Degrees F	Degrees C
3 inches (7.5 cm) or greater	40	4
Greater than 2 inches (50 mm) but less than 3 inches (7.5 cm)	45	7

403-4.2 Asphalt plant. Plants used for the preparation of asphalt shall conform to the requirements of American Association of State Highway and Transportation Officials (AASHTO) M156 including the following items:

a. Inspection of plant. The RPR, or RPR's authorized representative, shall have access, at all times, to all areas of the plant for checking adequacy of equipment; inspecting operation of the plant: verifying

weights, proportions, and material properties; and checking the temperatures maintained in the preparation of the mixtures.

b. Storage bins and surge bins. The asphalt mixture stored in storage and/or surge bins shall meet the same requirements as asphalt mixture loaded directly into trucks. Asphalt mixture shall not be stored in storage and/or surge bins for a period greater than twelve (12) hours. If the RPR determines there is an excessive heat loss, segregation or oxidation of the asphalt mixture due to temporary storage, temporary storage shall not be allowed.

403-4.3 Aggregate stockpile management. Aggregate stockpiles shall be constructed in such a manner that prevents segregation and intermixing of deleterious materials. Aggregates from different sources shall be stockpiled, weighed and batched separately at the concrete batch plant. Aggregates that have become segregated or mixed with earth or foreign material shall not be used.

A continuous supply of materials shall be provided to the work to ensure continuous placement.

403-4.4 Hauling equipment. Trucks used for hauling asphalt shall have tight, clean, and smooth metal beds. To prevent the asphalt from sticking to the truck beds, the truck beds shall be lightly coated with a minimum amount of paraffin oil, lime solution, or other material approved by the RPR. Petroleum products shall not be used for coating truck beds. Each truck shall have a suitable cover to protect the mixture from adverse weather. When necessary, to ensure that the mixture will be delivered to the site at the specified temperature, truck beds shall be insulated or heated and covers shall be securely fastened.

403-4.4.1 Material transfer vehicle (MTV). Material transfer Vehicles shall be required due to the improvement in smoothness and decrease in both physical and thermal segregation. To transfer the material from the hauling equipment to the paver, use a self-propelled, material transfer vehicle with a swing conveyor that can deliver material to the paver without making contact with the paver. The MTV shall be able to move back and forth between the hauling equipment and the paver providing material transfer to the paver, while allowing the paver to operate at a constant speed. The Material Transfer Vehicle will have remixing and storage capability to prevent physical and thermal segregation.

403-4.5 Asphalt pavers. Asphalt pavers shall be self-propelled with an activated heated screed, capable of spreading and finishing courses of asphalt that will meet the specified thickness, smoothness, and grade. The paver shall have sufficient power to propel itself and the hauling equipment without adversely affecting the finished surface. The asphalt paver shall be equipped with a control system capable of automatically maintaining the specified screed grade and elevation.

If the spreading and finishing equipment in use leaves tracks or indented areas, or produces other blemishes in the pavement that are not satisfactorily corrected by the scheduled operations, the use of such equipment shall be discontinued.

The paver shall be capable of paving to a minimum width specified in paragraph 401-4.11.

403-4.6 Rollers. The number, type, and weight of rollers shall be sufficient to compact the asphalt to the required density while it is still in a workable condition without crushing of the aggregate, depressions or other damage to the pavement surface. Rollers shall be in good condition, capable of operating at slow speeds to avoid displacement of the asphalt. All rollers shall be specifically designed and suitable for compacting asphalt concrete and shall be properly used. Rollers that impair the stability of any layer of a pavement structure or underlying soils shall not be used.

403-4.6.1 Density device. The Contractor shall have on site a density gauge during all paving operations in order to assist in the determination of the optimum rolling pattern, type of roller and frequencies, as well as to monitor the effect of the rolling operations during production paving. The Contractor shall also supply a qualified technician during all paving operations to calibrate the density gauge and obtain accurate density readings for all new asphalt. These densities shall be supplied to the RPR upon request at

any time during construction. No separate payment will be made for supplying the density gauge and technician.

403-4.7 Preparation of asphalt binder. The asphalt binder shall be heated in a manner that will avoid local overheating and provide a continuous supply of the asphalt material to the mixer at a uniform temperature. The temperature of the unmodified asphalt binder delivered to the mixer shall be sufficient to provide a suitable viscosity for adequate coating of the aggregate particles, but shall not exceed 325°F when added to the aggregate. The temperature of modified asphalt binder shall be no more than 350°F when added to the aggregate.

403-4.8 Preparation of mineral aggregate. The aggregate for the asphalt shall be heated and dried. The maximum temperature and rate of heating shall be such that no damage occurs to the aggregates. The temperature of the aggregate and mineral filler shall not exceed 350°F when the asphalt binder is added. Particular care shall be taken that aggregates high in calcium or magnesium content are not damaged by overheating. The temperature shall not be lower than is required to obtain complete coating and uniform distribution on the aggregate particles and to provide a mixture of satisfactory workability.

403-4.9 Preparation of asphalt mixture. The aggregates and the asphalt binder shall be weighed or metered and introduced into the mixer in the amount specified by the JMF. The combined materials shall be mixed until the aggregate obtains a uniform coating of asphalt binder and is thoroughly distributed throughout the mixture. Wet mixing time shall be the shortest time that will produce a satisfactory mixture, but not less than 25 seconds for batch plants. The wet mixing time for all plants shall be established by the Contractor, based on the procedure for determining the percentage of coated particles described in ASTM D2489, for each individual plant and for each type of aggregate used. The wet mixing time will be set to achieve 95% of coated particles. For continuous mix plants, the minimum mixing time shall be determined by dividing the weight of its contents at operating level by the weight of the mixture delivered per second by the mixer. The moisture content of all asphalt upon discharge shall not exceed 0.5%.

403-4.10 Application of Prime and Tack Coat. Immediately before placing the asphalt mixture, the underlying course shall be cleaned of all dust and debris.

A tack coat shall be applied in accordance with Item P-603 to all vertical and horizontal asphalt and concrete surfaces prior to placement of the first and each subsequent lift of asphalt mixture.

403-4.11 Laydown plan, transporting, placing, and finishing. Prior to the placement of the asphalt, the Contractor shall prepare a laydown plan with the sequence of paving lanes and width to minimize the number of cold joints; the location of any temporary ramps; laydown temperature; and estimated time of completion for each portion of the work (milling, paving, rolling, cooling, etc.). The laydown plan and any modifications shall be approved by the RPR.

Deliveries shall be scheduled so that placing and compacting of asphalt is uniform with minimum stopping and starting of the paver. Hauling over freshly placed material shall not be permitted until the material has been compacted, as specified, and allowed to cool to approximately ambient temperature. The Contractor, at their expense, shall be responsible for repair of any damage to the pavement caused by hauling operations.

Contractor shall survey each lift of asphalt surface course and certify to RPR that every lot of each lift meets the grade tolerances of paragraph 401-6.2e before the next lift can be placed.

Edges of existing asphalt pavement abutting the new work shall be saw cut and the cut off material and laitance removed. Apply a tack coat in accordance with P-603 before new asphalt material is placed against it.

The speed of the paver shall be regulated to eliminate pulling and tearing of the asphalt mat. Placement of the asphalt mix shall begin along the centerline of a crowned section or on the high side of areas with a one way slope unless shown otherwise on the laydown plan as accepted by the RPR. The asphalt mix shall be placed in consecutive adjacent lanes having a minimum width of 10 feet except where edge lanes require less width to complete the area. Additional screed sections attached to widen the paver to meet the minimum lane width requirements must include additional auger sections to move the asphalt mixture uniformly along the screed extension.

The longitudinal joint in one course shall offset the longitudinal joint in the course immediately below by at least 1 foot; however, the joint in the surface top course shall be at the centerline of crowned pavements. Transverse joints in one course shall be offset by at least 10 feet from transverse joints in the previous course. Transverse joints in adjacent lanes shall be offset a minimum of 10 feet. On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the asphalt may be spread and luted by hand tools.

The RPR may at any time, reject any batch of asphalt, on the truck or placed in the mat, which is rendered unfit for use due to contamination, segregation, incomplete coating of aggregate, or overheated asphalt mixture. Such rejection may be based on only visual inspection or temperature measurements. In the event of such rejection, the Contractor may take a representative sample of the rejected material in the presence of the RPR, and if it can be demonstrated in the laboratory, in the presence of the RPR, that such material was erroneously rejected, payment will be made for the material at the contract unit price.

Areas of segregation in the surface course, as determined by the RPR, shall be removed and replaced at the Contractor's expense. The area shall be removed by saw cutting and milling a minimum of the construction lift thickness as specified in paragraph 401-3.3, Table 2 for the approved mix design. The area to be removed and replaced shall be a minimum width of the paver and a minimum of 10 feet long.

403-4.12 Compaction of asphalt mixture. After placing, the asphalt mixture shall be thoroughly and uniformly compacted by self-propelled rollers. The surface shall be compacted as soon as possible when the asphalt has attained sufficient stability so that the rolling does not cause undue displacement, cracking or shoving. The sequence of rolling operations and the type of rollers used shall be at the discretion of the Contractor. The speed of the roller shall, at all times, be sufficiently slow to avoid displacement of the hot mixture and be effective in compaction. Any surface defects and/or displacement occurring as a result of the roller, or from any other cause, shall be corrected at the Contractor's expense.

Sufficient rollers shall be furnished to handle the output of the plant. Rolling shall continue until the surface is of uniform texture, true to grade and cross-section, and the required field density is obtained. To prevent adhesion of the asphalt to the roller, the wheels shall be equipped with a scraper and kept moistened with water as necessary.

In areas not accessible to the roller, the mixture shall be thoroughly compacted with approved power tampers.

Any asphalt that becomes loose and broken, mixed with dirt, contains check-cracking, or in any way defective shall be removed and replaced with fresh hot mixture and immediately compacted to conform to the surrounding area. This work shall be done at the Contractor's expense. Skin patching shall not be allowed.

403-4.13 Joints. The formation of all joints shall be made in such a manner as to ensure a continuous bond between the courses and obtain the required density. All joints shall have the same texture as other sections of the course and meet the requirements for smoothness and grade.

The roller shall not pass over the unprotected end of the freshly laid asphalt except when necessary to form a transverse joint. When necessary to form a transverse joint, it shall be made by means of placing a bulkhead or by tapering the course. The tapered edge shall be cut back to its full depth and width on a

straight line to expose a vertical face prior to placing the adjacent lane. In both methods, all contact surfaces shall be coated with an asphalt tack coat before placing any fresh asphalt against the joint.

Longitudinal joints which have been left exposed for more than four (4) hours; the surface temperature has cooled to less than 175°F; or are irregular, damaged, uncompacted or otherwise defective shall be cut back with a cutting wheel or pavement saw a maximum of 3 inches to expose a clean, sound, uniform vertical surface for the full depth of the course. All cutback material and any laitance produced from cutting joints shall be removed from the project. An asphalt tack coat or other product approved by the RPR shall be applied to the clean, dry joint prior to placing any additional fresh asphalt against the joint. The cost of this work shall be considered incidental to the cost of the asphalt.

403-4.14 Saw-cut grooving. Saw-cut grooving is not required.

403-4.15 Diamond grinding. Diamond grinding shall be completed prior to pavement grooving. Diamond grinding shall be accomplished by sawing with saw blades impregnated with industrial diamond abrasive.

Diamond grinding shall be performed with a machine designed specifically for diamond grinding capable of cutting a path at least 3 feet wide. The saw blades shall be 1/8-inch wide with a minimum of 55 to 60 blades per 12 inches of cutting head width; grooves between 0.090 and 0.130 inches wide; and peaks and ridges approximately 1/32 inch higher than the bottom of the grinding cut. The actual number of blades will be determined by the Contractor and depend on the hardness of the aggregate. Equipment or grinding procedures that causes ravels, aggregate fractures, spalls or disturbance to the pavement will not be permitted.

Grinding will be tapered in all directions to provide smooth transitions to areas not requiring grinding. The slurry resulting from the grinding operation shall be continuously removed and the pavement left in a clean condition. The Contractor shall apply a surface treatment per P-608 to all areas that have been subject to grinding.

403-4.16 Nighttime Paving Requirements. The Contractor shall provide adequate lighting during any nighttime construction. A lighting plan shall be submitted by the Contractor and approved by the RPR prior to the start of any nighttime work. All work shall be in accordance with the approved CSPP and lighting plan.

CONTRACTOR QUALITY CONTROL (CQC)

403-5.1 General. The Contractor shall develop a CQCP in accordance with Item C-100. No partial payment will be made for materials that are subject to specific QC requirements without an approved CQCP.

403-5.2 Contractor quality control (QC) facilities. The Contractor shall provide or contract for testing facilities in accordance with Item C-100. The RPR shall be permitted unrestricted access to inspect the Contractor's QC facilities and witness QC activities. The RPR will advise the Contractor in writing of any noted deficiencies concerning the QC facility, equipment, supplies, or testing personnel and procedures. When the deficiencies are serious enough to be adversely affecting the test results, the incorporation of the materials into the work shall be suspended immediately and will not be permitted to resume until the deficiencies are satisfactorily corrected.

403-5.3 Quality Control (QC) testing. The Contractor shall perform all QC tests necessary to control the production and construction processes applicable to these specifications and as set forth in the approved CQCP. The testing program shall include, but not necessarily be limited to, tests for the control of asphalt content, aggregate gradation, temperatures, aggregate moisture, field compaction, and surface smoothness. A QC Testing Plan shall be developed as part of the CQCP.

a. Asphalt content. A minimum of two tests shall be performed per day in accordance with ASTM D6307 or ASTM D2172 for determination of asphalt content. When using ASTM D6307, the correction factor shall be determined as part of the first test performed at the beginning of plant production; and as part of every tenth test performed thereafter. The asphalt content for the day will be determined by averaging the test results.

b. Gradation. Aggregate gradations shall be determined a minimum of twice per lot from mechanical analysis of extracted aggregate in accordance with ASTM D5444 and ASTM C136, and ASTM C117.

c. Moisture content of aggregate. The moisture content of aggregate used for production shall be determined a minimum of once per lot in accordance with ASTM C566.

d. Moisture content of asphalt. The moisture content of the asphalt shall be determined once per lot in accordance with AASHTO T329 or ASTM D1461.

e. Temperatures. Temperatures shall be checked, at least four times per lot, at necessary locations to determine the temperatures of the dryer, the asphalt binder in the storage tank, the asphalt at the plant, and the asphalt at the job site.

f. In-place density monitoring. The Contractor shall conduct any necessary testing to ensure that the specified density is being achieved. A nuclear gauge may be used to monitor the pavement density in accordance with ASTM D2950.

g. Smoothness for Contractor Quality Control.

The Contractor shall perform smoothness testing in transverse and longitudinal directions daily to verify that the construction processes are producing pavement with variances less than ¼ inch in 12 feet, identifying areas that may pond water which could lead to hydroplaning of aircraft. If the smoothness criteria is not met, appropriate changes and corrections to the construction process shall be made by the Contractor before construction continues

The Contractor may use a 12-foot (3.7 m) “straightedge, a rolling inclinometer meeting the requirements of ASTM E2133 or rolling external reference device that can simulate a 12-foot (3.7m) straightedge approved by the RPR. Straight-edge testing shall start with one-half the length of the straightedge at the edge of pavement section being tested and then moved ahead one-half the length of the straightedge for each successive measurement. Testing shall be continuous across all joints. The surface irregularity shall be determined by placing the freestanding (unleveled) straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length, and measuring the maximum gap between the straightedge and the pavement surface in the area between the two high points. If the rolling inclinometer or external reference device is used, the data may be evaluated using the FAA profile program, ProFAA, using the 12-foot straightedge simulation function.

Smoothness readings shall not be made across grade changes or cross slope transitions. The transition between new and existing pavement and between the start and stop of lanes place shall be evaluated separately for conformance with the plans.

(1) Transverse measurements. Transverse measurements shall be taken for each day’s production placed. Transverse measurements will be taken perpendicular to the pavement centerline each 50 feet (15 m) or more often as determined by the RPR. The joint between lanes shall be tested separately to facilitate smoothness between lanes.

(2) Longitudinal measurements. Longitudinal measurements shall be taken for each day’s production placed. Longitudinal tests will be parallel to the centerline of paving; at the center of paving lanes when widths of paving lanes are less than 20 feet (6 m); and at the third points of paving lanes when widths of paving lanes are 20 ft (6 m) or greater. When placement abuts previously placed material the

first measurement shall start with one half the length of the straight edge on the previously placed material.

Deviations on the final surface course in either the transverse or longitudinal direction that will trap water greater than 1/4 inch (6 mm) shall be corrected with diamond grinding per paragraph 403-4.15 or by removing and replacing the surface course to full depth. Grinding shall be tapered in all directions to provide smooth transitions to areas not requiring grinding. All areas in which diamond grinding has been performed shall be subject to the final pavement thickness tolerances specified in paragraph 401-6.1d(3). Areas that have been ground shall be sealed with a surface treatment in accordance with Item P-608. To avoid the surface treatment creating any conflict with runway or taxiway markings, it may be necessary to seal a larger area.

Control charts shall be kept to show area of each day's placement and the percentage of corrective grinding required. Corrections to production and placement shall be initiated when corrective grinding is required. If the Contractor's machines and/or methods produce significant areas that need corrective actions in excess of 10 percent of a day's production, production shall be stopped until corrective measures are implemented by the Contractor.

h. Grade. Grade shall be evaluated daily to allow adjustments to paving operations when grade measurements do not meet specifications. As a minimum, grade shall be evaluated prior to the placement of the first lift and then prior to and after placement of the surface lift.

Measurements will be taken at appropriate gradelines (as a minimum at center and edges of paving lane) and longitudinal spacing as shown on cross-sections and plans. The final surface of the pavement will not vary from the gradeline elevations and cross-sections shown on the plans by more than 1/2 inch (12 mm) vertically and 0.1 feet (30 mm) laterally. The documentation will be provided by the Contractor to the RPR by the end of the following working day.

Areas with humps or depressions that exceed grade or smoothness criteria and that retain water on the surface must be ground off provided the course thickness after grinding is not more than 1/2 inch less than the thickness specified on the plans. Grinding shall be in accordance with paragraph 403-4.15.

The Contractor shall repair low areas or areas that cannot be corrected by grinding by removal of deficient areas to the depth of the final course plus 1/2 inch and replacing with new material. Skin patching is not allowed.

403-5.4 Sampling. When directed by the RPR, the Contractor shall sample and test any material that appears inconsistent with similar material being sampled, unless such material is voluntarily removed and replaced or deficiencies corrected by the Contractor. All sampling shall be in accordance with standard procedures specified.

403-5.5 Control charts. The Contractor shall maintain linear control charts both for individual measurements and range (i.e., difference between highest and lowest measurements) for aggregate gradation, asphalt content, and VMA. The VMA for each day shall be calculated and monitored by the QC laboratory.

Control charts shall be posted in a location satisfactory to the RPR and kept current. As a minimum, the control charts shall identify the project number, the contract item number, the test number, each test parameter, the Action and Suspension Limits applicable to each test parameter, and the Contractor's test results. The Contractor shall use the control charts as part of a process control system for identifying potential problems and assignable causes before they occur. If the Contractor's projected data during production indicates a problem and the Contractor is not taking satisfactory corrective action, the RPR may suspend production or acceptance of the material.

a. Individual measurements. Control charts for individual measurements shall be established to maintain process control within tolerance for aggregate gradation, asphalt content, and VMA. The control

charts shall use the JMF target values as indicators of central tendency for the following test parameters with associated Action and Suspension Limits:

Control Chart Limits for Individual Measurements

Sieve	Action Limit	Suspension Limit
3/4 inch	±6%	±9%
1/2 inch	±6%	±9%
3/8 inch	±6%	±9%
No. 4	±6%	±9%
No. 16	±5%	±7.5%
No. 50	±3%	±4.5%
No. 200	±2%	±3%
Asphalt Content	±0.45%	±0.70%
Minimum VMA	-0.5%	-1.0%

b. Range. Control charts for range shall be established to control process variability for the test parameters and Suspension Limits listed below. The range shall be computed for each lot as the difference between the two test results for each control parameter. The Suspension Limits specified below are based on a sample size of $n = 2$. Should the Contractor elect to perform more than two tests per lot, the Suspension Limits shall be adjusted by multiplying the Suspension Limit by 1.18 for $n = 3$ and by 1.27 for $n = 4$.

**Control Chart Limits Based on Range
($n = 2$)**

Sieve	Suspension Limit
1/2 inch	11%
3/8 inch	11%
No. 4	11%
No. 16	9%
No. 50	6%
No. 200	3.5%
Asphalt Content	0.8%

c. Corrective action. The CQCP shall indicate that appropriate action shall be taken when the process is believed to be out of tolerance. The Plan shall contain sets of rules to gauge when a process is out of control and detail what action will be taken to bring the process into control. As a minimum, a process shall be deemed out of control and production stopped and corrective action taken, if:

- (1) One point falls outside the Suspension Limit line for individual measurements or range; or
- (2) Two points in a row fall outside the Action Limit line for individual measurements.

403-5.6 Quality control (QC) reports. The Contractor shall maintain records and shall submit reports of QC activities daily, in accordance with the CQCP described in Item C-100.

MATERIAL ACCEPTANCE

403-6.1. Quality Assurance Acceptance sampling and testing. Unless otherwise specified, all acceptance sampling and testing necessary to determine conformance with the requirements specified in this section will be performed by the RPR at no cost to the Contractor except that coring as required in this section shall be completed and paid for by the Contractor.

a. Quality Assurance (QA) testing laboratory. The QA testing laboratory performing these acceptance tests will be accredited in accordance with ASTM D3666. The QA laboratory accreditation will be current and listed on the accrediting authority's website. All test methods required for acceptance sampling and testing will be listed on the lab accreditation.

b. Lot Size. A standard lot will be equal to one day's production divided into approximately equal sublots of between 400 to 600 tons. When only one or two sublots are produced in a day's production, the sublots will be combined with the production lot from the previous or next day.

Where more than one plant is simultaneously producing asphalt for the job, the lot sizes will apply separately for each plant.

c. Asphalt air voids. Plant-produced asphalt will be tested for air voids on a subplot basis.

(1) Sampling. Material from each subplot shall be sampled in accordance with ASTM D3665. Samples shall be taken from material deposited into trucks at the plant or at the job site in accordance with ASTM D979. The sample of asphalt may be put in a covered metal tin and placed in an oven for not less than 30 minutes nor more than 60 minutes to maintain the material at or above the compaction temperature as specified in the JMF.

(2) Testing. Air voids will be determined for each subplot in accordance with ASTM D3203 for a set of three compacted specimens prepared in accordance with ASTM D6925.

d. In-place asphalt mat and joint density. Each subplot will be tested for in-place mat and joint density as a percentage of the theoretical maximum density (TMD).

(1) Sampling. The Contractor will cut minimum 5 inches diameter samples in accordance with ASTM D5361. The Contractor shall furnish all tools, labor, and materials for cleaning, and filling the cored pavement. Laitance produced by the coring operation shall be removed immediately after coring, and core holes shall be filled within one day after sampling in a manner acceptable to the RPR.

(2) Bond. Each lift of asphalt shall be bonded to the underlying layer. If cores reveal that the surface is not bonded, additional cores shall be taken as directed by the RPR to determine the extent of unbonded areas. Unbonded areas shall be removed by milling and replaced at no additional cost as directed by the RPR.

(3) Thickness. Thickness of each lift of surface course will be evaluated by the RPR for compliance to the requirements shown on the plans after any necessary corrections for grade. Measurements of thickness will be made using the cores extracted for each subplot for density measurement. The maximum allowable deficiency at any point will not be more than 1/4 inch less than the thickness indicated for the lift. Average thickness of lift, or combined lifts, will not be less than the indicated thickness. Where the thickness tolerances are not met, the lot or subplot shall be corrected by the Contractor at his expense by removing the deficient area and replacing with new pavement. The Contractor, at his expense, may take additional cores as approved by the RPR to circumscribe the deficient area.

(4) Mat density. One core shall be taken from each subplot. Core locations will be determined by the RPR in accordance with ASTM D3665. Cores for mat density shall not be taken closer than one foot (30 cm) from a transverse or longitudinal joint. The bulk specific gravity of each cored sample will be

determined in accordance with ASTM D2726. The percent compaction (density) of each sample will be determined by dividing the bulk specific gravity of each subplot sample by the TMD for that subplot.

(5) Joint density. One core centered over the longitudinal joint shall be taken for each subplot which contains a longitudinal joint. Core locations will be determined by the RPR in accordance with ASTM D3665. The bulk specific gravity of each core sample will be determined in accordance with ASTM D2726. The percent compaction (density) of each sample will be determined by dividing the bulk specific gravity of each joint density sample by the average TMD for the lot. The TMD used to determine the joint density at joints formed between lots will be the lower of the average TMD values from the adjacent lots.

403-6.2 Acceptance criteria.

a. General. Acceptance will be based on the implementation of the Contractor Quality Control Program (CQCP) and the following characteristics of the asphalt and completed pavements: air voids, mat density, joint density, and grade.

b. Air voids. Acceptance of each lot of plant produced material for air voids will be based upon the average air void from the sublots. If the average air voids of the lot are equal to or greater than 2% and equal to or less than 5%, then the lot will be acceptable. If the average is below 2% or greater than 5%, the lot shall be removed and replaced at the Contractor's expense.

c. Mat density. Acceptance of each lot of plant produced material for mat density will be based on the average of all of the densities taken from the sublots. If the average mat density of the lot so established equals or exceeds 94%, the lot will be acceptable. If the average mat density of the lot is below 94%, the lot shall be removed and replaced at the Contractor's expense.

d. Joint density. Acceptance of each lot of plant produced asphalt for joint density will be based on the average of all of the joint densities taken from the sublots. If the average joint density of the lot so established equals or exceeds 92%, the lot will be acceptable. If the average joint density of the lot is less than 92%, the Contractor shall stop production and evaluate the method of compacting joints. Production may resume once the reason for poor compaction has been determined and appropriate measures have been taken to ensure proper compaction.

e. Grade. The final finished surface of the pavement of the completed project shall be surveyed to verify that the grade elevations and cross-sections shown on the plans do not deviate more than 1/2 inch (12 mm) vertically or 0.1 feet laterally.

Cross-sections of the pavement shall be taken at a minimum 50-foot longitudinal spacing and at all longitudinal grade breaks. Minimum cross-section grade points shall include grade at centerline, and edge of apron pavement.

The survey and documentation shall be stamped and signed by a licensed surveyor. Payment for sublots that do not meet grade for over 25% of the subplot shall not be more than 95%.

403-6.3 Resampling Pavement for Mat Density.

a. General. Resampling of a lot of pavement will only be allowed for mat density and then, only if the Contractor requests same in writing, within 48 hours after receiving the written test results from the RPR. A retest will consist of all the sampling and testing procedures contained in paragraphs 403-6.1. Only one resampling per lot will be permitted.

(1) A redefined mat density will be calculated for the resampled lot. The number of tests used to calculate the redefined mat density will include the initial tests made for that lot plus the retests.

(2) The cost for resampling and retesting shall be borne by the Contractor.

b. Payment for resampled lots. The redefined mat density for a resampled lot will be used to evaluate the acceptance of that lot in accordance with paragraph 403-6.2.

c. Outliers. Check for outliers in accordance with ASTM E178, at a significance level of 5%. Outliers will be discarded and density determined using the remaining test values.

403-6.4 Leveling course. Not Used.

METHOD OF MEASUREMENT

403-7.1 Measurement. There will be no direct measurement for this section.

BASIS OF PAYMENT

403-8.1 Payment. Payment will be remitted per the contract lump sum.

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM International (ASTM)

ASTM C29	Standard Test Method for Bulk Density (“Unit Weight”) and Voids in Aggregate
ASTM C88	Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C117	Standard Test Method for Materials Finer than 75-μm (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C127	Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate
ASTM C131	Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136	Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates
ASTM C142	Standard Test Method for Clay Lumps and Friable Particles in Aggregates
ASTM C183	Standard Practice for Sampling and the Amount of Testing of Hydraulic Cement
ASTM C566	Standard Test Method for Total Evaporable Moisture Content of Aggregate by Drying
ASTM D75	Standard Practice for Sampling Aggregates
ASTM D242	Standard Specification for Mineral Filler for Bituminous Paving Mixtures
ASTM D946	Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction
ASTM D979	Standard Practice for Sampling Bituminous Paving Mixtures
ASTM D1073	Standard Specification for Fine Aggregate for Bituminous Paving Mixtures

ASTM D1074	Standard Test Method for Compressive Strength of Bituminous Mixtures
ASTM D1461	Standard Test Method for Moisture or Volatile Distillates in Bituminous Paving Mixtures
ASTM D2041	Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
ASTM D2172	Standard Test Method for Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
ASTM D2419	Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate
ASTM D2489	Standard Practice for Estimating Degree of Particle Coating of Bituminous-Aggregate Mixtures
ASTM D2726	Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures
ASTM D2950	Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods
ASTM D3203	Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures
ASTM D3381	Standard Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction
ASTM D3665	Standard Practice for Random Sampling of Construction Materials
ASTM D3666	Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials
ASTM D4125	Standard Test Methods for Asphalt Content of Bituminous mixtures by the Nuclear Method
ASTM D4318	Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D4552	Standard Practice for Classifying Hot-Mix Recycling Agents
ASTM D4791	Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D4867	Standard Test Method for Effect of Moisture on Asphalt Concrete Paving Mixtures
ASTM D5444	Standard Test Method for Mechanical Size Analysis of Extracted Aggregate
ASTM D5581	Standard Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus (6 inch-Diameter Specimen)
ASTM D5821	Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate
ASTM D6307	Standard Test Method for Asphalt Content of Hot-Mix Asphalt by Ignition Method
ASTM D6373	Standard Specification for Performance Graded Asphalt Binder
ASTM D6752	Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Automatic Vacuum Sealing Method

ASTM D6925	Standard Test Method for Preparation and Determination of the Relative Density of Hot Mix Asphalt (HMA) Specimens by Means of the SuperPave Gyratory Compactor
ASTM D6926	Standard Practice for Preparation of Bituminous Specimens Using Marshall Apparatus
ASTM D6995	Standard Test Method for Determining Field VMA based on the Maximum Specific Gravity of the Mix (Gmm)
ASTM E11	Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves
ASTM E178	Standard Practice for Dealing with Outlying Observations
ASTM E2133	Standard Test Method for Using a Rolling Inclinator to Measure Longitudinal and Transverse Profiles of a Traveled Surface
American Association of State Highway and Transportation Officials (AASHTO)	
AASHTO M156	Standard Specification for Requirements for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures
AASHTO T329	Standard Method of Test for Moisture Content of Hot Mix Asphalt (HMA) by Oven Method
AASHTO T 340	Standard Method of Test for Determining the Rutting Susceptibility of Hot Mix Asphalt (APA) Using the Asphalt Pavement Analyzer (APA)
Asphalt Institute (AI)	
MS-2	Mix Design Manual, 7th Edition
MS-26	Asphalt Binder Handbook AI State Binder Specification Database
FAA Orders	
5300.1	Modifications to Agency Airport Design, Construction, and Equipment Standards
Federal Highway Administration (FHWA)	
Long Term Pavement Performance Binder program	
Software	
FAARFIELD	

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Item P-603 Emulsified Asphalt Tack Coat

DESCRIPTION

603-1.1 This item shall consist of preparing and treating an asphalt or concrete surface with asphalt material in accordance with these specifications and in reasonably close conformity to the lines shown on the plans.

MATERIALS

603-2.1 Asphalt materials. The asphalt material shall be an emulsified asphalt as specified in ASTM D3628 as an asphalt application for tack coat appropriate to local conditions. The emulsified asphalt shall not be diluted. The Contractor shall provide a copy of the manufacturer's Certificate of Analysis (COA) for the asphalt material to the Resident Project Representative (RPR) before the asphalt material is applied for review and acceptance. The furnishing of COA for the asphalt material shall not be interpreted as a basis for final acceptance. The manufacturer's COA may be subject to verification by testing the material delivered for use on the project.

CONSTRUCTION METHODS

603-3.1 Weather limitations. The tack coat shall be applied only when the existing surface is dry and the atmospheric temperature is 50°F or above; the temperature has not been below 35°F for the 12 hours prior to application; and when the weather is not foggy or rainy. The temperature requirements may be waived when directed by the RPR.

603-3.2 Equipment. The Contractor shall provide equipment for heating and applying the emulsified asphalt material. The emulsion shall be applied with a manufacturer-approved computer rate-controlled asphalt distributor. The equipment shall be in good working order and contain no contaminants or diluents in the tank. Spray bar tips must be clean, free of burrs, and of a size to maintain an even distribution of the emulsion. Any type of tip or pressure source is suitable that will maintain predetermined flow rates and constant pressure during the application process with application speeds under eight (8) miles per hour or seven (700) feet per minute.

The equipment will be tested under pressure for leaks and to ensure proper set-up before use to verify truck set-up (via a test-shot area), including but not limited to, nozzle tip size appropriate for application, spray-bar height and pressure and pump speed, evidence of triple-overlap spray pattern, lack of leaks, and any other factors relevant to ensure the truck is in good working order before use.

The distributor truck shall be equipped with a minimum 12-foot spreader spray bar with individual nozzle control with computer-controlled application rates. The distributor truck shall have an easily accessible thermometer that constantly monitors the temperature of the emulsion, and have an operable mechanical tank gauge that can be used to cross-check the computer accuracy. If the distributor is not equipped with an operable quick shutoff valve, the prime operations shall be started and stopped on building paper.

The distributor truck shall be equipped to effectively heat and mix the material to the required temperature prior to application as required. Heating and mixing shall be done in accordance with the manufacturer's recommendations. Do not overheat or over mix the material.

The distributor shall be equipped with a hand sprayer.

Asphalt distributors must be calibrated annually in accordance with ASTM D2995. The Contractor must furnish a current calibration certification for the asphalt distributor truck from any State or other agency as approved by the RPR.

A power broom and/or power blower suitable for cleaning the surfaces to which the asphalt tack coat is to be applied shall be provided.

603-3.3 Application of emulsified asphalt material. The emulsified asphalt shall not be diluted. Immediately before applying the emulsified asphalt tack coat, the full width of surface to be treated shall be swept with a power broom and/or power blower to remove all loose dirt and other objectionable material.

The emulsified asphalt material shall be uniformly applied with an asphalt distributor at the rates appropriate for the conditions and surface specified in the table below. The type of asphalt material and application rate shall be approved by the RPR prior to application.

Emulsified Asphalt

Surface Type	Residual Rate, gal/SY (L/square meter)	Emulsion Application Bar Rate, gal/SY (L/square meter)
New asphalt	0.02-0.05	0.03-0.07
Existing asphalt	0.04-0.07	0.06-0.11
Milled Surface	0.04-0.08	.06-0.12
Concrete	0.03-0.05	0.05-0.08

After application of the tack coat, the surface shall be allowed to cure without being disturbed for the period of time necessary to permit drying and setting of the tack coat. This period shall be determined by the RPR. The Contractor shall protect the tack coat and maintain the surface until the next course has been placed. When the tack coat has been disturbed by the Contractor, tack coat shall be reapplied at the Contractor's expense.

603-3.4 Freight and waybills The Contractor shall submit waybills and delivery tickets, during progress of the work. Before the final statement is allowed, file with the RPR certified waybills and certified delivery tickets for all emulsified asphalt materials used in the construction of the pavement covered by the contract. Do not remove emulsified asphalt material from storage until the initial outage and temperature measurements have been taken. The delivery or storage units will not be released until the final outage has been taken.

METHOD OF MEASUREMENT

603-4.1 There will be no direct measurement for this section.

BASIS OF PAYMENT

603.5-1 Payment will be remitted per the contract lump sum.

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM International (ASTM)

ASTM D1250	Standard Guide for Use of the Petroleum Measurement Tables
ASTM D2995	Standard Practice for Estimating Application Rate and Residual Application Rate of Bituminous Distributors
ASTM D3628	Standard Practice for Selection and Use of Emulsified Asphalts

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Item P-605 Joint Sealants for Pavements

DESCRIPTION

605-1.1 This item shall consist of providing and installing a resilient and adhesive joint sealing material capable of effectively sealing joints in pavement; joints between different types of pavements; and cracks in existing pavement.

MATERIALS

605-2.1 Joint sealants. Joint sealant materials shall meet the requirements of ASTM 6690.

Each lot or batch of sealant shall be delivered to the jobsite in the manufacturer's original sealed container. Each container shall be marked with the manufacturer's name, batch or lot number, the safe heating temperature, and shall be accompanied by the manufacturer's certification stating that the sealant meets the requirements of this specification.

605-2.2 Backer rod. The material furnished shall be a compressible, non-shrinking, non-staining, non-absorbing material that is non-reactive with the joint sealant in accordance with ASTM D5249. The backer-rod material shall be $25\% \pm 5\%$ larger in diameter than the nominal width of the joint.

605-2.3 Bond breaking tapes. Provide a bond breaking tape or separating material that is a flexible, non-shrinkable, non-absorbing, non-staining, and non-reacting adhesive-backed tape. The material shall have a melting point at least 5°F greater than the pouring temperature of the sealant being used when tested in accordance with ASTM D789. The bond breaker tape shall be approximately 1/8 inch wider than the nominal width of the joint and shall not bond to the joint sealant.

CONSTRUCTION METHODS

605-3.1 Time of application. Joints shall be sealed as soon after completion of the curing period as feasible and before the pavement is opened to traffic, including construction equipment. The pavement temperature shall be 50°F and rising at the time of application of the poured joint sealing material. Do not apply sealant if moisture is observed in the joint.

605-3.2 Equipment. Machines, tools, and equipment used in the performance of the work required by this section shall be approved before the work is started and maintained in satisfactory condition at all times. Submit a list of proposed equipment to be used in performance of construction work including descriptive data, 10 days prior to use on the project.

a. Tractor-mounted routing tool. Provide a routing tool, used for removing old sealant from the joints, of such shape and dimensions and so mounted on the tractor that it will not damage the sides of the joints. The tool shall be designed so that it can be adjusted to remove the old material to varying depths as required. The use of V-shaped tools or rotary impact routing devices will not be permitted. Hand-operated spindle routing devices may be used to clean and enlarge random cracks.

b. Concrete saw. Provide a self-propelled power saw, with water-cooled diamond or abrasive saw blades, for cutting joints to the depths and widths specified.

c. Sandblasting equipment. Sandblasting is not allowed.

d. Waterblasting equipment. The Contractor must demonstrate waterblasting equipment including the pumps, hose, guide and nozzle size, under job conditions, before approval in accordance with paragraph 605-3.3. The Contractor shall demonstrate, in the presence of the RPR, that the method cleans the joint and does not damage the joint.

e. Hand tools. Hand tools may be used, when approved, for removing defective sealant from a crack and repairing or cleaning the crack faces. Hand tools should be carefully evaluated for potential spalling effects prior to approval for use.

f. Hot-poured sealing equipment. The unit applicators used for heating and installing ASTM D6690 joint sealant materials shall be mobile and shall be equipped with a double-boiler, agitator-type kettle with an oil medium in the outer space for heat transfer; a direct-connected pressure-type extruding device with a nozzle shaped for inserting in the joint to be filled; positive temperature devices for controlling the temperature of the transfer oil and sealant; and a recording type thermometer for indicating the temperature of the sealant. The applicator unit shall be designed so that the sealant will circulate through the delivery hose and return to the inner kettle when not in use.

g. Cold-applied, single-component sealing equipment. Not Used.

605-3.3 Preparation of joints. Pavement joints for application of material in this specification must be dry, clean of all scale, dirt, dust, curing compound, and other foreign matter. The Contractor shall demonstrate, in the presence of the RPR, that the method cleans the joint and does not damage the joint.

a. Sawing. All joints shall be sawed in accordance with specifications and plan details. Immediately after sawing the joint, the resulting slurry shall be completely removed from joint and adjacent area by flushing with a jet of water, and by use of other tools as necessary.

b. Sealing. Immediately before sealing, the joints shall be thoroughly cleaned of all remaining laitance, curing compound, filler, protrusions of hardened concrete, old sealant and other foreign material from the sides and upper edges of the joint space to be sealed. Cleaning shall be accomplished by tractor-mounted routing equipment, concrete saw or waterblaster as specified in paragraph 605-3.2. The newly exposed concrete joint faces and the pavement surface extending a minimum of 1/2 inch from the joint edge shall be sandblasted clean. Sandblasting shall be accomplished in a minimum of two passes. One pass per joint face with the nozzle held at an angle directly toward the joint face and not more than 3 inches from it. After final cleaning and immediately prior to sealing, blow out the joints with compressed air and leave them completely free of debris and water. The joint faces shall be surface dry when the seal is applied.

c. Backer Rod. When the joint opening is of a greater depth than indicated for the sealant depth, plug or seal off the lower portion of the joint opening using a backer rod in accordance with paragraph 605-2.2 to prevent the entrance of the sealant below the specified depth. Take care to ensure that the backer rod is placed at the specified depth and is not stretched or twisted during installation.

d. Bond-breaking tape. Where inserts or filler materials contain bitumen, or the depth of the joint opening does not allow for the use of a backup material, insert a bond-separating tape breaker in accordance with paragraph 605-2.3 to prevent incompatibility with the filler materials and three-sided adhesion of the sealant. Securely bond the tape to the bottom of the joint opening so it will not float up into the new sealant.

605-3.4 Installation of sealants. Joints shall be inspected for proper width, depth, alignment, and preparation, and shall be approved by the RPR before sealing is allowed. Sealants shall be installed in accordance with the following requirements:

Immediately preceding, but not more than 50 feet ahead of the joint sealing operations, perform a final cleaning with compressed air. Fill the joints from the bottom up to 1/8 inch $\pm$ 1/16 inch below the top of pavement surface; or bottom of groove for grooved pavement. Remove and dispose of excess or spilled sealant from the pavement by approved methods. Install the sealant in such a manner as to prevent the formation of voids and entrapped air. In no case shall gravity methods or pouring pots be used to install the sealant material. Traffic shall not be permitted over newly sealed pavement until authorized by the RPR. When a primer is recommended by the manufacturer, apply it evenly to the joint faces in accordance with the manufacturer's instructions. Check the joints frequently to ensure that the newly installed sealant is cured to a tack-free condition within the time specified.

605-3.5 Inspection. The Contractor shall inspect the joint sealant for proper rate of cure and set, bonding to the joint walls, cohesive separation within the sealant, reversion to liquid, entrapped air and voids. Sealants exhibiting any of these deficiencies at any time prior to the final acceptance of the project shall be removed from the joint, wasted, and replaced as specified at no additional cost to the airport.

605-3.6 Clean-up. Upon completion of the project, remove and legally dispose of all unused materials from the site and leave the pavement in a clean condition.

METHOD OF MEASUREMENT

605-4.1 There will be no direct measurement for this section.

BASIS OF PAYMENT

605-5.1 Payment will be remitted per the Contract lump sum.

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM International (ASTM)

ASTM D789	Standard Test Method for Determination of Relative Viscosity of Polyamide (PA)
ASTM D5249	Standard Specification for Backer Material for Use with Cold- and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints
ASTM D5893	Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements
ASTM D6690	Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt
ASTM D7116	Standard Specification for Joint Sealants, Hot Applied, Jet Fuel Resistant Types for Portland Cement Concrete Pavements

Advisory Circulars (AC)

AC 150/5340-30	Design and Installation Details for Airport Visual Aids

END ITEM P-605

Item P-620 Runway and Taxiway Marking

DESCRIPTION

620-1.1 This item shall consist of the preparation and painting of numbers, markings, and stripes on the surface of runways, taxiways, aprons and other pavements, in accordance with these specifications and at the locations shown on the plans, or as directed by the Resident Project Representative (RPR). The terms “paint” and “marking material” as well as “painting” and “application of markings” are interchangeable throughout this specification.

MATERIALS

620-2.1 Materials acceptance. The Contractor shall furnish manufacturer’s certified test reports, for materials shipped to the project. The certified test reports shall include a statement that the materials meet the specification requirements. This certification along with a copy of the paint manufacturer’s surface preparation; marking materials, including adhesion, flow promoting and/or floatation additive; and application requirements must be submitted and approved by the Resident Project Representative (RPR) prior to the initial application of markings. The reports can be used for material acceptance or the RPR may perform verification testing. The reports shall not be interpreted as a basis for payment. The Contractor shall notify the RPR upon arrival of a shipment of materials to the site. All material shall arrive in sealed containers that are easily quantifiable for inspection by the RPR.

620-2.2 Marking materials.

Table 1. Marking Materials

Paint ¹				Glass Beads ²	
Type	Color	Fed Std. 595 Number	Application Rate Maximum	Type	Application Rate Minimum
II	Yellow	33538 or 33655	115 ft ² /gal	III	10 lb/gal
II	White	37925	115 ft ² /gal	III	10 lb/gal
II	Red	31136	115 ft ² /gal	I	5 lb/gal
II	Black	37038	115 ft ² /gal		
Prime Type II	Yellow/ White	See Above	230 ft ² /gal		

¹ See paragraph 620-2.2a

² See paragraph 620-2.2b

a. Paint. Paint shall be waterborne in accordance with the requirements of this paragraph. Paint colors shall comply with Federal Standard No. 595.

Waterborne. Paint shall meet the requirements of Federal Specification TT-P-1952F, Type II. The non-volatile portion of the vehicle for all paint types shall be composed of a 100% acrylic polymer as determined by infrared spectral analysis.

Epoxy. Not Used.

Methacrylate. Not Used.

Solvent-Base. Not Used.

Preformed Thermoplastic Airport Pavement Markings. Not Used.

b. Reflective media. Glass beads for white and yellow paint shall meet the requirements for Federal Specification TT-B-1325D Type III.

Glass beads for red and pink paint shall meet the requirements for Type I, Gradation A.

Glass beads shall be treated with all compatible coupling agents recommended by the manufacturers of the paint and reflective media to ensure adhesion and embedment.

Glass beads shall not be used in black and green paint.

Type III glass beads shall not be used in red and pink paint.

CONSTRUCTION METHODS

620-3.1 Weather limitations. Painting shall only be performed when the surface is dry, and the ambient temperature and the pavement surface temperature meet the manufacturer's recommendations in accordance with paragraph 620-2.1. Painting operations shall be discontinued when the ambient or surface temperatures does not meet the manufacturer's recommendations. Markings shall not be applied when the wind speed exceeds 10 mph unless windscreens are used to shroud the material guns. Markings shall not be applied when weather conditions are forecasts to not be within the manufacturers' recommendations for application and dry time.

620-3.2 Equipment. Equipment shall include the apparatus necessary to properly clean the existing surface, a mechanical marking machine, a bead dispensing machine, and such auxiliary hand-painting equipment as may be necessary to satisfactorily complete the job.

The mechanical marker shall be an atomizing spray-type or airless type marking machine with automatic glass bead dispensers suitable for application of traffic paint. It shall produce an even and uniform film thickness and appearance of both paint and glass beads at the required coverage and shall apply markings of uniform cross-sections and clear-cut edges without running or spattering and without over spray. The marking equipment for both paint and beads shall be calibrated daily.

620-3.3 Preparation of surfaces. Immediately before application of the paint, the surface shall be dry and free from dirt, grease, oil, laitance, or other contaminants that would reduce the bond between the paint and the pavement. Use of any chemicals or impact abrasives during surface preparation shall be approved in advance by the RPR. After the cleaning operations, sweeping, blowing, or rinsing with pressurized water shall be performed to ensure the surface is clean and free of grit or other debris left from the cleaning process.

a. Preparation of new pavement surfaces. The area to be painted shall be cleaned by broom, blower, water blasting, or by other methods approved by the RPR to remove all contaminants, including PCC curing compounds, minimizing damage to the pavement surface.

b. Preparation of pavement to remove existing markings. Existing pavement markings shall be removed by rotary grinding, water blasting, or by other methods approved by the RPR minimizing damage to the pavement surface. The removal area may need to be larger than the area of the markings to

eliminate ghost markings. After removal of markings on asphalt pavements, apply a fog seal or seal coat to 'block out' the removal area to eliminate 'ghost' markings.

c. Preparation of pavement markings prior to remarking. Prior to remarking existing markings, loose existing markings must be removed minimizing damage to the pavement surface, with a method approved by the RPR. After removal, the surface shall be cleaned of all residue or debris.

Prior to the application of markings, the Contractor shall certify in writing that the surface is dry and free from dirt, grease, oil, laitance, or other foreign material that would prevent the bond of the paint to the pavement or existing markings. This certification along with a copy of the paint manufactures application and surface preparation requirements must be submitted to the RPR prior to the initial application of markings.

620-3.4 Layout of markings. The proposed markings shall be laid out in advance of the paint application. The locations of markings to receive glass beads shall be shown on the plans.

620-3.5 Application. A period of 30 days shall elapse between placement of surface course or seal coat and application of the permanent paint markings. Paint shall be applied at the locations and to the dimensions and spacing shown on the plans. Paint shall not be applied until the layout and condition of the surface has been approved by the RPR.

The edges of the markings shall not vary from a straight line more than 1/2 inch in 50 feet, and marking dimensions and spacing shall be within the following tolerances:

Marking Dimensions and Spacing Tolerance

Dimension and Spacing	Tolerance
36 inch (910 mm) or less	±1/2 inch
greater than 36 inch to 6 feet	±1 inch
greater than 6 feet to 60 feet	±2 inch
greater than 60 feet	±3 inch

The paint shall be mixed in accordance with the manufacturer's instructions and applied to the pavement with a marking machine at the rate shown in Table 1. The addition of thinner will not be permitted.

Glass beads shall be distributed upon the marked areas at the locations shown on the plans to receive glass beads immediately after application of the paint. A dispenser shall be furnished that is properly designed for attachment to the marking machine and suitable for dispensing glass beads. Glass beads shall be applied at the rate shown in Table 1. Glass beads shall not be applied to black paint or green paint. Glass beads shall adhere to the cured paint or all marking operations shall cease until corrections are made. Different bead types shall not be mixed. Regular monitoring of glass bead embedment and distribution should be performed.

620-3.6 Application--preformed thermoplastic airport pavement markings.

Preformed thermoplastic pavement markings not used.

620-3.7 Control strip. Prior to the full application of airfield markings, the Contractor shall prepare a control strip in the presence of the RPR. The Contractor shall demonstrate the surface preparation method and all striping equipment to be used on the project. The marking equipment must achieve the prescribed application rate of paint and population of glass beads (per Table 1) that are properly embedded and evenly distributed across the full width of the marking. Prior to acceptance of the control strip, markings must be evaluated during darkness to ensure a uniform appearance.

620-3.8 Retro-reflectance. [Reflectance shall be measured with a portable retro-reflectometer meeting ASTM E1710 (or equivalent). A total of 6 reading shall be taken over a 6 square foot area with 3 readings taken from each direction. The average shall be equal to or above the minimum levels of all readings which are within 30% of each other.

Minimum Retro-Reflectance Values

Material	Retro-reflectance mcd/m ² /lux		
	White	Yellow	Red
Initial Type I	300	175	35
Initial Type III	600	300	35
Initial Thermoplastic	225	100	35
All materials, remark when less than ¹	100	75	10

¹ Prior to remarking determine if removal of contaminants on markings will restore retro-reflectance

620-3.9 Protection and cleanup. After application of the markings, all markings shall be protected from damage until dry. All surfaces shall be protected from excess moisture and/or rain and from disfiguration by spatter, splashes, spillage, or drippings. The Contractor shall remove from the work area all debris, waste, loose reflective media, and by-products generated by the surface preparation and application operations to the satisfaction of the RPR. The Contractor shall dispose of these wastes in strict compliance with all applicable state, local, and federal environmental statutes and regulations.

METHOD OF MEASUREMENT

620-4.1 There will be no direct measurement for this section.

BASIS OF PAYMENT

620-5.1 Payment will be remitted per the contract lump sum.

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM International (ASTM)

ASTM D476	Standard Classification for Dry Pigmentary Titanium Dioxide Products
ASTM D968	Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM D1652	Standard Test Method for Epoxy Content of Epoxy Resins
ASTM D2074	Standard Test Method for Total, Primary, Secondary, and Tertiary Amine Values of Fatty Amines by Alternative Indicator Method

ASTM D2240	Standard Test Method for Rubber Property - Durometer Hardness
ASTM D7585	Standard Practice for Evaluating Retroreflective Pavement Markings Using Portable Hand-Operated Instruments
ASTM E303	Standard Test Method for Measuring Surface Frictional Properties Using the British Pendulum Tester
ASTM E1710	Standard Test Method for Measurement of Retroreflective Pavement Marking Materials with CEN-Prescribed Geometry Using a Portable Retroreflectometer
ASTM E2302	Standard Test Method for Measurement of the Luminance Coefficient Under Diffuse Illumination of Pavement Marking Materials Using a Portable Reflectometer
ASTM G154	Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials

Code of Federal Regulations (CFR)

40 CFR Part 60, Appendix A-7, Method 24	Determination of volatile matter content, water content, density, volume solids, and weight solids of surface coatings
29 CFR Part 1910.1200 Hazard Communication	

Federal Specifications (FED SPEC)

FED SPEC TT-B-1325D	Beads (Glass Spheres) Retro-Reflective
FED SPEC TT-P-1952F	Paint, Traffic and Airfield Marking, Waterborne
FED STD 595	Colors used in Government Procurement

Commercial Item Description

A-A-2886B	Paint, Traffic, Solvent Based

Advisory Circulars (AC)

AC 150/5340-1	Standards for Airport Markings
AC 150/5320-12	Measurement, Construction, and Maintenance of Skid Resistant Airport Pavement Surfaces

END OF ITEM P-620

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Item 34 77 13 Passenger Boarding Bridges (PBB)

PART 1 - GENERAL

34 77 13-1.1 GENERAL DESCRIPTION

This item shall consist of the Passenger Boarding Bridge (PBB) requirements, including major and minor assemblies and components, equipment, accessories, options, design and performance standards and requirements, and warranty information. The Oshkosh Aerotech Jetway Systems (Jetway) Passenger Boarding Bridge (PBB) was used as the basis of design; however, the Contractor may submit an equivalent PBB for review and approval.

Contractor must provide a turn-key installation of a new boarding bridge and fixed-tunnel walkway as described here and in the plans. The Contractor must verify all field conditions and is responsible for any engineering, purchasing, coordination, obtaining permits and other related items in order to procure and install the PBB. This must also include one (1) standard collapsible “gang plank” hand ramp, railings, and cover. Provide solid rubber tires at Wheel Carriage (Wheel Bogie) in lieu of standard inflatable tires.

Refer to **Section 01 11 00 Summary of Work** for any Owner-provided items and/or items to be salvaged and reinstalled by the Contractor with the new PBB.

Refer to structural drawings for PBB support columns and foundation requirements.

34 77 13-1.2 SYSTEM DESCRIPTION

The PBB covered by this specification shall be designed to extend from a terminal departure lounge doorway to the aircraft boarding door. The design shall enable passengers to enplane and deplane during normal or emergency operations, while providing an environment protected from weather and hazardous conditions. The PBB shall provide a simple, convenient, and controlled method for boarding passengers. The complete assembly shall be protected against inclement weather conditions, both when sealed against an aircraft and when parked with the weather door closed.

NOTE: For orientation when referring to left or right, the observer shall be positioned with their back to the terminal end, facing the aircraft end of the PBB.

34 77 13-1.3 SUBMITTALS

The Contractor must submit complete and detailed shop drawings and specifications for the new PBB, fixed-tunnel walkway, and associated components, to the Engineer for review. An index prepared in sequential order listing all drawings, sketches, details, and materials to be submitted shall be provided. All submitted documents must be in English, in United States units, including dimensions, volumes, weights, and forces. The use of metric or SI units is not acceptable.

1.3.1 SHOP DRAWINGS

Shop drawings must include the following:

A. Interior Elements:

- Interior scheme of the bridge and fixed-tunnel walkway model including all components.
- Transition details.
- Wall finish attachment.

- Light fixture details and layout.
- Joint details.
- Loading bridge and fixed-tunnel walkway dimensions and general arrangement drawings.
- Tunnel floor finish.
- Cab floor finish.
- Interior walls and ceiling finishes.
- Carpet edging details, including lines of demarcation between carpeted and hard surfaced floor at wall areas and treatment at doors, thresholds and doors to terminal building.

B. Exterior Elements

- General bridge and fixed-tunnel walkway layout.
- Exterior sketch of each bridge and fixed-tunnel walkway element.
- Graphics.
- Paint finishes,
- Handrails and ladder to roof.
- Flashing (building to fixed-tunnel walkway and fixed-tunnel walkway to bridge).
- Flashing (bridge segments)
- Cab door seal.
- Ramp service stairway and landing.

C. Cab Features

- Operator's cone of visibility from control console.
- Control panel location and functional layout.
- View panels.
- Safety devices.
- Interface with Aircraft.
- Modifications necessary for appropriate mating with required aircraft types (including auto-leveling devices).
- Safety strips.
- Signage (exterior).
- Signage and plaques (interior).
- Door at end of bridge with full glass lites.

D. Appearance and Safety Markings

- Color and finish, exterior.

E. Apron Layout Plan

- CAD files of the proposed aircraft and gate layout will be provided by the Engineer for equipment verification by the PBB manufacturer.
- Verify proposed aircraft layout plan and submit a scaled layout drawing for approval.

1.3.2 ENGINEERING CALCULATIONS

The Contractor must submit to the Engineer structural calculations and power requirement computations including the following:

- A.** Electrical power and control schematic diagrams.
- B.** Structural drawings including all pertinent calculations for PBB and fixed-tunnel walkway, which must be signed and sealed by a professional Structural Engineer licensed in the State of Oregon. The 2025 Oregon Structural Specialty Code (OSSC) and City of Eugene amendments, along with notes on the structural drawings shall be the basis of the calculations.
- C.** Interface requirements for existing foundations and buildings supplied utilities.

1.3.3 ELECTRICAL DISCONNECT AND CONTROL PANELS

The Contractor must provide complete details on the electrical disconnect and controls panel.

1.3.4 MAINTENANCE MANUALS

- A.** The Contractor must provide 30 days prior to acceptance inspections of the loading bridge, four (4) copies of the technical manuals and one (1) electronic copy in searchable PDF or DOC format.
- B.** The shop drawings and manuals must reflect the exact construction (not typical construction) of the unit including manufacturer's part number and pictorial drawings for each item. PDF scans of the shop drawings shall be included in the electronic copy of the maintenance manual.
- C.** The technical manuals must include the following information:
 - List of equipment with description and operation.
 - Significant design criteria.
 - Operating instructions.
 - Maintenance instructions for equipment and systems, including troubleshooting/diagnostics guidelines.
 - Overhaul instructions.
 - List of parts and part numbers for each component, including manufacturer's name and part number, as well as the supplier's name and part number.
 - Illustrated parts list.
 - Recommended spare parts list and source.
 - Maintenance instructions for finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
- D.** Manuals shall be compact and produced in such a manner that the maintenance personnel can easily refer to any of its pages or schematics while standing on the apron while subjected to

jet blast, wind, etc. All binder punch holes shall be reinforced by proper material to prevent tearing.

E. Electrical drawings shall reflect the wiring as it has been constructed and not general drawings. Place one (1) set of drawings in control console of the bridge and one (1) in the manual.

34 77 13-1.4 DESIGN AND PERFORMANCE REQUIREMENTS

The PBB shall be designed in accordance with sound engineering practices and the standards developed and adopted by the passenger boarding bridge industry. Particular attention shall be given to keeping components simple, rugged, and easily accessible for routine maintenance, including lubrication, component exchange, and ease of adjustment. All access panels and openings shall be sized to accommodate the component being changed or adjusted, as well as the equipment and personnel necessary to accomplish the work.

Provided operation and maintenance are performed according to manufacturer specifications and schedules, the PBB shall be engineered to achieve a design service life of up to 20 years in standard operating environments. In coastal operating environments, the PBB shall achieve a design service life of up to 15 years.

1.4.1 STRUCTURAL LOADS

The PBB structure shall support at a minimum the following industry standard loads. These loads may be applied in total or in part, singularly or simultaneously. The design shall be based on the combination that imposes the most adverse loading using load combinations per AISC and ASCE 7 standards. In addition to the dead loads and strain caused by movement, the entire PBB shall support:

- A. Floor load: 40 pounds per square foot (191.5 dN/m²)
- B. Wind load:
 - Retracted and Stowed: Wind velocity of 90 MPH (150 km/hr). Winds over 90 MPH can be accommodated with optional equipment.
 - Extended and Elevated: Wind velocity of 60 MPH (100 km/hr)
- C. Roof load: 25 pounds per square foot (119.7 dN/m²)
- D. Seismic load: As required by local jurisdiction or customer specifications

The structural design shall provide sufficient torsional rigidity to avoid excessive sway when the PBB is brought to a gradual stop.

All mechanisms for actuating, guiding, and restraining the PBB and its components shall be designed to minimize noise and sway. No operating vibrations or loads shall be transmitted to the terminal building.

1.4.2 ENVIRONMENTAL CONSIDERATIONS

The PBB shall operate satisfactorily under ambient temperature conditions of -25 degrees F (-32 degrees C) to +125 degrees F (+52 degrees C). With optional equipment, operation is possible to -40 degrees F (-40 degrees C) or lower temperatures if specified.

All components and materials shall be individually and collectively designed or selected for long service life under such conditions

1.4.3 POWER CHARACTERISTICS

The PBB shall operate on 480 volts, 3 phase, 60 amps, 60 Hz delta configuration with separate ground (4 wire). The 480 VAC shall be transformed to 120/230 VAC for lighting and controls.

All electrical equipment and methods of installation must conform, where applicable, to the requirements and recommendations of the 2023 Oregon Electrical Specialty Code (OESC) with Eugene Amendments, NEMA, and NEC latest issue.

1.4.4 FIRE SAFETY

In accordance with NFPA 415 safety standards, during a ramp fire emergency, PBB interiors shall have uncontaminated air delivered from the terminal building to provide positive air pressure through the PBB. The air shall be provided either by opening the terminal doors or being ducted through a ventilation system using a customer-supplied fan. Wiring provisions for a customer-supplied fan shall be included with the PBB.

The pressurization system to the PBB shall adequately restrict the entry of smoke into the PBB from a free-burning jet fuel spill, to allow safe egress by passengers from an aircraft.

34 77 13-1.5 WARRANTY

- A.** Warranty shall include all parts, labor, travel time, and expenses necessary for remedial repairs or replacement of defective or malfunctioning bridge units or defective system components.
- All parts and materials shall be guaranteed against defects in material and workmanship for a period of five (5) years from the date of acceptance of the work by the Owner with the following exceptions:
 - i. The design of the PBB structure, fixed-tunnel walkway, shell, mechanical assemblies, and electrical systems shall be designed with a life expectancy of twenty (20) years except for normal maintenance components.
 - ii. Paint coatings shall not peel, blister, chip, crack, check and shall not chalk more than represented by a No. 8 rating based on ASTM D659 for a period of ten (10) years.
 - iii. Vertical Drive components and assemblies shall have a minimum of a ten (10) year design life and associated warranty.
 - iv. Door closures shall have an extended warranty as provided by the manufacturer, with a design life of ten (10) years against failure. Extended warranty shall be included in the Operation and Maintenance Manual.
 - v. Warranty shall include the performance of all Service Bulletins by the PBB manufacturer issued by the manufacturer during the warranty period.
 - vi. Consumables such as the canopy, pad, aircraft GPU cable, etc. not covered by warranty.
 - vii. Warranty shall be issued and take effect upon completion of the project.

B. All work by the Contractor within this warranty period shall be provided without cost to the Owner and shall include all labor and necessary materials required to replace defective material and workmanship. If a component is replaced, the warranty period begins again as if the part were new.

C. Contract shall warrant that the equipment and all components and accessories furnished in connection therewith, shall comply fully with the contract documents; be free of any defect in design, material, or workmanship; be new and of good quality; and free and clear from any liens, encumbrances and title defects.

34 77 13-1.6 QUALITY ASSURANCE

A. The Contractor shall verify that no asbestos products, components or additives have been used un this work or supplied to the job.

B. Manufacturer Qualifications: A minimum of ten (10) years of successful experience in the United States in the design, fabrication, and installation of similar PBBs is required. A list with a minimum of five (5) completed projects supplying new PBBs in the United States, with references and contact information, must be included in the qualifications.

C. Installer: Installer must be either the PBB manufacturer or a licensee of the manufacturer with no less than ten (10) years' experience in the installation of comparable passenger boarding bridges.

D. Certifications:

- Independent NRTL listing to certify conformance to NFPA 415, latest edition.
- Independent NRTL listing to certify conformance to NFPA 70, latest edition.
- Independent NRTL listing to certify conformance to UL #508A for Passenger Boarding Bridges.

34 77 13-1.7 DELIVERY, STORAGE AND HANDLING

A. Use all means necessary to protect materials before, during and after installation and to protect installed work and materials of other trades.

B. Deliver materials of this section to job site in their original unopened containers with all labels intact and legible at time of use.

C. Store materials under cover in a manner to prevent damage.

D. Replacement: In the event of damage, immediately make all repairs and replacements necessary for approval of Owner, at no additional cost.

34 77 13-1.8 PROJECT/SITE CONDITIONS

A. The contract documents indicate the location of the PBB foundation and types of aircraft at the gate. The Contractor shall be responsible for verifying all locations (rotunda foundation, aircraft position for the various types of aircraft services, etc.) and advise the Engineer of any conflict or code violation (such as excessive slope, etc.) prior to beginning the fabrication of the PBB.

B. The Contractor shall visit the site and familiarize himself/herself regarding the existing conditions at the project site.

- C. Foundation anchor nuts shall be provided by the PBB Manufacturer, coordinate anchor bolt size and pattern with Engineer.

34 77 13-1.9 PERMITS

The Contractor shall be responsible for applying for and obtaining all required permits. All airport required special permit requirements/conditions are the responsibility of the PBB manufacturer.

The FAA 7460 form will be filed by others.

34 77 13-1.10 AIRPORT SECURITY

The Contractor shall be responsible for determining and complying with Airport Security, Badging and Vehicle access requirements. PBB Contractor shall not rely on the Owner's Representatives for airport access/escorts. No extension of the performance period will be allowed due to the Contractor's ability to comply with Airport Security requirements.

34 77 13-1.11 CONSTRUCTION WASTE

Construction waste shall be managed in accordance with the specification provisions regarding construction waste management and disposal.

34 77 13-1.12 MAINTENANCE

A. Preventative Maintenance: Prior to final completion and during the on-airport storage and installation, the Contractor shall be responsible for the preventative maintenance and general protection from deterioration of the PBB. All preventative maintenance performed shall be documented by the Contractor and forwarded to the Owner. After final completion, the Owner shall be responsible for all preventative maintenance, in accordance with the manufacturer's manual.

B. Corrective Maintenance: The Contractor shall be responsible for all corrective maintenance, under the terms of the warranty (parts and labor) for five (5) years from the date of acceptance of the PBB. Corrective maintenance shall include all maintenance except minor and routine adjustments and lubrication. In the event that the Contractor fails to respond within twenty-four (24) hours to correct a maintenance occurrence (and expediently perform whatever repairs necessary to restore the PBB into service), the Owner reserves the right to perform (with its own maintenance forces or otherwise) such corrective maintenance work and the Contractor shall reimburse the Owner whatever expenses incurred by the Owner in performing such corrective maintenance work. All corrective maintenance performed shall be documented by the Contractor and forwarded to the Owner.

C. The Contractor shall provide the maintenance personnel of the Owner with service bulletins outlining product improvement data resulting from continuing field operation experiences.

PART 2 - PRODUCT

34 77 13-2.1 PRODUCT DETAILS

34 77 13-2.1.1 ROTUNDA ASSEMBLY

The rotunda assembly shall be designed as the terminal-end pivot for the PBB vertical and horizontal motion. As the main PBB pivot, the rotunda assembly shall allow the PBB to swing a total of 175 degrees: 87.5 degrees clockwise and 87.5 degrees counterclockwise from the corridor

centerline. The rotunda assembly shall be designed such that no loads or vibrations shall be transmitted to the building.

A. CORRIDOR

The corridor shall be the interface between the rotunda and the terminal building or fixed passageway. The inside clear width of the corridor shall be 52.5 inches (1334mm) and length 15.5 inches (393mm). The clear height shall be 90.5 inches (2300mm). The corridor shall accommodate installation of flexible exterior weather seals and interior metal flashing and floor thresholds for connection to the terminal building or fixed walkway.

B. ROTUNDA

The rotunda shall provide a smooth transition between the corridor and the telescoping tunnels. The rotunda floor shall remain stationary (i.e., shall not rotate with PBB swing motion) and level through all PBB movements. Flap type seals shall provide weather protection between the rotunda and the hinged telescoping tunnel section. The rotunda shall include a frame that rotates about the vertical axis of the support column and supports the terminal end of the telescoping tunnels. The tunnel attachment shall be pinned to allow the tunnels to rotate about a horizontal axis and allow the tunnels to move vertically through their intended range of motion.

C. SUPPORT COLUMN

The support column shall be the structural support for the PBB. The support column shall bolt to a foundation specified in the structural drawings. The support column shall be custom built to meet specific site conditions and shall have limited adjustment for height and leveling once the column is constructed. The standard anchor bolt pattern for the PBB shall be pattern #7 (eight 2 1/4" diameter bolts in an octagonal pattern). Other bolt patterns shall be optionally available and shall be designed for the loads applied by the specific PBB configuration and location (including wind and seismic loads).

D. ELECTRICAL DISCONNECT PANEL

A NEMA 4X (IP65) rated stainless steel heavy-duty electrical disconnect panel, mounted on the rotunda support column, shall provide electrical disconnects, overcurrent protection and lighting transformer to adapt and distribute the specified, customer-provided 3 phase supply power to the electrical systems of the gate equipment. The disconnect panel shall incorporate the same provisions for the pre-conditioned air, ground power unit, and other systems at the gate in addition to the PBB. The disconnect panel shall be equipped with an interior dead front door. A variety of power source options shall be accommodated where needed, for example, either a single power feed or separate power feeds into the disconnect panel shall be accommodated.

E. ROTUNDA BEARING

The rotunda bearing shall employ a flanged, bronze bearing to support vertical loads. A separate bronze sleeve bearing shall also be used. Together, the bronze sleeve bearing and bronze flanged bearing shall support and prevent overturning of the bridge. The bearing system shall be designed such that the bearing is accessible for lubrication. The bearing system shall be designed such that a catastrophic bearing failure will not result in a toppling or fall of the boarding bridge. Rotunda bearings shall not be secured using bolts.

F. MINIMUM FLOOR HEIGHT

The standard rotunda and support column configuration shall accommodate a rotunda floor height of 4 feet 6 inches (1.37m) above the surface of the supporting foundation.

G. PBB MECHANICAL STOPS

The rotunda frame shall be equipped with rubber bumper-type mechanical stops to prevent over-retraction of the telescoping tunnel sections.

H. SLOPE LIMITS

Slope limits shall be located on the rotunda assembly. Slope limits shall be adjustable up to 10% (5.71°) for both up and down slopes. This limit shall be adjustable to meet local operating conditions and requirements.

I. SWING LIMITS

The operational and ultimate swing limits shall include a position sensor located in the rotunda ceiling that shall be accessible from the rotunda interior and a physical limit switch mounted on the support column. The physical limit switch located on the support column shall be an ultimate limit, serving as backup to the operational limits defined by the position sensor. Together, the sensor and limit switch shall provide three levels of safety for bridge swing (side-to-side) motion:

1. Approach: Bridge speed shall be reduced when within 2 degrees of the operational limit.
2. Operational limit: Bridge motion shall be stopped when operation limits are reached. A yellow warning text message shall be displayed on the Human-Machine Interface (HMI) touchscreen informing the operator that an operation swing limit has been activated. Additionally, an audible alarm shall sound while the bridge is at the limit and the joystick is active. Motion in the opposite direction shall remain enabled.
3. Ultimate limit: Bridge 3-phase power shall be disconnected, and a red fault text message displayed at the PBB controls. Should the bridge pass through the operational swing limits, the ultimate swing limit shall trip and stop bridge motion. Should the ultimate swing limit be reached, maintenance personnel will be required to move the bridge.

34 77 13-2.1.2 TELESCOPING TUNNELS

Apron drive PBBs shall be available in either two- or three-tunnel telescoping models in a variety of lengths. Floor panels shall be constructed from 14 gauge (.075 inch or 1.9mm) corrugated steel. The roof shall be 12-gauge (0.11 inch or 2.7mm) steel construction reinforced with structural steel tube cross members. The roof surface shall incorporate a 3/4 inch (19mm) crown to promote water drainage. Water diverter slats at the aircraft end of each tunnel roof shall provide additional deflection of water to the drainage system. Wall and roof panels shall be constructed using water-tight, continuous welded seams. Caulking to seal tunnel panels shall not be used. Walls shall be constructed from 14 gauge (.075 inch or 1.9mm) corrugated steel panels or, optionally, steel trusses.

A. TRUSS EXTERIOR CLADDING

Tunnels constructed using steel trusses shall be clad with 16 gauge (0.064 inch or 1.61 mm) galvanized steel cladding panels. The cladding panels shall be installed inside channels at the top and bottom of the tunnel trusses. The bottom channel shall be drilled to provide water

drainage. The cladding panels shall be secured against the tunnel structure using adhesive applied to the truss supports and galvanized steel upright panels that bridge the gap between each cladding panel and attach to the upright truss supports using rivets.

B. TUNNELS

The A-tunnel (smallest), B-tunnel (mid-size on three tunnel PBBs, largest on two tunnel PBBs), and C-tunnel (largest on three tunnel PBB only) shall be rectangular in cross section. The tunnels with the larger cross sections shall be toward the aircraft end of the PBB.

C. TRANSITION RAMPS

Transition ramps with sloping sections shall accommodate the differences in floor elevations where telescoping tunnel sections overlap. Slope of the transition ramps shall not exceed 1:16 (3.6 degrees) relative to the tunnel floors. The transition ramp sections shall comprise sloping floor areas within the tunnels to minimize the slope of the hinged transition ramp sections. Handrails shall be provided on both sides of the tunnels in the ramp areas. The handrails for the A-tunnel transition ramp fixed section shall be attached to the tunnel walls. The B-tunnel handrails shall be attached to the tunnel header.

D. MINIMUM CLEAR DIMENSIONS

Minimum interior clear dimensions for both two- and 3-tunnel PBBs shall be as follows:

1. Minimum width, wall-to-wall: 58.5 inches (1486mm)
2. Minimum interior height: 84 inches (2134mm)
3. Minimum inter-tunnel ramp width: 53.5 inches (1359mm)
4. Minimum corridor width: 52.0 inches (1321mm)

E. ELECTRICAL CABLE CONVEYANCE AND MANAGEMENT

The PBB shall be equipped with an exterior, side-mounted electrical cable conveyance system known as a dogleg. The system shall consist of one (1), two (2), or three (3) aluminum conduits as necessary to accommodate cables and hoses used for PBB operation.

Each dogleg section shall be connected by hinged brackets, allowing the dogleg to extend and retract in conjunction with the PBB. The sections shall be mounted to the rotunda, B-tunnel, and C-Tunnel (when equipped).

The cable system may be installed on the left or right side of the PBB and shall be accessible to maintenance personnel for inspection at all PBB positions and operating conditions. Access to the cable conveyance system shall not impede passenger traffic or PBB operation.

F. VENTILATOR

Provide thermostatically controlled 3000 CFM PBB Ventilator. Provide fire detection and controls to automatically shut down the fan in the event of fire emergency per NFPA-415.

34 77 13-2.1.3 AIRCRAFT CAB

The aircraft cab shall house the PBB operator control console and serve as the interface between the PBB and the aircraft. The transition between the final tunnel and the cab, known as the bubble, shall be fixed and serve as a transition point between the fixed tunnel floor and the rotating cab.

A. CAB ROTATION

The aircraft cab shall rotate 125 degrees, 92.5 degrees counterclockwise and 32.5 degrees clockwise from the tunnel centerline. The cab shall rotate at a variable speed up to 145 degrees per minute (2.41 degrees per second), controlled by a Variable Frequency Drive (VFD). The rotation limits shall be controlled by an analog position sensor with programmable operational limits in addition to limit switches and physical stops.

B. CONTROL CONSOLE AND OPERATOR VISIBILITY

The cab shall be equipped with a forward-facing control console, with a laminated safety glass window providing full forward view of the aircraft interface. It shall be possible to operate the PBB without opening the cab weather doors. Additional visibility shall be provided for the operator by a wire glass window to the left of the operator, a window to the right, and by windows in the weather doors and a wire glass window in the service door. Wire glass vision panels shall be provided in the cab side-coiling curtains, one panel in every other slat. The front window size shall be 31.5 X 24 inches (800mm x 610mm). The left window size shall be 30.5 X 10.5 inches (775mm x 267mm). The right window shall be 32 X 6 inches (813mm x 152mm).

C. WEATHER DOORS

Double inward-swinging weather doors shall be installed to the right side of the operator control console to secure the PBB from unauthorized access, and to seal the interior of the PBB from adverse weather conditions when the door is closed. The minimum clear width of the weather door shall be 43 inches (1092mm), and the minimum door height shall be 92.5 inches (2349mm). The upper portion of each door shall be equipped with a 12 inch wide X 32 inch high (305mm x 812mm) safety glass window to enhance visibility.

Door type and finishes to match existing Gate A1.

D. AIRCRAFT SPACER

A full-width yellow elastomer spacer shall be located at the aircraft end of the cab floor. The spacer shall be 122 inches (3100mm) wide. The spacer material shall meet the fire protection specifications of NFPA-415 and shall be sufficiently flexible and non-abrasive to prevent scratching or other damage to the aircraft fuselage.

E. ADJUSTABLE CAB FLOOR

The aircraft end of the cab shall be equipped with an adjustable aluminum floor that provides a level surface adjacent to the aircraft doorsill. The floor shall actuate independently of the bridge and level automatically. The floor shall be equipped with a manual override control switch and shall support adjustment for PBB slopes from -10% to +10%. The automatic leveling system shall correct the floor to a slope not to exceed $\pm 2\%$ ($\pm 1.2^\circ$) from level. The maximum slope of the cab floor shall be limited to ± 6.5 degrees ($\pm 11.4\%$).

A double hinge floor shall be included in the adjustable cab floor system to provide a smooth transition and walking surface between the level floor and the tunnel section. There shall be no raised surfaces that may introduce a tripping hazard to the passenger. Adjacent surfaces shall be at the same level regardless of the position of the cab floor or the PBB.

The cab floor covering shall be 3/16 inch thick ribbed rubber.

F. AUTOLEVEL ARM

An autolevel arm and wheel assembly shall be located on the right side of the PBB cab area, inside the canopy closure area, in full view of the PBB operator. The arm shall deploy the wheel to make contact with the aircraft fuselage when the PBB is in autolevel mode. See the Automatic Leveling System section for more detail.

G. EXTERIOR ILLUMINATION

Two exterior LED floodlights shall be provided to illuminate the apron directly ahead of the PBB. A floodlight shall be located beneath the tunnel section to illuminate the drive column wheel carriage.

A weatherproof LED fixture shall be provided outside the cab weather door to illuminate the cab-aircraft interface.

H. 400 HERTZ CABLE HOIST

Provide a new cable hoist and new 400 Hz cables. The new cable hoist shall be for the external elevated storage of 400 Hz cable and connector for the proposed Ground Power units (GPU). Hoist shall come with a 5-button remote control station which operates the hoist as well as the 400 Hz converter unit. Hoist shall be cab mounted and shall operate separate of bridge power. The intent is to allow raising or lowering the cable if the bridge is not in operate mode.

I. GATE SIGNAGE

Provide and install lighted gate signage as follows: 3-sided gate sign with 360 degree visibility mounted on top of the cab end, at the upper right side of the PBB. The gate letter and number shall match the existing PBBs. The gate BACKGROUND COLOR TO BE WHITE (TRANLUCENT), LETTER AND NUMBER COLOR TO BE BLACK. Gate numbering of the new sign shall be "A6". The gate sign shall be highly visible to approaching aircraft from any angle at a distance. The gate sign shall be lit for visibility at night. The gate sign shall be raised to provide better visibility by the aircraft pilot approaching the gate. Font and final appearance shall match the existing PBBs.

- Provisions and mounting bracket for installation. Install on the upper side of cab to match existing, adjacent PBB signage.
- Provisions for installation of electrical power feed to power gate sign.
- The lighted gate sign shall be photocell controlled. The gate sign lens photocell shall be located under the PBB bubble.

34 77 13-2.1.4 AIRCRAFT CLOSURE

The cab shall be equipped with a folding bellows-type aircraft closure canopy consisting of two fabric layers, one for UV and weather protection and the second for fire protection. The closure, when fitted against the aircraft fuselage, shall surround both the open aircraft door and the doorway to protect passengers from the elements. The closure shall be designed to accommodate any special door requirements associated with specified aircraft types. The horizontal width of the canopy opening at the aircraft interface shall be at least 10 feet (3.05m). The closure fabric shall be grey in color and shall not absorb water, shall be highly tear resistant and remain flexible throughout the rated operational temperature range of the PBB. The closure shall meet the requirements of NFPA 415. A protective aluminum hood mounted on the cab shall protect the canopy when retracted to prolong the life of the canopy.

Each side of the aircraft closure shall be independently power actuated to raise and lower the canopy and seal against aircraft contours.

Pressure sensitive switches shall be incorporated into the closure mechanism to prevent excessive pressure on the aircraft.

The sealing pads that contact the aircraft shall be a soft material to prevent scratching or damage to the aircraft skin. The pads shall be segmented and attached to the main closure assembly with Velcro-type fastener strips for easy replacement.

A fixed canopy design is not allowed. The canopy must retract, with a minimum of two (2) feet of clearance between the leading edge of the canopy and fuselage at the time the spacer is in the proper docking position. Once the bridge has stopped horizontal motion, the canopy may be deployed against the aircraft.

34 77 13-2.1.5 AUTOMATIC LEVELING SYSTEM

The PBB shall be equipped with an automatic leveling (autolevel) system. This system shall allow the PBB to follow the normal aircraft elevation changes that occur during loading and unloading of specified aircraft types. The autolevel system shall function with equal reliability for all specified aircraft types. The autolevel arm shall be located on the right side of the cab inside the aircraft closure, in full view of an operator at the control console. The autolevel arm shall extend and contact the aircraft when autolevel mode is selected at the control console.

The autolevel control circuit shall include a sustained travel timer. The timer shall limit continuous bridge vertical motion due to autolevel operation. The timer shall be factory set at 4 seconds and adjustable for an operational range of 2 to 10 seconds. If the travel timer reaches its preset time limit, a fault condition shall be identified. Upon identification of an autolevel fault condition, all vertical drive shall be disconnected and audible and visual alarms shall be energized.

34 77 13-2.1.6 SERVICE ACCESS

A service door, landing, and stair leading to the apron shall constitute the service access. The service access shall be located on the right-hand side of the cab end of the PBB to provide access between the PBB cab and apron for authorized personnel.

A. SERVICE DOOR

The service door shall be steel, hollow core, and meet or exceed the ¾ hour fire rating per ASTM E152. A fire-rated glass window shall be located in the service door. The minimum door width shall be 2 feet 6 inches (762mm) and minimum height 6 feet 8 inches (2032mm). The door shall be equipped with medium-duty commercial-type hardware and automatic door closure. The door shall open outward onto the landing. A keyed outside knob shall be provided.

B. SERVICE STAIR LANDING

The service stair landing shall be parallel to the adjacent tunnel floor. It shall be made of hot dipped galvanized steel. The landing deck shall be covered with open serrated grating (such as Grip Strut™ or approved equal). The landing shall be protected on the open sides by galvanized steel handrails compliant with OSHA standards.

C. SERVICE STAIR

The service stair shall be equipped with self-adjusting risers and open mesh steel treads made from galvanized steel channel sections with open serrated grating (such as Grip Strut™ or approved equal) providing high-traction, high-drainage walking surfaces. All steps shall have

an equal rise. The tread width shall be 28 inches (711mm) and the maximum tread depth shall be 9.5 inches (241mm). The service stair shall be protected on both sides by handrails compliant with OSHA standards. The entire service stair assembly shall be constructed from hot-dip galvanized steel. The service stair shall be accessible to ramp service personnel at all operational heights and positions of the PBB.

D. SERVICE STAIR AND LANDING ILLUMINATION

An exterior rated LED light fixture shall be provided on the exterior of the PBB above the service stair and landing to illuminate the service access. The light shall be controlled by a light switch provided on the interior wall of the PBB adjacent to the service stair access door.

34 77 13-2.1.7 DRIVE COLUMN

The drive column provides the vertical and horizontal motion of the PBB. The drive column and its control systems shall be designed for smooth operation. It shall be possible to operate the vertical and horizontal PBB motion simultaneously.

The drive column shall be divided into two major components: vertical drive and horizontal drive.

A. VERTICAL DRIVE

The PBB shall be moved vertically by means of two recirculating ball bearing screw assemblies. Vertical travel speed shall be approximately 45 inches (1143 mm) per minute $\pm 15\%$ measured at the aircraft end of the PBB.

1. Each vertical drive assembly shall be independent. Each independent assembly shall be capable of supporting the PBB under full design load.
2. The ball nut in each recirculating bearing-type ball screw shall be equipped with wiper brushes to remove grit and dirt from the screw threads.
3. Each ball nut shall be equipped with a special thread profile designed to be self-locking. This feature will support the PBB in the absence of the recirculating ball bearings.
4. The vertical drive motors shall each be an AC induction motor with an integral speed reducer and brake. The motor brake shall be spring applied and electrically released and shall hold securely at all PBB elevations whenever electrical power is not applied.
5. A fault detector shall sense differential motion of the ball screw assemblies. The detector shall disconnect electrical power from the vertical drive motors and provide a message to the operator if a fault is detected.

B. HORIZONTAL DRIVE

A variable speed, electro-mechanical drive system shall provide horizontal travel.

1. The tires used on the horizontal drive wheels shall be solid elastomer, specially designed for PBB applications and rated for the applicable load.
2. The horizontal drive system shall use AC gear motors with integral brakes. The AC motors shall be driven by solid state, variable frequency motor controllers for smooth variable speed proportional control operation. The AC drive system shall provide high efficiency, smooth performance, and good component availability. The individual variable frequency drive controller for each drive motor shall provide adjustable

speeds from 0 to 90 feet per minute (27.4m/min), and be factory preset to a maximum 60 feet per minute (18.3m/min). The controller shall be adjustable to provide optimum responsiveness to the horizontal controls. The controller shall provide built-in diagnostics to assist with trouble shooting.

3. A steer angle of 200° shall be possible both in place and in motion. The wheel carriage shall steer 110° to the left and 90° to the right of the centered position. Steering speed shall be adjustable between 16° and 42° per second. The steering rate shall be factory set at a maximum 23° per second. The horizontal drive wheel system shall be equipped with mechanical stops to prevent over steer. A wheel position potentiometer shall monitor rotational alignment with the bridge and provide operational steering limits before the mechanical hard stops are contacted. Wheel bogey position shall be indicated on the touch screen at the operator console.
4. A dynamic braking system shall allow the PBB to come to smooth, controlled stops. Integral spring-applied, electrically released brakes shall be provided with each drive motor. The brakes lock the PBB in place when electrical power is disconnected, when the operator control stick is in the neutral position, or when operating power is turned off at the PBB controls.
5. The horizontal drive motors shall be equipped with manual brake releases to allow the PBB to be towed in the event of power failure. Tow lugs shall be provided at the lower wheel frame. The manual brake release shall automatically reset and re-engage the motor brakes when the PBB drive is engaged.
6. A wheel bogie protection system shall be installed surrounding the horizontal drive system. This system shall include pressure-sensitive switches to detect contact with objects and personnel in the PBB drive path and to stop PBB movement. This system shall prevent further movement of the PBB in any direction until the obstruction is safely removed from the drive path.

34 77 13-2.1.8 CONTROL STATION

The control station or operator compartment shall be located at the aircraft end of the PBB. It provides the operator with a control console, service utilities, and control interlocks required for PBB operation. The control station shall be positioned on the left side of the cab and oriented to position the operator facing forward in full view of the aircraft during bridge operations. It provides the optimum PBB maneuvering visibility without obstructing passenger traffic flow. An operator of average height shall have an unobstructed view of the boarding bridge cab spacer to position it at the aircraft fuselage during bridge operations.

A. CONTROL CONSOLE

Match control panel in existing PBB at Gate A1.

The control console shall be located at the control station in the operator compartment and shall be protected from the outside environment. The control console shall include an HMI touchscreen (see paragraph 1.8.3), joystick, pushbutton controls, and a cabinet containing the main programmable controller for the PBB plus terminal blocks, relays, and related electrical components necessary for full, safe control of the PBB.

B. PROGRAMMABLE LOGIC CONTROLLER

PBB functions and information systems shall be controlled using a Beckhoff Programmable Logic Controller (PLC) or approved equal. The PLC system used shall comply with IEC 61131.

C. HMI TOUCHSCREEN

The control console shall include a Graphical User Interface (GUI) installed on a 15.6-inch (396.2mm) HMI touchscreen display that provides the operator with a means to log in and control the PBB, as well as display maintenance and diagnostic information, wheel position information, fault/limit/status and warning messages, and fault history as described in paragraph 2.1.9.

D. NETWORKING WITH GATE EQUIPMENT

The PLC shall be designed to allow Modbus TCP/IP networking of the boarding bridges and appropriately equipped ancillary equipment, such as Pre-Conditioned Air (PCA) units and Ground Power Units (GPU), to a common remote monitoring station using Ethernet protocols and appropriate hardware.

E. PHYSICAL CONTROLS

All major PBB motion controls (vertical drive, cab rotation, and horizontal drive) shall be momentary contact type pushbuttons or joysticks located on the control console. All major motions shall only occur while a control is maintained in the active position (“dead-man” functionality). All of the motion controls shall be positioned relative to the function of the PBB being controlled, e.g., “Raise” pushbutton shall be located above the “Lower” pushbutton.

1. HORIZONTAL DRIVE CONTROL

Bridge movement in the horizontal (forward/reverse propulsion and left/right steering) shall be controlled by a four-quadrant variable control stick (joystick). Forward/reverse propulsion shall be controlled by fore/aft motion of the joystick and steering shall be controlled by right/left motion of the joystick. A wheel position indicator on the GUI shall display the direction of drive. Speed shall be proportionally controlled: as the joystick is moved progressively from the neutral position, wheel speed increases proportionally with the position of the joystick. The joystick shall have a momentary “dead-man” type trigger that, when depressed, shall enable PBB horizontal motion after a 3-second delay. During the 3-second delay, the travel warning bell at the horizontal drive shall sound and an amber indication shall be displayed at the console to inform the operator to wait to drive. After the 3-second delay period is complete, with the trigger remaining depressed, a green indicator on the console shall indicate that drive is enabled.

2. VERTICAL DRIVE CONTROL

Pushbutton switches that raise and lower the PBB shall be provided at the control console.

3. CAB ROTATION CONTROL

Pushbutton switches that control cab rotation, left or right, shall be provided at the control console.

4. EMERGENCY STOP

The control console shall be equipped with an illuminated red mushroom type pushbutton switch for discontinuing all bridge movement in an emergency. Two additional illuminated emergency stop switches accessible to ground personnel shall be installed, one at the lower end of the left vertical drive column and one at the lower end of the service stairs.

5. CLOSED-CIRCUIT TV MONITOR

A 5 inch (125mm) diagonal color LCD monitor shall be mounted in the control console that continuously displays a camera image of the PBB horizontal drive wheel area. The Closed-Circuit Television (CCTV) camera shall be mounted at a location that provides a clear view of the wheel area.

34 77 13-2.1.9 OPERATION AND CONTROL LOGIC

A. OPERATOR LOGON AND SECURITY

An operator, maintenance, or administration password shall be required to access PBB operations or maintenance activities. An operator shall be required to log on at the HMI using a valid password to operate the PBB, to include enabling or disabling the automatic leveling mode. Passwords shall be used to control access to bridge functions, set up, maintenance, and diagnostic screens and password maintenance. The PBB shall have three levels of passwords:

1. Level I – Operator passwords: Up to forty-two (42) operator passwords shall allow access to all aircraft docking functions.
2. Level II – Maintenance password: One (1) maintenance password shall allow access to all operator and maintenance/setup functions.
3. Level III – Administrative password: One (1) administrative password shall allow access to all Level I and Level II functions, plus allow the administrative user to view and edit passwords

B. LOGOFF

To log off, the operator shall touch the LOGOFF touch button on the HMI. This returns the HMI to the opening logon/password screen.

C. PBB OPERATION MODES

The controls shall provide autolevel, operate, and logged off modes that shall be selected using touch buttons on the touchscreen as follows:

1. Autolevel: Selecting the AUTOLEVEL touch button shall initiate the autolevel sequence. The autolevel arm extends toward the aircraft, and the system shall perform an automatic check (test nod) of the autolevel system to verify that the aircraft sensor has made contact with the aircraft and that the autolevel control system is functional. Upon completion of the verification process, a message shall be displayed indicating that the PBB is in AUTOLEVEL MODE. When in autolevel mode, the PBB shall allow only vertical travel; canopy, cab rotation, and horizontal travel are inactive. In autolevel mode, the PBB shall engage the autolevel system and automatically follow the vertical movement of the parked aircraft. To exit autolevel mode and return to manual mode, the operator must touch the AUTOLEVEL touch button and enter a valid password.
2. Operate: Logging on using a valid password, or exiting autolevel mode using a valid password, enables all bridge movements – extend/retract, vertical, floor movement, and cab rotation – provided there are no faults or activated limits. In operate mode, all bridge movement shall be initiated by the operator. The appropriate pushbuttons shall be lighted to indicate the functions available, and a message on the GUI shall be displayed indicating the PBB is in OPERATE MODE.

Logged Off: The operator must touch the LOGOFF touch button to exit the main screen and return to the logon Screen. All PBB functions except lighting shall be disabled.

D. LANGUAGES

The operator shall be able to select one of the optional preprogrammed languages for display on the GUI. English shall be the standard default language, unless otherwise specified. Pre-loaded languages, accessible from the GUI maintenance screen, shall include Spanish, French, Russian, Simplified Chinese, and Traditional Chinese. Once a language has been selected, all messages shall be displayed in the selected language until a different language is selected on the log on screen.

E. CAB FLOOR ADJUSTMENT

The cab floor of the PBB shall be both automatically and manually adjustable to align the floor level with the aircraft doorsill. Touch buttons on the GUI shall allow control of the cab floor to be toggled between the automatic and manual modes of operation. Text on the touch button shall display which mode is active.

Upon selection of cab floor manual mode, two additional touch buttons become active enabling the manual movement of the cab floor up or down. Touching the UP button shall move the right side of the cab floor in the upward direction. Touching the DOWN button shall lower the right side of the cab floor. When the PBB is AUTOLEVEL MODE, all cab floor movement shall be disabled and the touch buttons shall NOT be visible. The cab floor mode of operation previously selected when the auto level mode of operation was energized shall be reactivated when the auto level mode is deactivated.

F. CANOPY CLOSURE CONTROL

The bellows-type aircraft closure canopy shall be powered for extend and retract operation. The HMI shall contain GUI touch buttons to control extension and retraction of the canopy.

The aircraft canopy closure shall be capable of dual activation of both sides of the canopy simultaneously or independent activation of the right or left sides of the canopy in the up or down directions. A GUI touch button shall be provided to select either independent adjustment of the left and right sides of the aircraft closure or simultaneous operation of both sides. Canopy actuation shall be active only when the PBB is in operate mode. When the PBB is in autolevel mode, both canopy touch buttons shall be not visible; the canopies must be deployed prior to entering autolevel mode. The left and right-side canopy actuator motors shall be independently controlled by limit switches that sense both the pressure against the aircraft, and operational range limits to provide positioning of the canopy to the aircraft and prevent over extension or retraction of the canopy closures.

G. FLOODLIGHT CONTROL

A GUI touch button shall be provided to allow control of the apron floodlights that shall be located on the underside of the PBB. These floodlights shall be positioned to illuminate the apron for a distance of approximately 30 feet (10m) forward of the PBB, and around the wheel carriage area. Touching the floodlight touch button will toggle the apron flood lighting on and off.

H. TRAVEL BELL CONTROL

A momentary GUI touch button shall be provided to allow manual activation of the travel warning bell. When touched, the travel bell shall be activated until the button is released. The

travel warning bell shall sound automatically while the PBB is moving and also during the three-second motion delay period.

I. “MORE CONTROLS” BUTTON

A touch button labelled “More Controls” shall be available on the GUI to allow additional PBB features to be selected and controlled. These features may include selections such as floor heating, window heating, additional lighting, and others dependent upon customer-selected options and features.

J. MAINTENANCE BUTTON

A GUI touch button shall be provided that shall access maintenance functions available on the GUI. The maintenance touch button shall function only when a maintenance or administrative password has been entered during log on. The maintenance button shall provide access to the following:

- Calibration
- Limit Setup
- Diagnostics
- Options Setup
- Warning History
- Fault History
- Save/Restore Data
- PCA/GPU Data
- Troubleshooting
- System Configuration
- Password Management (Admin Login)

K. OPERATIONAL INDICATORS

The following indicators are displayed on the GUI in both autolevel and manual modes.

1. Vertical Height: The current vertical height of the PBB measured from ground level shall be measured and indicated. The measurement shall be displayed as a percentage between 0% (minimum height) and 100% (maximum height).
2. Rotational Angle: The rotational angle of the bridge shall be displayed. The display identifies angular counterclockwise (left) rotation in positive (+) degrees, and clockwise (right) rotation in negative (-) degrees from the centerline axis in reference to a programmed zero position.
3. Cab Rotation Angle: The cab rotation angle shall be measured and indicated. The zero data point shall be identified when the aircraft spacer shall be positioned perpendicular to the telescoping tunnel centerline. The display shall indicate counterclockwise (left) rotation in positive (+) degrees and clockwise (right) rotation in negative (-) degrees from the centerline axis.

4. Wheel Position Angle: The wheel position angle shall be measured and indicated. Zero degrees shall be identified when the drive wheels shall be positioned parallel to the bridge telescoping tunnel centerline axis. The display will indicate counterclockwise (left) rotation in positive (+) degrees and clockwise (right) rotation in negative (-) degrees from the centerline axis.
5. Autolevel Indicator: An amber indicator lamp and a text message on the GUI shall indicate the autolevel system is energized and functioning.
6. Autolevel Failure Indicator: A red indicator lamp, a text message on the GUI, and an audible warning shall indicate the autolevel sustained travel timer has activated, indicating an auto level failure alarm.
7. Canopy Extend Indicator: An amber flashing indicator on the GUI indicates the aircraft canopy is down. The canopy must be fully retracted before the PBB can be moved forward.
8. Vertical Drive Column Fault Indicator: A red indicator, a text message on the GUI, and an audible alarm indicate vertical drive column faults.

Other operational indicators shall be provided that are not located on the control console, including the following:

1. Flashing Travel Beacons: A flashing amber beacon shall be mounted under the cab. The beacon shall indicate that power is on and the bridge may move at any moment. Two additional flashing amber beacons shall be provided, one mounted at the bottom end of each vertical lift column, that shall flash during the 3-second travel delay period and during PBB horizontal motion.
2. Warning Bell: An audible warning bell shall be mounted under the bridge on the wheel carriage and shall ring at 98 decibels at 10 feet (3.0m) when the bridge is moving horizontally and also during the 3-second travel delay period

L. GUI MESSAGE DISPLAY

The GUI shall provide status and fault information to the operator. Standard messages shall include the following:

1. Limit Messages: Limit messages shall be displayed as yellow warning messages.

Horizontal Extend Limit. Forward motion disabled.

Horizontal Retract Limit. Reverse motion disabled.

Vertical Up Limit reached. Drive PBB down.

Vertical Down Limit reached. Drive PBB up.

Cab Left Limit reached. Rotate cab right.

Cab Right Limit reached. Rotate cab left.

Left Swing Limit reached. Rotate PBB right.

Right Swing Limit reached. Rotate PBB left.

ACF Fault. Level floor manually.

Main contactor not energized. Check interlocks and emergency stops.

Limits Disabled. Use caution while driving the PBB with the Limits disabled.

Slope Up Limit reached. Reverse and up motion disabled.

Slope Down Limit reached. Reverse and down motion disabled.
 Slowdown Sensor Activated. PBB in Horizontal Slow-down. Speed reduced by ½.
 Main Contactor Disabled. To reset Main Contactor, you must log OFF then ON.
 Ground Power Unit On. Horizontal motion disabled.

2. Fault Messages: Fault messages shall be displayed as red fault messages.

Vertical Up Ultimate Limit. Call Maintenance.
 Vertical Down Ultimate Limit. Call Maintenance.
 Horizontal Extend Ultimate Limit. Retract bridge.
 Horizontal Retract Ultimate. Extend bridge.
 Cab Left Ultimate Limit. Rotate right.
 Cab Right Ultimate Limit. Rotate left.
 Inverter Fault. Log Off, Wait XX Seconds, Log back On. Call Maintenance.
 Vertical Column Fault. Call Maintenance.
 Swing Ultimate Limit. Call Maintenance.
 Auto Level Failure. Reset Auto Level System. Call Maintenance.
 Left Vertical Overload activated. Call Maintenance.
 Right Vertical Overload activated. Call Maintenance.
 Cab Position Sensor Failure. Call Maintenance.
 Main Contactor Weld Fault. Press E-Stop and Call Maintenance.
 Vertical Up Contactor Weld Fault. Call Maintenance.
 Vertical Down Contactor Weld Fault. Call Maintenance.
 Cab Left Contactor Weld Fault. Call Maintenance.
 Cab Right Contactor Weld Fault. Call Maintenance.

M. CONTROL FEATURES AND INTERLOCKS

The following control interlocks shall be provided.

1. Mechanical and logical interlocks shall be provided to prevent damage to control circuits or boarding bridge components by selecting opposite motions simultaneously, e.g., pressing an UP button prevents pressing a DOWN button.
2. When the operator selects the autolevel mode, or logs off the control system, all basic bridge operational controls shall be inoperative.
3. Basic functional logic of the PBB shall be programmed by the manufacturer. This logic resides in non-volatile memory.
4. The software shall act upon PBB location sensor inputs and operator control inputs to provide valid PBB motions. If a conflict arises between operator inputs and sensor inputs, error routines shall be executed to display messages on the GUI, turn on warning lights, sound an alarm, and/or stop the bridge as necessary.
5. PBB motions that, if unprotected, could endanger personnel or cause damage to the PBB shall be protected by three levels of limits.
 - First-level limits shall provide a slowdown of PBB motion.

- Second-level limits shall provide warning to the operator and interrupt motion. Motion away from the limit shall be allowed, while other motion shall be disabled. Information suggesting allowable motion shall be displayed for the operator on the GUI where applicable.
 - Third-level limits shall prevent motion entirely. Third-level limit devices shall interrupt the main line input power to all bridge control circuits except lighting. The PLC shall monitor the limit fault, and the error and operator instructions shall be displayed on the GUI. Fault clearance and PLC reset shall require maintenance personnel before the PBB can move again.
6. A motion-enabled interlock shall require that an operator must initiate any bridge movement by activating a control panel switch. Otherwise, power cannot be applied to the energizing circuitry.
 7. A non-contact sensor shall slow the bridge horizontal motion as it approaches the aircraft when in operate mode.
 8. An interlock shall prevent the PBB from driving forward when the aircraft closure canopy is deployed.
 9. When equipped with a GPU cable management system, an interlock shall prevent the PBB from driving horizontally if the cable hoist is not fully raised.
 10. When equipped with a GPU, an interlock shall prevent the PBB from driving horizontally if the GPU is connected to an aircraft.

N. COLLISION AVOIDANCE SYSTEM

All PBBs installed at gates with multiple bridges where there is any possibility of PBBs colliding with one another shall be equipped with a Collision Avoidance System (CAS). The CAS shall include control software installed in each PBB subject to possible collision that shall:

1. Continuously monitor the position of the PBB.
2. Continuously receive position data from any PBB with which it could collide.
3. Calculate the position of adjacent bridges and analyze the distance between them.
4. Stop horizontal motion of the PBB and provide a message to the operator before collision occurs.
5. If an impending collision is detected, allow each PBB to only drive in a direction away from the other.

The communication of position information and other data between PBBs shall be accomplished over an Ethernet network. Communications between PBBs shall be continuously monitored, and if loss of communication occurs a warning message shall be displayed and PBB motion inhibited. In this event, the operator shall be permitted to override the inhibited drive by positive action.

In addition to the primary software-based collision avoidance, the CAS shall also include hardware sensors as a secondary backup. A secondary sensor shall be mounted on each PBB subject to possible collision and oriented to sense the location of a PBB with which it could collide. If the PBB could collide with more than one other PBB then a sensor shall be provided

for each potential collision partner. The sensors shall employ laser, ultrasound, radar, or other suitable technology to sense and prevent an impending collision in all weather conditions.

Setup and configuration of the CAS shall be possible using screens accessible to maintenance personnel on the HMI.

34 77 13-2.1.10 MAINTENANCE AND SETUP SCREENS

The PBB shall be designed to provide a quick method for programming the PLC to accept new operational parameters. The maintenance/setup screens shall allow maintenance personnel to complete initial setup or adjustment of the PBB operational parameters directly using the HMI at the PBB control console without the use of additional programming devices or external computer. The following paragraphs detail the maintenance and setup screens available. A maintenance or administrator password shall be required to access these functions.

A. PBB CALIBRATION

The bridge calibration screen shall be provided to accommodate input of critical data used in establishing operational parameters for a particular gate location during the initial PBB setup operation. The calibration includes the following data:

1. Wheel Calibration: This section shall provide the ability to establish a zero or straight forward calibration point and 90° left calibration point used in determining wheel bogie position.
2. Cab Calibration: This section shall provide the ability to establish a zero or straight forward calibration point and 90° left calibration point used in determining Cab position.
3. Rotunda Calibration: This section shall provide the ability to establish a zero calibration point and a 90° reference point used in determining bridge swing position.
4. Length Calibration: This section shall provide the ability to establish two length reference points used in determining bridge length.
5. Height Calibration: This section shall provide the ability to establish vertical data points used as the base for calculation of the vertical height measurements displayed on the screen.

B. LIMITS SETUP

The maintenance screen shall permit maintainers to manage PBB limits, including setup and backing up and restoring limit settings. The limit setup screen shall allow the setting of bridge software limits as follows:

1. PBB Height: This setting shall allow the setting of vertical up/down height limits anywhere within the operation vertical range of the PBB.
2. Cab Rotation: This setting shall allow the setting of cab left/right limits anywhere within the operational cab rotation range of the PBB.
3. PBB Length: This setting shall allow the setting of PBB length extend/retract limits anywhere within the Length operational range of the PBB.

PBB Swing: This setting shall allow the setting of PBB swing left/right limits anywhere within the PBB swing operational range of the PBB

C. PASSWORD MAINTENANCE

The maintenance screen shall permit maintainers to manage passwords, including password creation, change, and deletion, as well as backing up and restoring passwords. Passwords shall be managed at three levels as follows:

1. Operator: There shall be a maximum of forty-two (42) operator passwords available. These passwords give the operator the ability to log on and operate the PBB in manual and autolevel modes with full rights to drive the PBB and select autolevel mode when docked to an aircraft. The alarm history screen and I/O diagnostic screens shall also be available to operators.
2. Maintenance: The maintenance password shall give maintainers the ability to operate and configure the PBB with all calibration and limit setups and all other configuration screens.

Administration: The administration password shall give administrators the ability to operate and setup the PBB, as well as maintain passwords. Administrators shall have access to alarm history, I/O diagnostic, and all other configuration screens

D. GATE CONFIGURATION

The gate configuration screen shall permit maintainers to manage PBB settings for multi-bridge gates.

E. OPTIONS SETUP

The options setup screens shall permit the maintainer to enable or disable options on the PBB. HMI interfaces and bridge capabilities are affected by the selections made on these screens.

F. SYSTEM CONFIGURATION

The system configuration screens shall permit the maintainer to edit HMI settings, including network address and communication settings.

34 77 13-2.1.11 UTILITIES

A. NETWORKING CABLES

A high-speed communication/networking cable consisting of 3 bundles of 4 pair each category six, 24-gauge communications cable shall be provided from the upper rotunda junction box to the control console.

B. UTILITY OUTLETS

Unswitched 120 volt, 1 phase, 20 amp utility outlets shall be located as follows:

1. On the left wall of the cab, adjacent to the operator control console
2. In the rotunda corridor
3. On the rotunda disconnect
4. A 20 amp GFI duplex outlet shall be provided on the drive column wheel carriage cross beam where it shall be accessible to maintenance personnel at ground level.

34 77 13-2.1.12 INTERIOR FINISHES AND LIGHTING

The Interior finish of the PBB shall be designed to be durable and easy to clean. The materials shall be selected and proven to withstand the environmental exposure of airport traffic.

A. FINISHED CEILING

The finished ceiling shall consist of aluminum plank-type panels. Each plank shall be 7.25 inches (184mm) wide with a 0.75 inch (19mm) accent between adjacent planks. The planks shall be oriented perpendicular to the tunnel centerline and run continuously from wall to wall. The planks shall be manufactured from 0.020 (0.51mm) thick aluminum, with a baked-on enamel finish. Standard ceiling color shall be Off-White.

B. ALUMINUM CORNER MOLDINGS

Aluminum corner moldings shall be used to support and provide a finished appearance to the ends of the ceiling planks and cover the top edges of the wall panels. The molding shall be black in color

C. INSULATION

Insulation above the finished ceiling shall be 1 inch (25mm) thick black, fire-resistant fiberglass.

D. SUBFLOORS

The subfloor in the cab and bubble area as well as the PBB tunnels shall be 0.75 inch (19 mm) thick marine grade plywood that has a high resistance to moisture and moisture damage.

E. FIRE RETARDANT TREATED LUMBER

Fire retarded treated lumber complies with AWPA C-20:

- Fire Spread: Less than 25
- Moisture Content: Not more than 19 percent.
- Locations: Provide fire retardant treated lumber at all interior locations, including the following locations:
 - Concealed dimensional lumber
 - Concealed blocking
- Acceptable manufacturers and products:
 - Hickson Corporation – Dricon FRT
 - Hoover Treated Wood Products, Inc. – Pyro-Guard
 - Substitutions: Comply with specifications contained herein or approved by the Engineer.

F. FIRE RETARDANT TREATED PLYWOOD:

Fire retardant plywood with organic-resin solution, relatively insoluble in water, thermally set in wood by kiln drying.

- Conform to PS1 and AWPA C-20
- Thickness: Minimum $\frac{3}{4}$ inch

- Flame Spread: 20
- Smoke Development: 25
- Grade for Entire PBB Floor: APA rated marine grade exterior exposure.

G. FIRE RATED PARTICLE BOARD

- Conform to ANSI A208.1, Grade 1-M-1, complying with UL 723.
- Thickness: Minimum 3/8 inch
- Flame Spread: 20
- Smoke Development: 25
- Acceptable Manufacturers:
 - Williams Industries, Inc. – Duraflake FR
 - Substitutions: Comply with specifications herein or approved by the Engineer.

H. FIRE RATED PLASTIC LAMINATE

- Conform to NEMA LD-3, Grade FR32 (0.032 inches thick), complying with UL 723
- Flame Spread: 5
- Smoke Development: 65
- As selected by Engineer from manufacturer's standard colors, or Owner's custom color specification.
- Acceptable Manufacturer:
 - Wilsonart International
 - Formica Corporation
 - Nevamar Division International Paper
 - Substitutions: Comply with specifications contained herein or approved by the Engineer.

I. FIRE RATED BACKING SHEET

Comply with UL 723.

J. SLAT CURTAIN WALLS

Slat Curtain Walls in the Cab (hot-dipped galvanized panels) shall have viewing windows spaced every other panel in a single row, at a height that allows the operator to have the best view of the tarmac.

K. FLOOR COVERING

Carpet will be based on manufacturer's standard. Match existing Gate A1 Bridge finishes.

Manufacturer's standard black ribbed rubber flooring 3/16 inch (4.76mm) thick shall be applied to the floor from the aircraft end of the PBB to the terminal side of the service door.

L. WALL FINISH

The tunnel wall treatment (wallboard) shall be Thermally Fused Laminate (TFL) panels or approved equal, floor to ceiling. The panels shall be 0.375 inches (9.5mm) thick and approximately 60 inches (1524 mm) on center. The wallboard panels shall be supported by anodized aluminum trim with a black accent stripe. The design shall allow each panel to be removed individually. The built-up wall structure shall result in an average thermal resistance R (in the wall structure) of 2.4 Hr-Ft²-°F/Btu (0.42 m²-°C/W).

Wall treatments in the pivoting sections (rotunda and cab) shall be galvanized steel slats with grey enamel surface finish

M. OTHER SURFACES EXPOSED TO PASSENGERS

Other interior surfaces visible to passengers shall be finished as follows.

1. SURFACE PREPARATION

Contaminants shall be removed from the surface in accordance with SSPC SP-1 and appropriate SSPC commentaries.

The surface shall be mechanically cleaned in accordance with SSPC SP-3 to remove loose scale and contaminants from the surface where required.

The cab surface shall be dry abrasive blast cleaned in accordance with SSPC SP-6 to obtain a 1-3 mil profile.

2. PRIMER

One coat of chromate-free corrosion-resistant primer shall be applied.

3. FINISH COAT

The paint shall be a two-coat system meeting corrosion protection requirements according to ISO 12944-6, level C3. The first layer shall be an epoxy primer, and the second layer a topcoat of pigmented, high solids, catalyzed acrylic polyurethane finish paint.

N. OTHER SURFACES NOT EXPOSED TO PASSENGERS

Other interior surfaces not visible to passengers shall be finished as follows:

1. SURFACE PREPARATION

Contaminants shall be removed from the surface in accordance with SSPC SP-1 and appropriate SSPC commentaries.

The surface shall be mechanically cleaned in accordance with SSPC SP-3 to remove loose scale and contaminants from the surface where required.

2. PRIMER

One coat of chromate-free corrosion-resistant primer shall be applied.

34 77 13-2.1.13 INTERIOR LIGHTING

Tunnel and rotunda interior lighting shall be provided by 24 X 48 inch (610mm X 1220mm) LED light fixtures with adjustable color temperature and brightness. The average light intensity at the

floor shall be 18 foot-candles (194 lux). Lighting intensity levels may vary with changes in interior color designs.

Every other fixture shall function as an emergency light. During emergency operation, the light fixtures shall provide at minimum an average light intensity of 1 foot-candle along the length of the PBB.

Single three-way switches shall be located in the rotunda and on the wall near the service door at the aircraft end of the PBB. These switches shall control interior tunnel, bubble, and rotunda lights, and the cab floor light fixture mounted outside the cab weather door.

34 77 13-2.1.14 EXTERIOR FINISHES

All exterior steel surfaces shall meet corrosion protection requirements according to ISO 12944-6, level C3, achieved through the following processes:

A. SURFACE PREPARATION

All contaminants shall be removed from the surface in accordance with SSPC-SP-1 (Solvent Wipe) requirements and commentaries.

Surfaces shall then be dry abrasive blast cleaned in accordance with SSPC SP-6 (Commercial Blast Cleaning) requirement to obtain a 1-3 mil profile.

Galvanized or galvanized steel exterior surfaces shall be prepared with solvent wipe only in accordance with SSPC-SP-1 and shall not be abrasive blast cleaned.

B. PRIMER

One coat of SHERWIN-WILLIAMS high build zinc primer is applied over the prepared surface to a dry film thickness of 3-17 mils (75-425 microns). One coat of SHERWIN-WILLIAMS high build epoxy, chromate free primer.

C. FINISH COAT

The topcoat shall consist of pigmented, high solids, catalyzed acrylic polyurethane finish paint applied over the primer coat at a dry film thickness of 2-3 mils (50-75 microns). The exterior PBB color shall be "ARCTIC WHITE" SW#: G64WY8 by Sherwin-Williams, to match the existing, adjacent PBBs. All new exterior components and housing shall be factory painted to match bridge finish coat. Contractor shall provide a color matched sample for approval.

The total exterior finish shall provide a minimum dry film thickness of 6 mils (150 microns).

D. BRACKET AND WING PLATES

- Dry abrasive blast clean in accordance with SSPCSP 6 or better to obtain a 0.5-1.5 mils profile. If steel is not new or is corroded, blast to SSPC-SP 10 standard.
- Apply one coat of MORTON INTL. Corvel Zinc Rich, Gray, Epoxy Powder 13-7007 heated to 350 FE for 35 minutes at 2-5 mils.

E. MAIN EXTERIOR PAINT COLOR

- Top and sides of unit
- Underside of floors
- Cab roll-up side curtain covers

- Cab hood, aircraft closure hood
- Cab area forward of the cab door
- Upper drive column outer tubes
- Upper drive column inner tubes
- Lower drive column complete and adjuster bearing Rotunda
- Rotunda
- Rotunda support column

F. OTHER STANDARD COLORS

- Color: Zinc Gray
 - Bolt Mechanical stops, rollers, trips, brackets & supports, and cable carrier brackets
 - Side skirts
 - Actuator arm
 - Actuator covers
 - Upper and lower cab curtain mounting brackets (not visible from ground)
 - Hoist and mounting brackets
 - Camera mounting brackets
 - Slope limit trip
 - Rotunda rotation trip
 - Solid wheel assembly
- Color: Safety Yellow
 - CE floor handrails

G. GALVANIZED EXTERIOR PARTS

Standard galvanized exterior parts shall not be painted.

- Gate ID sign
- Roof handrails
- Service stair treads and stringers
- Service stair and handrail
- Landing and handrail
- Service ladder
- Dog legs

34 77 13-2.2 OTHER EQUIPMENT**A. TOWBAR AND TOWBAR ATTACHMENT**

The towbar shall be capable of directly interfacing with the PBB wheel bogie, with or without a wheel bogie protection system. The towbar shall be able to move the PBB, regardless of size or options, without transferring structural stress or otherwise risking damage to the PBB. The towbar shall be capable of effecting PBB movement forward, backward, and to either side as directed by the towing vehicle. The towbar shall be painted Safety Yellow.

PART 3 - EXECUTION**34 77 13-3.1 INSPECTION**

Examine the areas and conditions under which work of this section shall be performed. Correct conditions are detrimental to timely and proper completion of the work.

34 77 13-3.2 PREPARATION

The Contractor is advised that the locations of foundations presently shown on the plans are approximate and that all dimensions and existing conditions shall be field verified.

34 77 13-3.3 INSTALLATION/APPLICATION/ERECTIONS**Structural Support Elements**

- A.** Verify the design dimensions from the top of the foundation to the floor of the terminal building door sill at the gate location.
- B.** All anchor bolts shall be properly protected from bending and damage during and after construction. All anchor bolts shall be double nutted, with 3 full threads minimum showing. The Contractor shall install anchor and leveling nuts, provide an appropriate size flat washer to cover the slotted opening in PBB support column base plate and provide proper installation of the nuts as required to complete the installation. After installation, tack weld the anchor nuts to the base. All zinc coating removed or damaged by welding or by any other reason shall be cleaned and repaired with galvanizing repair primer meeting the requirements of Federal Specification TT-P-641 G (1), Type II. Anchor bolts are provided by others: reference Structural.
- C.** An approved non-shrinking grout shall be used underneath the column base plate and leveling plate and fill all anchor bolt pipe sleeves. Grout shall be nonferrous to avoid unsightly rust marks. Form all grout pours. The grouting shall be done to ACI standards. Grouting by dry packing and filling the center area with bags and blocks is not acceptable.

34 77 13-3.4 ASSEMBLY INSPECTION**A. Preliminary Inspection:**

- A functional inspection and demonstration of each unit shall be performed at the installation site by a representative of the Contractor in the presence of the using Airlines technical representative and Owner's Representative. Demonstrate full operation of each bridge. Utilize "Loading Bridge Standard Performance and Acceptance Test Procedure" as shown in Appendix "A" in performing inspection and demonstration. Complete all items as listed in procedure.

- Verification of compliance with the specification shall be accomplished by inspection, review of data, demonstration, testing (if required), or a combination of these.

B. Final Inspection:

- After full compliance by the Contractor of all outstanding items determined from the Preliminary Inspection as shown on the performance and acceptance test procedure list, the Airline technical representative and Owner's representative shall perform the final inspection of the unit.
- Perform inspection and demonstration of all items shown in Appendix "A" as done under Primary Inspection. Full acceptance of the unit shall be made in writing to the Contractor after satisfactory completion of all outstanding items as determined by the Airline technical representative and the Owner's Representative.
- The manufacturer shall provide services of quality assurance manager for the final inspection of the installation. A letter certifying that the installation meets the quality standards for the manufacturer and complies with the specifications shall be provided to the Owner.

34 77 13-3.5 TRAINING REQUIREMENTS

- A. The Contractor shall provide as a minimum eight (8) hours of operation and sixteen (16) hours of maintenance training, in separate sessions by a qualified Manufacturer's representative. Provide full-time supervisor for ten (10) days. Training shall be conducted at the installation site and in classrooms as designated and provided for by the Owner and airlines. Maintenance training shall include proper demonstration of cut-away models of critical parts, full instruction on proper maintenance and troubleshooting, instructions on proper use of manuals, etc. Operation training shall include proper training of the operators on correct bridge operations to avoid damaging the equipment by improper use of the controls. The Contractor shall provide a complete operation training program and maintenance training program both recorded on separate video tapes to enable the Owner to train additional employees in the future.
- B. Training shall be conducted by the Contractor utilizing prepared texts, slides, actual PBBs and other instructional aids as appropriate.
- C. Training dates shall be mutually agreed upon by the Contractor, airlines, and the Owner and shall be at dates prior to the bridge going into regular operational service.
- D. The Contractor shall, prior to commencing demonstration and training, provide the Owner with operation and maintenance manuals for the PBB.

34 77 13-3.6 SPARE PARTS

The Contractor shall furnish, not less than 45 days prior to completion of a PBB, a list of suggested spare parts, including prices and sources, to the Engineer for review by the Owner. Spare parts are recommended in this context are those items which are necessary to maintain in stores in order to maintain service availability of bridges.

METHOD OF MEASUREMENT

34 77 13-4.1 There will be no direct measurement for this section.

BASIS OF PAYMENT

34 77 13-5.1 Payment will be remitted per the contract lump sum.

REFERENCES

The PBB shall be designed and manufactured to meet U.S. codes and regulations that have been adopted by the PBB industry. Portions or all of the recognized industry or association standards referred to in this specification shall be considered as binding unless supplemented or modified by more stringent requirements as specified in binding contracts or agreements. Unless otherwise stated, the standards referenced herein shall be current as of the date of issuance of this specification.

AISC	American Institute of Steel Construction
ASCE 7	Minimum Design Loads for Buildings and Other Structures
ASME	American Society of Mechanical Engineers
ASTM A36	Specification for Carbon Structural Steel
ASTM A53	Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A311 (Grades 1018 and 1144)	Specification for Cold Drawn, Stress-Relief Carbon Steel Bars Subject to Mechanical Property Requirements
ASTM A325	Specification for Structural Bolts, Steel, Heat-Treated, 120/105 ksi Minimum Tensile Strength
ASTM A490	Specification for Heat-Treated Steel, Structural Bolts, 150 ksi Minimum Tensile Strength
ASTM A500	Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A514	Specification for High-Yield Strength, Quenches and Tempered Alloy Steel Plate, Suitable for Welding
ASTM A517	Standard Specification for Pressure Vessel Plates, Alloy Steel, High-Strength Quenched and Tempered
ASTM A570	Standard Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled
ASTM A572	Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
AWS	American Welding Society
CSA/C22.2-2471992	Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA-415	Standard on Construction and Protection of Aircraft Loading Walkways
SAE	Society of Automotive Engineers
SAE J429 (Grades 5 and 8)	Mechanical and quality requirements for steel fasteners used in automotive and related industries up to 1-1/2" inclusive

RS&H

SSPC

UL 325 3rd Edition

Structural Steel Painting Council

Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems

APPENDIX "A"

STANDARD PERFORMANCE

AND

ACCEPTANCE TEST PROCEDURES

FOR PASSENGER BOARDING BRIDGES

STANDARD PERFORMANCE TEST PROCEDURES

Preliminary/Final Inspection (circle one) Date _____

Loading Bridge Gate Number: _____

Airline Served: _____

Airline Representative present during demonstration: _____

Architect/Engineer's Representative present during demonstration: _____

Owner's Representative present during demonstration: _____

A. ELECTRICAL INSTALLATION

General: Prior to connecting power supply, check all circuits as follows:

		Functioning <u>Properly</u>	<u>Malfunctioning</u>
1.	Insulation resistance	_____	_____
2.	Continuity	_____	_____
3.	Polarity	_____	_____
4.	Earth loop resistance from each main part of the ground connection with building ground	_____	_____
5.	Disconnect operation	_____	_____

		Functioning <u>Properly</u>	<u>Malfunctioning</u>
B.	<u>FUNCTIONAL TESTS</u>		
1.	Electrical: Demonstrate the following:		
a.	Emergency lights	_____	_____
b.	Emergency stops	_____	_____
c.	Warning lights	_____	_____
d.	Obstruction lights	_____	_____
e.	Floodlights	_____	_____
f.	Bogie visual alarms	_____	_____
g.	Bridge lighting	_____	_____

h.	Stair lighting	_____	_____
i.	Heatable window (if fitted)	_____	_____
j.	Key switch for manual and automatic operation	_____	_____
k.	Height indicator	_____	_____
l.	Signal lamps	_____	_____
m.	Main control panel	_____	_____
n.	Cabin floor heater	_____	_____
o.	Selector switches:		
	1) Lifting/lowering	_____	_____
	2) Cabin rotation	_____	_____
	3) Wheels - steer right/left	_____	_____
	4) Bridge - extend/retract	_____	_____
	5) Emergency back-off	_____	_____
	6) Main/Aux changeover switch (if fitted)	_____	_____
p.	Safety interlocks:		
	1) Maintenance switches	_____	_____
	2) Main panel isolator	_____	_____
	3) Safety barrier (if fitted)	_____	_____
q.	Fault Monitoring (if fitted)		
2.	Mechanical: Demonstrate the following:		
a.	Cabin window shutters (if fitted)	_____	_____
b.	Door closer on service door	_____	_____
c.	Tires	_____	_____
d.	Self sustaining elevation screw	_____	_____
C.	<u>OPERATION TESTS (ALL DONE TWICE)</u>		
1.	Extension/Retraction		
a.	Extension limit switch No. 1	_____	_____
b.	Extension limit switch No. 2	_____	_____
c.	Retraction limit switch No. 1	_____	_____
d.	Retraction limit switch No. 2	_____	_____
e.	Speed reduced (if fitted)	_____	_____

2. Lifting/Lowering

a. Height switch No. 1 fully extended

b. Height switch No. 2 fully extended

c. Lower switch No. 1 fully extended

d. Lower switch No. 2 fully extended

e. Height switch No. 1 fully retracted

f. Height switch No. 2 fully retracted

g. Lower switch No. 1 fully retracted

h. Lower switch No. 2 fully retracted

i. Inclination switch bridge up
fully retracted

j. Inclination switch bridge down
fully retracted

3. Rotation (Bridges)

a. Approach switches left hand

b. Approach switches right hand

c. Check slow-down or supplementary
switches as above

d. Ultimate limit switches L/R

4. Rotation (Cabin)

a. Limit switch left hand

b. Limit switch right hand

5. Canopy

a. Extension, check both side
switches

b. Retraction, check both side
switches

END OF ITEM 34 77 13

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SECTION 01 10 00 - SUMMARY

PART 1 GENERAL

1.01 PROJECT

- A. Project Name: 20245144006 - Concourse A Passenger Boarding Bridge Upgrades
- B. Owner's Name: City of Eugene.
- C. Architect's Name: RS&H Oregon.
- D. The Project consists of the alteration of the airport concourse including the replacement and relocation of one Passenger Boarding Bridge (PBB) and the replacement of a second PBB at the same location. Interior renovations include the addition of a gate ticket counter, removal of existing windows, and installation of a new door to the PBB. .

1.02 CONTRACT DESCRIPTION

- A. Contract Type: A single prime contract based on a Stipulated Price as described in Document 00 52 00 - Agreement Form.

1.03 DESCRIPTION OF ALTERATIONS WORK

- A. Scope of demolition and removal work is indicated on drawings and specified in section 02 41 19..
- B. Scope of alterations work is indicated on drawings.
- C. Contractor is required to remove and store the following prior to start of work, for later reinstallation by Contractor:
 - 1. Gate A5 PBB: Preconditioned Air Unit.
 - 2. Gate A6 PBB: Preconditioned Air Unit and Ground Power Unit.

1.04 OWNER OCCUPANCY

- A. Owner intends to continue to occupy adjacent portions of the existing building during the entire construction period.
- B. Owner intends to occupy the Project upon Substantial Completion.
- C. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
- D. Schedule the Work to accommodate Owner occupancy.

1.05 CONTRACTOR USE OF SITE AND PREMISES

- A. Provide access to and from site as required by law and by Owner:
 - 1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
 - 2. Do not obstruct roadways, sidewalks, or other public ways without permit.
- B. Utility Outages and Shutdown:
 - 1. Limit disruption of utility services to hours the building is unoccupied.
 - 2. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Owner and authorities having jurisdiction.
 - 3. Prevent accidental disruption of utility services to other facilities.

END OF SECTION

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SECTION 01 20 00 - PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procedures for preparation and submittal of applications for progress payments.
- B. Documentation of changes in Contract Sum and Contract Time and schedule.

1.02 RELATED REQUIREMENTS

1.03 SCHEDULE OF VALUES

- A. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.
- B. Forms filled out by hand will not be accepted.
- C. Revise schedule to list approved Change Orders, with each Application For Payment.

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

- A. Payment Period: Submit at intervals stipulated in the Agreement.
- B. Use Form AIA G702 and Form AIA G703, edition stipulated in the Agreement.
- C. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.
- D. Forms filled out by hand will not be accepted.
- E. For each item, provide a column for listing each of the following:
 - 1. Item Number.
 - 2. Description of work.
 - 3. Scheduled Values.
 - 4. Previous Applications.
 - 5. Work in Place and Stored Materials under this Application.
 - 6. Authorized Change Orders.
 - 7. Total Completed and Stored to Date of Application.
 - 8. Balance to Finish.
 - 9. Retainage.
- F. Execute certification by signature of authorized officer.
- G. Submit one electronic and three hard-copies of each Application for Payment.

1.05 MODIFICATION PROCEDURES

- A. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect will issue instructions directly to Contractor.
- B. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
 - 1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
 - 2. Promptly execute the change.
- C. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 14 calendar days.
- D. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.

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PRICE AND PAYMENT
PROCEDURES**

1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
 2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.
 3. For change ordered by Architect without a quotation from Contractor, the amount will be determined by Architect based on the Contractor's substantiation of costs as specified for Time and Material work.
- E. Substantiation of Costs: Provide full information required for evaluation.
1. Provide the following data:
 - a. Quantities of products, labor, and equipment.
 - b. Taxes, insurance, and bonds.
 - c. Overhead and profit.
 - d. Justification for any change in Contract Time.
 - e. Credit for deletions from Contract, similarly documented.
 2. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.
- F. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.
- G. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.
- H. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.

1.06 APPLICATION FOR FINAL PAYMENT

- A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 25 00 - SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 01 30 00 - Administrative Requirements: Submittal procedures, coordination.

1.02 DEFINITIONS

- A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
 - 1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
 - a. Unavailability.
 - b. Regulatory changes.
 - 2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.
 - a. Substitution requests offering advantages solely to the Contractor will not be considered.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
 - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
 - 2. Agrees to provide the same warranty for the substitution as for the specified product.
 - 3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
 - 4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
 - 5. Waives claims for additional costs or time extension that may subsequently become apparent.
 - 6. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.
- B. A Substitution Request for specified installer constitutes a representation that the submitter:
 - 1. Has acted in good faith to obtain services of specified installer, but was unable to come to commercial, or other terms.
- C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
 - 1. Note explicitly any non-compliant characteristics.
- D. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
 - 1. No specific form is required. Contractor's Substitution Request documentation must include the following:
 - a. Project Information:
 - 1) Official project name and number, and any additional required identifiers established in Contract Documents.
 - 2) Owner's, Architect's, and Contractor's names.
 - b. Substitution Request Information:
 - 1) Discrete and consecutive Substitution Request number, and descriptive subject/title.
 - 2) Issue date.

- 3) Reference to particular Contract Document(s) specification section number, title, and article/paragraph(s).
- 4) Description of Substitution.
- 5) Reason why the specified item cannot be provided.
- 6) Differences between proposed substitution and specified item.
- 7) Description of how proposed substitution affects other parts of work.
- c. Attached Comparative Data: Provide point-by-point, side-by-side comparison addressing essential attributes specified, as appropriate and relevant for the item:
 - 1) Physical characteristics.
 - 2) In-service performance.
 - 3) Expected durability.
 - 4) Visual effect.
 - 5) Warranties.
 - 6) Other salient features and requirements.
- d. Impact of Substitution:
 - 1) Savings to Owner for accepting substitution.
 - 2) Change to Contract Time due to accepting substitution.
- E. Limit each request to a single proposed substitution item.
 1. Submit an electronic document, combining the request form with supporting data into single document.

3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT

- A. Submittal Time Restrictions:
 1. Instructions to Bidders specifies time restrictions and the documents required for submitting substitution requests during the bidding period.

3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

- A. Submit request for Substitution for Cause within 14 days of discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
- B. Substitutions will not be considered under one or more of the following circumstances:
 1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
 2. Without a separate written request.
 3. When acceptance will require revisions to Contract Documents.

3.04 RESOLUTION

- A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.
- B. Architect will notify Contractor in writing of decision to accept or reject request.

3.05 ACCEPTANCE

- A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

3.06 CLOSEOUT ACTIVITIES

- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

END OF SECTION

SECTION 01 30 00 - ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General administrative requirements.
- B. Electronic document submittal service.
- C. Preconstruction meeting.
- D. Progress meetings.
- E. Construction progress schedule.
- F. Submittals for review, information, and project closeout.
- G. Number of copies of submittals.
- H. Requests for Information (RFI) procedures.
- I. Submittal procedures.

1.02 RELATED REQUIREMENTS

- A. Section 01 70 00 - Execution and Closeout Requirements: Additional coordination requirements.
- B. Section 01 78 00 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

1.03 GENERAL ADMINISTRATIVE REQUIREMENTS

- A. Comply with requirements of Section 01 70 00 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.
- B. Make the following types of submittals to Architect:
 - 1. Requests for Information (RFI).
 - 2. Requests for substitution.
 - 3. Shop drawings, product data, and samples.
 - 4. Test and inspection reports.
 - 5. Design data.
 - 6. Manufacturer's instructions and field reports.
 - 7. Applications for payment and change order requests.
 - 8. Progress schedules.
 - 9. Coordination drawings.
 - 10. Correction Punch List and Final Correction Punch List for Substantial Completion.
 - 11. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

- A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, or MS Excel) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
 - 1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Information (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
 - 2. Contractor and Architect are required to use this service.

3. It is Contractor's responsibility to submit documents in allowable format.
 4. Subcontractors, suppliers, and Architect's consultants will be permitted to use the service at no extra charge.
 5. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.
 6. Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.
 7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.
- B. Submittal Service: Use one of the following:
1. Newforma ConstructEx: www.newforma.com/our-solutions/constructex/#sle.
 2. ProCore or similar.
 3. Autodesk Build.
- C. Training: One, one-hour, web-based training session will be arranged for all participants, with representatives of Architect and Contractor participating; further training is the responsibility of the user of the service.
- D. Project Closeout: Architect will determine when to terminate the service for the project and is responsible for obtaining archive copies of files for Owner.

3.02 PRECONSTRUCTION MEETING

- A. Owner will schedule a meeting after Notice of Award.
- B. Attendance Required:
1. Owner.
 2. Architect.
 3. Contractor.
- C. Agenda:
1. Execution of Owner-Contractor Agreement.
 2. Submission of executed bonds and insurance certificates.
 3. Distribution of Contract Documents.
 4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
 5. Designation of personnel representing the parties to Contract, _____ and Architect.
 6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 7. Scheduling.
- D. GC prepare agenda with copies for participants, preside at meeting, record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.03 PROGRESS MEETINGS

- A. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
- B. Attendance Required:
1. Contractor.
 2. Owner.
 3. Architect.
 4. Contractor's superintendent.
 5. Major subcontractors.
- C. Agenda:
1. Review minutes of previous meetings.

2. Review of work progress.
 3. Field observations, problems, and decisions.
 4. Identification of problems that impede, or will impede, planned progress.
 5. Review of submittals schedule and status of submittals.
 6. Review of RFIs log and status of responses.
 7. Maintenance of progress schedule.
 8. Corrective measures to regain projected schedules.
 9. Planned progress during succeeding work period.
 10. Maintenance of quality and work standards.
 11. Effect of proposed changes on progress schedule and coordination.
 12. Other business relating to work.
- D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 CONSTRUCTION PROGRESS SCHEDULE

- A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of work, with a general outline for remainder of work.
- B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
1. Include written certification that major contractors have reviewed and accepted proposed schedule.
- D. Within 10 days after joint review, submit complete schedule.
- E. Submit updated schedule with each Application for Payment.

3.05 REQUESTS FOR INFORMATION (RFI)

- A. Definition: A request seeking one of the following:
1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
- B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.
- C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
1. Prepare a separate RFI for each specific item.
 - a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
 - b. Do not forward requests which solely require internal coordination between subcontractors.
 2. Prepare in a format and with content acceptable to Owner.
 3. Prepare using software provided by the Electronic Document Submittal Service.
 4. Combine RFI and its attachments into a single electronic file. PDF format is preferred.
- D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
 2. Unacceptable Uses for RFIs: Do not use RFIs to request the following::
 - a. Approval of submittals (use procedures specified elsewhere in this section).

- b. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
 - c. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).
 - 3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.
- E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
 - 1. Official Project name and number, and any additional required identifiers established in Contract Documents.
 - 2. Owner's, Architect's, and Contractor's names.
 - 3. Discrete and consecutive RFI number, and descriptive subject/title.
 - 4. Issue date, and requested reply date.
 - 5. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
 - 6. Annotations: Field dimensions and/or description of conditions which have engendered the request.
 - 7. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.
- F. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.
- G. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
 - 1. Indicate current status of every RFI. Update log promptly and on a regular basis.
 - 2. Note dates of when each request is made, and when a response is received.
 - 3. Highlight items requiring priority or expedited response.
 - 4. Highlight items for which a timely response has not been received to date.
- H. Review Time: Architect will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
 - 1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.
- I. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.
 - 1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
 - 2. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
 - 3. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.06 SUBMITTAL SCHEDULE

- A. Submit to Architect for review a schedule for submittals in tabular format.

1. Submit at the same time as the preliminary schedule specified in Section - 01 32 16 - Construction Progress Schedule.
2. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.

3.07 SUBMITTALS FOR REVIEW

- A. When the following are specified in individual sections, submit them for review:
 1. Product data.
 2. Shop drawings.
 3. Samples for selection.
 4. Samples for verification.
- B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.
- C. Samples will be reviewed for aesthetic, color, or finish selection.
- D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 78 00 - Closeout Submittals.

3.08 SUBMITTALS FOR INFORMATION

- A. When the following are specified in individual sections, submit them for information:
 1. Design data.
 2. Certificates.
 3. Test reports.
 4. Inspection reports.
 5. Manufacturer's instructions.
 6. Manufacturer's field reports.
 7. Other types indicated.
- B. Submit for Architect's knowledge as contract administrator or for Owner.

3.09 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit Correction Punch List for Substantial Completion.
- B. Submit Final Correction Punch List for Substantial Completion.
- C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 78 00 - Closeout Submittals:
 1. Project record documents.
 2. Operation and maintenance data.
 3. Warranties.
 4. Bonds.
 5. Other types as indicated.
- D. Submit for Owner's benefit during and after project completion.

3.10 NUMBER OF COPIES OF SUBMITTALS

- A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.
- B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
 1. After review, produce duplicates.
 2. Retained samples will not be returned to Contractor unless specifically so stated.

3.11 SUBMITTAL PROCEDURES

- A. General Requirements:
 1. Use a separate transmittal for each item.

2. Transmit using approved form provided by Architect.
 3. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
 4. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
 5. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
 - a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
 6. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
 - a. Upload submittals in electronic form to Electronic Document Submittal Service website.
 7. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
 8. Provide space for Contractor and Architect review stamps.
 9. When revised for resubmission, identify all changes made since previous submission.
 10. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
 11. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
- B. Product Data Procedures:
1. Submit only information required by individual specification sections.
 2. Collect required information into a single submittal.
 3. Submit concurrently with related shop drawing submittal.
 4. Do not submit (Material) Safety Data Sheets for materials or products.
- C. Shop Drawing Procedures:
1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
 2. Do not reproduce Contract Documents to create shop drawings.
 3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.
- D. Samples Procedures:
1. Transmit related items together as single package.
 2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.
 3. Include with transmittal high-resolution image files of samples to facilitate electronic review and approval. Provide separate submittal page for each item image.

3.12 SUBMITTAL REVIEW

- A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.
- B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.
- C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
1. Notations may be made directly on submitted items and/or listed on appended Submittal Review cover sheet.
- D. Architect's and consultants' actions on items submitted for review:
1. Authorizing purchasing, fabrication, delivery, and installation:

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- a. "Approved", or language with same legal meaning.
 - b. "Approved as Noted, Resubmission not required", or language with same legal meaning.
 - 1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
 - c. "Approved as Noted, Resubmit for Record", or language with same legal meaning.
 - 1) Resubmit corrected item, with review notations acknowledged and incorporated. Resubmit separately, or as part of project record documents.
 - 2. Not Authorizing fabrication, delivery, and installation:
 - a. "Revise and Resubmit".
 - 1) Resubmit revised item, with review notations acknowledged and incorporated.
- E. Architect's and consultants' actions on items submitted for information:
- 1. Items for which no action was taken:
 - a. "Received" - to notify the Contractor that the submittal has been received for record only.
 - 2. Items for which action was taken:
 - a. "Reviewed" - no further action is required from Contractor.

END OF SECTION

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SECTION 01 35 53 - SECURITY PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Security measures including formal security program, entry control, and personnel identification.

1.02 SECURITY PROGRAM

- A. Protect Work , existing premises and Owner's operations from theft, vandalism, and unauthorized entry.
- B. Initiate program at project mobilization.
- C. Maintain program throughout construction period until Owner acceptance precludes the need for Contractor security.

1.03 ENTRY CONTROL

- A. Restrict entrance of persons and vehicles into Project site and existing facilities.
- B. Allow entrance only to authorized persons with proper identification.
- C. Owner will control entrance of persons and vehicles related to Owner's operations.

1.04 PERSONNEL IDENTIFICATION

- A. Provide identification badge to each person authorized to enter premises.
- B. Badge To Include: Personal photograph, name, assigned number , expiration date and employer.
- C. Maintain a list of accredited persons, submit copy to Owner on request.
- D. Require return of badges at expiration of their employment on the Work.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Submittals.
- B. Quality assurance.
- C. Testing and inspection agencies and services.
- D. Contractor's construction-related professional design services.
- E. Control of installation.
- F. Manufacturers' field services.
- G. Defect Assessment.

1.02 CONTRACTOR'S CONSTRUCTION-RELATED PROFESSIONAL DESIGN SERVICES

- A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.
- B. Provide such engineering design services as may be necessary to plan and safely conduct certain construction operations, pertaining to, but not limited to the following:
 - 1. Temporary sheeting, shoring, or supports.
 - 2. Temporary scaffolding.
 - 3. Temporary bracing.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

1.04 QUALITY ASSURANCE

- A. Testing Agency Qualifications:
 - 1. Prior to start of work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
- B. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1.05 TESTING AND INSPECTION AGENCIES AND SERVICES

- A. Owner will employ and pay for services of an independent testing agency to perform other specified testing.
- B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
- D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

- E. Have work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 TESTING AND INSPECTION

- A. Testing Agency Duties:
 - 1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 2. Perform specified sampling and testing of products in accordance with specified standards.
 - 3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
 - 5. Perform additional tests and inspections required by Architect.
 - 6. Submit reports of all tests/inspections specified.
- B. Limits on Testing/Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency may not approve or accept any portion of the Work.
 - 3. Agency may not assume any duties of Contractor.
 - 4. Agency has no authority to stop the Work.
- C. Contractor Responsibilities:
 - 1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
 - 2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
 - 3. Provide incidental labor and facilities:
 - a. To provide access to Work to be tested/inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
 - c. To facilitate tests/inspections.
 - d. To provide storage and curing of test samples.
 - 4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
 - 5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
 - 6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- D. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- E. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.03 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.
- B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

**EUGENE AIRPORT
CONCOURSE A PASSENGER BOARDING
BRIDGE UPGRADES
EUGENE, OREGON**

**SECTION 01 40 00
QUALITY REQUIREMENTS**

3.04 DEFECT ASSESSMENT

- A. Replace Work or portions of the Work not complying with specified requirements.
- B. If, in the opinion of Owner, it is not practical to remove and replace the work, Owner will direct an appropriate remedy or adjust payment.

END OF SECTION

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SECTION 01 45 33 - CODE-REQUIRED SPECIAL INSPECTIONS AND PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Code-required special inspections.
- B. Submittals.
- C. Manufacturers' field services.
- D. Fabricators' field services.

1.02 DEFINITIONS

- A. Code or Building Code: ICC (IBC), International Building Code, most recent edition adopted by authority having jurisdiction, including all applicable amendments and supplements without limitation, and specifically Chapter 17 - Special Inspections and Tests.
- B. Authority Having Jurisdiction (AHJ): Agency or individual officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located.
- C. NIST: National Institute of Standards and Technology.
- D. Special Inspections and Tests: Inspections and testing of materials, installation, fabrication, erection, or placement of components and connections mandated by Building Code to safeguard public welfare.
 - 1. Special inspections and tests are separate from and independent of tests and inspections conducted by Owner or Contractor for purposes of quality assurance and contract administration.

1.03 REFERENCE STANDARDS

- A. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2025b.
- B. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2025.
- C. IAS AC291 - Accreditation Criteria for Special Inspection Agencies AC291; 2025, with Editorial Revision.
- D. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Special Inspection Agency Qualifications: Prior to start of work, Special Inspection Agency is required to:
 - 1. Submit agency name, address, and telephone number, names of full time registered Engineer and responsible officer.
 - 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
 - 3. Submit certification that Special Inspection Agency is acceptable to AHJ.
 - 4. Submit documentation that Special Inspection Agency is accredited by IAS according to IAS AC291.
- C. Testing Agency Qualifications: Prior to start of work, Testing Agency is required to:
 - 1. Submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.

2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
 3. Submit certification that Testing Agency is acceptable to AHJ.
 4. Submit documentation that Testing Agency is accredited by IAS according to IAS AC89.
- D. Special Inspection Reports: After each special inspection, Special Inspector is required to submit at least two copies of report; one to Architect and one to AHJ.
1. Final Special Inspection Report: Document special inspections and correction of discrepancies prior to the start of the work.
- E. Fabricator Special Inspection Reports: After each special inspection of fabricated items at fabricator's facility, Special Inspector is required to submit report to Architect and to AHJ.
1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of Special Inspector.
 - d. Date and time of special inspection.
 - e. Identification of fabricated item and specification section.
 - f. Location in the Project.
 - g. Results of special inspection.
 - h. Verification of fabrication and quality control procedures.
 - i. Compliance with contract documents.
 - j. Compliance with referenced standards.
- F. Test Reports: After each test or inspection, Testing Agency is required to submit report to Architect and to AHJ.
1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of inspector.
 - d. Date and time of sampling or inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.
 - g. Type of test or inspection.
 - h. Date of test or inspection.
 - i. Results of test or inspection.
 - j. Compliance with contract documents.
- G. Fabricator's Inspection Reports: When required by AHJ, submit reports to Architect and AHJ.

1.05 SPECIAL INSPECTION AND TESTING AGENCY

- A. Owner or Architect to employ services of Special Inspection Agency to perform inspections and associated testing and sampling in accordance with ASTM E329 and required by building code.
- B. Special Inspection Agency may delegate to independent testing agency to perform testing and sampling associated with special inspections and required by building code.
- C. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of contract documents.

1.06 TESTING AND INSPECTION AGENCIES

- A. Owner or Architect may employ services of independent testing agency to perform additional testing and sampling required by contract documents or associated with special inspections but not required by building code.
- B. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of contract documents.

1.07 QUALITY ASSURANCE

- A. Special Inspection Agency Qualifications:
 - 1. Independent firm specializing in performing testing and inspections of the type specified in this section.
 - 2. Accredited by IAS according to IAS AC291.
- B. Testing Agency Qualifications:
 - 1. Independent firm specializing in performing testing and inspections of the type specified in this section.
 - 2. Accredited by IAS according to IAS AC89.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SPECIAL INSPECTIONS AND TESTING

- A. The Code requires special inspections and testing of certain materials, components, assemblies, and connections used in constructing the project. Special inspections and testing will be performed in accordance with the Code.

3.02 SPECIAL INSPECTION AGENCY DUTIES AND RESPONSIBILITIES

- A. Special Inspection Agency shall:
 - 1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 2. Perform specified sampling and testing of products in accordance with specified reference standards.
 - 3. Ascertain compliance of materials and products with requirements of Contract Documents.
 - 4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of work or products.
 - 5. Perform additional tests and inspections required by Architect.
 - 6. Submit reports of all tests or inspections specified.
- B. Limits on Special Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency may not approve or accept any portion of the work.
 - 3. Agency may not assume any duties of Contractor.
 - 4. Agency has no authority to stop the work.
- C. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- D. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.03 CONTRACTOR DUTIES AND RESPONSIBILITIES

- A. Contractor Responsibilities, General:
 - 1. Deliver to agency at designated location, adequate samples of materials for special inspections that require material verification.
 - 2. Cooperate with agency and laboratory personnel; provide access to approved documents at project site, to the work, to manufacturers' facilities, and to fabricators' facilities.
 - 3. Provide incidental labor and facilities:
 - a. To provide access to work to be tested or inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested or inspected.
 - c. To facilitate tests or inspections.
 - d. To provide storage and curing of test samples.

4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing or inspection services.
5. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

3.04 FABRICATORS' FIELD SERVICES

- A. When required by AHJ or specified in individual specification sections, require fabricators to provide qualified staff personnel to observe site conditions, installation conditions, quality of workmanship, and start-up of equipment and systems and to initiate instructions when necessary.
- B. Submit qualifications of observer to Architect 30 days in advance of required observations.
- C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

END OF SECTION

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General product requirements.
- B. Re-use of existing products.
- C. Transportation, handling, storage and protection.
- D. Product option requirements.
- E. Substitution limitations.

1.02 RELATED REQUIREMENTS

- A. Section 01 10 00 - Summary: Lists of products to be removed from existing building.
- B. Section 01 25 00 - Substitution Procedures: Substitutions made during procurement and/or construction phases.
- C. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.

1.03 SUBMITTALS

- A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
 - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

- A. Specific Products to be Reused: The reuse of certain materials and equipment already existing on the project site is required.
 - 1. See Section 01 10 00 for list of items required to be salvaged for reuse and relocation.

2.02 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by Contract Documents.
- B. Use of products having any of the following characteristics is not permitted:
- C. Where other criteria are met, Contractor shall give preference to products that:
 - 1. If used on interior, have lower emissions, as defined in Section 01 61 16.
 - 2. If wet-applied, have lower VOC content, as defined in Section 01 61 16.

2.03 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

- A. See Section 01 25 00 - Substitution Procedures.

3.02 TRANSPORTATION AND HANDLING

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- D. Transport and handle products in accordance with manufacturer's instructions.
- E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
- H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.03 STORAGE AND PROTECTION

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 74 19.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- G. Comply with manufacturer's warranty conditions, if any.
- H. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- I. Prevent contact with material that may cause corrosion, discoloration, or staining.
- J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 01 70 00 - EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Examination, preparation, and general installation procedures.
- B. Requirements for alterations work, including selective demolition.
- C. Cutting and patching.
- D. Surveying for laying out the work.
- E. Cleaning and protection.
- F. Starting of systems and equipment.
- G. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

1.02 RELATED REQUIREMENTS

- A. Section 01 10 00 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.
- B. Section 01 30 00 - Administrative Requirements: Submittals procedures, Electronic document submittal service.
- C. Section 01 40 00 - Quality Requirements: Testing and inspection procedures.
- D. Section 01 50 00 - Temporary Facilities and Controls: Temporary exterior enclosures.
- E. Section 01 50 00 - Temporary Facilities and Controls: Temporary interior partitions.
- F. Section 01 78 00 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
 - 1. On request, submit documentation verifying accuracy of survey work.
 - 2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
 - 3. Submit surveys and survey logs for the project record.
- C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
 - 1. Structural integrity of any element of Project.
 - 2. Integrity of weather exposed or moisture resistant element.
 - 3. Efficiency, maintenance, or safety of any operational element.
 - 4. Visual qualities of sight exposed elements.
 - 5. Work of Owner or separate Contractor.

1.04 QUALIFICATIONS

- A. For surveying work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

1.05 PROJECT CONDITIONS

- A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 LAYING OUT THE WORK

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Architect of any discrepancies discovered.
- C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
- F. Utilize recognized engineering survey practices.
- G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
 - 1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations; and _____.
 - 2. Grid or axis for structures.
 - 3. Building foundation, column locations, ground floor elevations, and _____.
- H. Periodically verify layouts by same means.
- I. Maintain a complete and accurate log of control and survey work as it progresses.

3.04 GENERAL INSTALLATION REQUIREMENTS

- A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.05 ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 - 1. Verify that construction and utility arrangements are as indicated.
 - 2. Report discrepancies to Architect before disturbing existing installation.
 - 3. Beginning of alterations work constitutes acceptance of existing conditions.
- B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
 - 1. Provide, erect, and maintain temporary dustproof partitions of construction around construction site as approved by owner .
- C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
 - 1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
 - 2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.
- D. Remove existing work as indicated and as required to accomplish new work.
 - 1. Remove items indicated on drawings.
 - 2. Relocate items indicated on drawings.
 - 3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
 - 4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.
- E. Services (Including but not limited to Electrical and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
 - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
 - 2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
 - 3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
 - b. Provide temporary connections as required to maintain existing systems in service.
 - 4. Verify that abandoned services serve only abandoned facilities.
 - 5. Remove abandoned pipe, ducts, conduits, and equipment , including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

- F. Protect existing work to remain.
 - 1. Prevent movement of structure; provide shoring and bracing if necessary.
 - 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 - 3. Repair adjacent construction and finishes damaged during removal work.
- G. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
 - 1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.
 - 2. Where a change of plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.
- H. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.
- I. Refinish existing surfaces as indicated:
 - 1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
 - 2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.
- J. Clean existing systems and equipment.
- K. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.
- L. Do not begin new construction in alterations areas before demolition is complete.
- M. Comply with all other applicable requirements of this section.

3.06 CUTTING AND PATCHING

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. See Alterations article above for additional requirements.
- C. Perform whatever cutting and patching is necessary to:
 - 1. Complete the work.
 - 2. Fit products together to integrate with other work.
 - 3. Provide openings for penetration of mechanical, electrical, and other services.
 - 4. Match work that has been cut to adjacent work.
 - 5. Repair areas adjacent to cuts to required condition.
 - 6. Repair new work damaged by subsequent work.
 - 7. Remove samples of installed work for testing when requested.
 - 8. Remove and replace defective and non-complying work.
- D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- E. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- G. Restore work with new products in accordance with requirements of Contract Documents.
- H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

- I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 84 00, to full thickness of the penetrated element.
- J. Patching:
 - 1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
 - 2. Match color, texture, and appearance.
 - 3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.07 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.08 PROTECTION OF INSTALLED WORK

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- G. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.09 SYSTEM STARTUP

- A. Coordinate schedule for start-up of various equipment and systems including Passenger Boarding Bridges.
- B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- D. Verify that wiring and support components for equipment are complete and tested.
- E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- F. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.10 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.11 FINAL CLEANING

- A. Use cleaning materials that are nonhazardous.
- B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- E. Clean filters of operating equipment.
- F. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, drainage systems, and _____.
- G. Clean site; sweep paved areas, rake clean landscaped surfaces.
- H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.12 CLOSEOUT PROCEDURES

- A. Make submittals that are required by governing or other authorities.
- B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.
- C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.
- D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.
- E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.
- F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
- G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.
- H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

END OF SECTION

SECTION 01 78 00 - CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Operation and maintenance data.
- B. Warranties and bonds.

1.02 RELATED REQUIREMENTS

- A. Section 01 30 00 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- B. Individual Product Sections: Specific requirements for operation and maintenance data.
- C. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

- A. Operation and Maintenance Data:
 - 1. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
 - 2. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
 - 3. Submit two sets of revised final documents in final form within 10 days after final inspection.
- B. Warranties and Bonds:
 - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
 - 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
 - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 OPERATION AND MAINTENANCE DATA

- A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.02 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

- A. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.03 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For Each Item of Equipment and Each System:
 - 1. Description of unit or system, and component parts.
 - 2. Identify function, normal operating characteristics, and limiting conditions.
 - 3. Include performance curves, with engineering data and tests.
 - 4. Complete nomenclature and model number of replaceable parts.
- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
- D. Include color coded wiring diagrams as installed.
- E. Provide servicing and lubrication schedule, and list of lubricants required.
- F. Include manufacturer's printed operation and maintenance instructions.
- G. Include sequence of operation by controls manufacturer.
- H. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

3.04 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

- A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
- B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
- C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
- F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
- G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
- H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.
- I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

3.05 WARRANTIES AND BONDS

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.
- E. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.

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**SECTION 01 78 00
CLOSEOUT SUBMITTALS**

- F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.
- G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.
- H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

END OF SECTION

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SECTION 02 41 00 - DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Selective demolition of built site elements.
- B. Selective demolition of building elements for alteration purposes.

1.02 RELATED REQUIREMENTS

- A. Section 01 10 00 - Summary: Limitations on Contractor's use of site and premises.
- B. Section 01 10 00 - Summary: Description of items to be salvaged or removed for re-use by Contractor.
- C. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- D. Section 01 70 00 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

1.03 DEFINITIONS

- A. Remove: Detach or dismantle items from existing construction and dispose of them off site, unless items are indicated to be salvaged or reinstalled.
- B. Remove and Salvage: Detach or dismantle items from existing construction in a manner to prevent damage. Clean, package, label and deliver salvaged items to Owner in ready-for-reuse condition.
- C. Remove and Reinstall: Detach or dismantle items from existing construction in a manner to prevent damage. Clean and prepare for reuse and reinstall where indicated.
- D. Existing to Remain: Designation for existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Site Plan: Indicate:
 - 1. Areas for temporary construction and field offices.
 - 2. Areas for temporary and permanent placement of removed materials.
- C. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

PART 3 EXECUTION

2.01 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain required permits.
 - 2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
 - 3. Provide, erect, and maintain temporary barriers and security devices.
 - 4. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
 - 5. Do not close or obstruct roadways or sidewalks without permits from authority having jurisdiction.
 - 6. Conduct operations to minimize obstruction of public and private entrances and exits. Do not obstruct required exits at any time. Protect persons using entrances and exits from removal operations.

7. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon, or limit access to their property.
- B. Do not begin removal until receipt of notification to proceed from Owner.
- C. Do not begin removal until built elements to be salvaged or relocated have been removed.
- D. Protect existing structures and other elements to remain in place and not removed.
 1. Provide bracing and shoring.
 2. Prevent movement or settlement of adjacent structures.
 3. Stop work immediately if adjacent structures appear to be in danger.
- E. Minimize production of dust due to demolition operations. Do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- F. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

2.02 EXISTING UTILITIES

- A. Coordinate work with utility companies. Notify utilities before starting work, comply with their requirements, and obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
- E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.
- F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

2.03 SELECTIVE DEMOLITION FOR ALTERATIONS

- A. Existing construction and utilities indicated on drawings are based on casual field observation and existing record documents only.
 1. Verify construction and utility arrangements are as indicated.
 2. Report discrepancies to Architect before disturbing existing installation.
 3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
- B. Separate areas in which demolition is being conducted from areas that remain occupied.
 1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 50 00 .
- C. Remove existing work as indicated and required to accomplish new work.
 1. Remove items indicated on drawings.
- D. Services including, but not limited to, HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications: Remove existing systems and equipment as indicated.
 1. Maintain existing active systems to remain in operation, and maintain access to equipment and operational components.
 2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 3. Verify that abandoned services serve only abandoned facilities before removal.
 4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings. Remove back to source of supply where possible, otherwise cap stub and tag with identification.

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DEMOLITION**

- E. Protect existing work to remain.
 - 1. Prevent movement of structure. Provide shoring and bracing as required.
 - 2. Perform cutting to accomplish removal work neatly and as specified for cutting new work.
 - 3. Repair adjacent construction and finishes damaged during removal work.
 - 4. Patch to match new work.

2.04 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

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SECTION 03 10 00 - CONCRETE FORMWORK

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Work under this section includes the furnishing and installing of all form work for cast-in-place concrete, complete, with all related accessories, items and incidentals required.

1.2 APPLICABLE STANDARDS (LATEST EDITIONS APPLY)

- A. ACI- American Concrete Institute
 - 1. 301, Specifications for Structural Concrete for Buildings.
 - 2. 318, Building Code Requirements for Reinforced Concrete.
 - 3. 347, Recommended Practice for Concrete Formwork.

PART 2 - PRODUCTS

2.1 FORMING MATERIALS

- A. Unless otherwise indicated, materials for formwork shall be wood, steel, fiber or reinforced plastic and of suitable quality to achieve required finishes. Contractor shall conform with considerations and recommendations in ACI-347, Chapter 3, Materials for Formwork.
- B. Unless otherwise indicated, contact surfaces in fabricated forms shall be smooth and uniform without warps, bends, dents, sags or irregular absorptive conditions and imperfections which might telegraph or produce objectionable irregularities in the exposed concrete finish.
- C. Form ties and spreaders shall leave a hole not larger than 7/8-inch nor less than 1/2-inch in diameter in the concrete surface. The portion of the tie remaining in the concrete shall be at least 1-inch back from the concrete surface that will be exposed to view, painted, dampproofed or waterproofed.
- D. Chamfer strips: Milled from clear straight-grain lumber, surfaced on all sides. Other material of equal quality may be used only as authorized by Architect.
- E. Round Pier Forms: Sonotube or equal

2.2 FORM COATINGS

- A. Form coating and bond breaking materials shall be non-staining and completely compatible with paint materials and other surface treatment materials to be used.

2.3 OTHER MATERIALS

- A. Sand Cushion: Sand shall be clean, sharp and moist.
- B. Rock Base: To be provided as indicated in the project Geotechnical Report.

- C. Expansion Joint Material: Preformed expansion joint filler, nonextruding, resilient bituminous type conforming to ASTM D1751.

PART 3 - EXECUTION

3.1 CONSTRUCTION OF FORMS

- A. The forms shall be constructed smooth, mortar-tight, true to the required lines and grade, and with sufficient strength to resist springing out of shape during the placing and vibrating of concrete. All dirt, chips, sawdust and other foreign matter shall be completely removed before concrete is placed. Forms previously used shall be thoroughly cleaned of all dirt, mortar and foreign matter before being used.
- B. Before reinforcing steel is placed in forms, all inside surfaces of the forms shall be thoroughly coated with an approved form sealer. The form sealer shall be of high penetrating quality leaving no film on the surface of the forms that can be absorbed by the concrete or be incompatible with concrete paint.
- C. All exposed edges shall be chamfered with triangular fillets 3/4-inch by 3/4-inch.
- D. Joints in formwork for exposed walls and curbs shall be taped.

3.2 EARTH FORMS

- A. Earth forms may be utilized where foundation trench walls are stable.
- B. Remove loose dirt and debris prior to placement of concrete.

3.3 STRIPPING

- A. Forms shall be removed in such manner as to insure the complete safety of the structure. Conform to minimum requirements established by ACI 347 for specific conditions.
- B. Formwork for walls and other parts not supporting the weight of the concrete may be removed as soon as the concrete has hardened sufficiently to resist damage from removal operations.
- C. Whenever the formwork is removed during the curing period, the exposed concrete shall be protected and cured by one of the methods specified in Section 03 30 00.

**SECTION 03 10 00
CONCRETE FORMING AND ACCESSORIES
END OF SECTION**

SECTION 03 20 00 - CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Work under this Section includes the furnishing and installing of all steel reinforcing for cast-in-place concrete, complete, with all related items, accessories and incidentals required, such as ties, spacing devices inserts and all other material required to complete installation.

1.2 APPLICABLE STANDARDS (LATEST EDITIONS APPLY)

- A. ACI- American Concrete Institute:
 - 1. 301, Specifications for Structural Concrete for Buildings.
 - 2. 315, Manual of Standard Practice for Detailing Reinforced Concrete Structures.
 - 3. 318, Building Code Requirements for Reinforced Concrete.
- B. ASTM- American Society for Testing and Materials, Referenced Standards
- C. AWS- American Welding Society:
 - 1. D1.4 Structural Welding Code - Reinforcing Steel
 - 2. A5.1 Mild Steel Covered Arc - Welding Electrodes
- D. CRSI- Concrete Reinforcing Steel Institute:
 - 1. Manual of Standard Practices
 - 2. Recommended Practice for Placing Reinforcing Bars

1.3 SUBMITTALS

- A. Shop Drawings of all reinforcing steel shall be submitted for approval.
- B. Mill Reports for each different heat to be used on the job shall be submitted for approval.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Reinforcing bars: Deformed, new billet-steel bars conforming to ASTM Designation A615, Grade 60 or ASTM A706 unless noted otherwise.
- B. Reinforcing mesh: Welded wire fabric conforming to ASTM A185.
- C. Tie wires and spirals: ASTM A1064.
- D. Reinforcement supports

1. At reinforcing placed over sand or earth, use precast concrete cubes.
 2. At reinforcing placed over forms, provide supports with legs which are hot dip galvanized, stainless steel or plastic protected.
- E. Mechanical Bar Splice: Xtender by Headed Reinforcement Corp. or equal to develop a minimum of 125% of yield strength of bar.

2.2 FABRICATION

- A. Except where specified otherwise herein or shown otherwise on the plans, reinforcing steel shall be cleaned, fabricated, placed, tied and supported in accordance with ACI 301 and ACI 315.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Reinforcing bars shall be accurately placed and shall be supported and secured against displacement by the use of adequate and proper supporting and spacing devices, tie wire, etc., so that it will remain in its correct location in the finished work. No supporting devices shall be used that will impede the flow of concrete.
- B. Do not bend or straighten reinforcing in any manner that will injure the material.
- C. Install splices for reinforcing bars in accordance with drawings and ACI 318 and the structural drawings.

3.2 CLEARANCES

- A. Where not shown otherwise on the drawings, the minimum concrete coverage for steel reinforcement shall be as follows:
1. Concrete placed against and permanently exposed to earth: 3"
 2. Concrete formed below grade or exposed to weather: 2"
- B. The clear spacing between parallel bars shall be not less than 1-1/2 times the normal diameter of the maximum size aggregate, and in no case less than 1-1/2 inches, except at splices which may be wired together.

3.3 FIELD QUALITY CONTROL

- A. Contractor shall examine placement of all reinforcement and embedded items prior to inspection by Owner's Testing Agency to ensure the proper clearances have been maintained and that all reinforcement and inserts are firmly tied to resist displacement.
- B. The Owner's Testing Agency will inspect:
1. In-place reinforcing steel

3.4 NOTIFICATION:

- A. Notify the Architect two working days in advance of concrete placement.

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**SECTION 03 20 00
CONCRETE REINFORCING**

**SECTION 03 20 00
CONCRETE REINFORCING
END OF SECTION**

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Work under this Section includes the furnishings and installing of all concrete work, complete, with all related accessories, items and incidentals required.
- B. Coordinate installation of all inserts and embedded items required or indicated.

1.2 APPLICABLE STANDARDS (LATEST EDITIONS APPLY)

- A. ACI- American Concrete Institute
 - 1. 301, Specifications for Structural Concrete for Buildings.
 - 2. 305, Recommended Practice for Hot Weather Concreting.
 - 3. 306, Recommended Practice for Cold Weather Concreting.
 - 4. 318, Building Code Requirements for Reinforced Concrete.
- B. ASTM- American Society of Testing and Materials, Referenced Standards
- C. ICC- International Code Council:
 - 1. OSSC – Oregon Structural Specialty Code
- D. ASCE/ SEI – American Society of Civil Engineers:
 - 1. ASCE-7 – Minimum Design Loads for Buildings and Other Structures.

1.3 SUBMITTALS

- A. Mix Design and Tests:
 - 1. Submit mix designs and compressive strength test reports from previous applications for specified types of concrete.
 - 2. Submit test reports for projects within 12 months of this project's contract date.
 - 3. The concrete mixes shall be based on designs of a professional testing laboratory, verified by test.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Materials for cast-in-place concrete shall be set as forth in ACI 301 except as modified herein and as otherwise indicated in project documents.

- B. Portland Cement: ASTM C150 Type I/II or IL modified, with maximum alkali content of 0.6 percent (from only one source).
- C. Aggregates: ASTM C33, (from source as approved by the Testing Agency).
- D. Water: Clean, Potable and free of injurious materials.
- E. Fly Ash: ASTM C618, Class C or F.
- F. Slag: Ground Granulated Blast-Furnace Slag; ASTM C989 Grade 100 or 120.
- G. Admixtures: Only brand products documented to have had not less than five years of satisfactory performance shall be used. Admixtures containing chlorides shall not be used.
 - 1. Air Entraining: ASTM C260
- H. Nonshrink Grout: Manufactured pre-mixed. Non-ferrous, non-staining, flowable grout which will not shrink as it cures, 4000 psi @ 7 days, 7500 psi @ 28 day.

2.2 CONCRETE MIX

- A. Ready-Mix Concrete: ASTM C94.

2.3 PROPORTION AND MIXTURE

- A. Proportioning mixtures and production of concrete shall be determined in accordance with ACI 318. Mixtures shall be proportioned to provide the minimum concrete compressive strength as indicated in the structural drawings and shall be in accordance with mix designs submitted by Laboratory and approved by the Owner's Testing Agency.
- B. Concrete exposed to freeze-thaw cycles shall have 5% +/- 1%, air entrainment when approved by Testing Agency.
- C. Water reducing admixtures may be used in concrete when approved by Testing Agency. Such admixtures shall not interfere with or reduce required air content dosage of air-entrained concrete.
- D. Use a minimum of 5 sacks of cement per cubic yard for all concrete.
- E. Concrete mix designs shall meet the requirements as indicated in the structural drawings.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Areas in which concrete is to be placed shall be inspected by Contractor for defects which would prohibit satisfactory placement of concrete or related miscellaneous items. Such defects shall be corrected prior to commencement of work.
- B. Concrete shall not be deposited or placed until all forms, reinforcing steel and construction joints have been inspected by Owner's Testing Agency and accepted in advance within the entire extent of the pour. Architect shall be notified 48 hours prior to first pour.

3.2 FIELD QUALITY CONTROL

- A. The Owner's Testing Agency will:

1. Review concrete mix designs.
2. Perform testing in accordance with ACI 318 and OSSC Section 1705.3 as indicated in the structural drawings.
3. Continuously monitor concrete temperature and inspect concrete placement.
4. Test concrete to control slumps according to ASTM C143.
5. Test concrete for required compressive strength in accordance with ACI 318 and OSSC Section 1705.3:
 - a. Make and cure three specimen cylinders according to ASTM C31 for each 150 cubic yards, or fraction thereof, of each class poured at site each day.
 - b. Retain one cylinder for 7-day test and two for the 28-day test.
 - c. Number each cylinder 1A, 1B, 1C, 2A, 2B, 2C, etc; date each set; and keep accurate record of pour each set represents.
 - d. Transport specimen cylinders from job to laboratory after cylinders have cured for 24-hours on site. Cylinders shall be covered and kept at air temperatures between 60 and 80 degrees Fahrenheit.
 - e. Test specimen cylinders at age 7-days and age 28-days for specified strength according to ASTM C39.
 - f. Base strength value on average of two cylinders taken for 28-day test.

B. The Contractor shall:

1. Submit ticket for each batch of concrete delivered to job site. Ticket shall bear the following information:
 - a. Design mix number
 - b. Signature or initials of ready mix representative
 - c. Comply with approved submittal mix design.

3.3 WORKMANSHIP

- A. All concrete shall be placed, finished and cured, and all other pertinent construction practices shall be in accordance with the Specifications for Structural Concrete for Buildings (ACI 301) hereby made a part of these specifications.
- B. In addition to the requirements of ACI 301, the following shall prevail:
 1. Concrete shall be placed so that a uniform appearance of the surface will be obtained.
 2. The concrete shall be free of all rock pockets, honeycombs and voids.
 3. Concrete shall be deposited as nearly as practical in its final position.
 4. The subgrade shall be slightly moist when the concrete is placed for floor slabs to prevent excessive loss of water from the concrete mix.
- C. Vibrators and Vibrating:
 1. Employ as many vibrators and tampers as necessary to secure the desired results. Minimum: one per each 20 cubic yards of concrete placed per hour.
 2. Eliminate the following applications:
 - a. Pushing of concrete with vibrator.

- b. External vibration of forms.
 - c. Allowing vibrator to vibrate against reinforcing steel where steel projects into green concrete.
 - d. Allowing vibrator to vibrate contact faces of forms.
 - 3. Vibrators shall function at a minimum frequency of 3600 cycles per minute when submerged in concrete.
 - 4. Supplement vibration by forking and spading along the surfaces of the forms and between reinforcing whenever flow is restricted.
- D. Curing:
- 1. General: Freshly deposited concrete shall be protected from premature drying and excessively hot or cold temperatures and shall be maintained with minimal moisture loss at a relatively constant temperature for the period of time necessary for the hydration of the cement and proper hardening of the concrete.
 - 2. Initial Curing: Initial curing shall immediately follow the finishing operation. Concrete shall be kept continuously moist at least over night. One of the following materials or methods shall be used:
 - a. Ponding or continuous sprinkling.
 - b. Absorptive mat or fabric kept continuously wet.
 - 3. Final Curing: Immediately following the initial curing and before the concrete has dried, additional curing shall be accomplished by one of the following materials or methods:
 - a. Continuing the method used in initial curing. Slabs to receive finish flooring materials to be continuously wet cured for 7 days.
 - b. Waterproof paper conforming to "Specifications for Waterproof Paper for Curing Concrete" (ASTM C171).
 - c. Curing compounds conforming to "Specifications for Liquid Membrane-Forming Compounds for Curing Concrete" (ASTM C309). Such compounds shall be applied in accordance with the recommendations of the manufacturer and shall not be used on any surfaces against which additional concrete or other cementitious finishing materials (such as ceramic tile) are to be bonded, nor on surfaces on which such curing is prohibited by the project specifications.
 - d. Other moisture-retaining coverings as approved.
 - 4. Duration of Curing: The final curing continue until the cumulative number of days or fractions thereof, not necessarily consecutive, during which temperature of the air in contact with the concrete is above 50 degrees F., has totaled 7 days.
 - 5. Formed Surfaces: Steel forms heated by the sun and all wood forms in contact with the concrete during the final curing period shall be kept wet. If forms are to be removed during the curing period, one of the above curing materials or methods shall be employed immediately. Such curing shall be continued for the remainder of the curing period.
- E. Construction Joints
- 1. Joints not shown on the drawing shall be so made and located as to least impair the strength of the structural element and shall be approved by the Owner and Structural Engineer.
 - 2. The surfaces of all concrete at all joints shall be thoroughly cleaned and all laitance removed by sandblasting.

3. Concrete surfaces at designated joints shall be roughened to 1/4" relief with rotohammer or similar method.
 4. Moisten all joints immediately prior to placement of concrete.
- F. Embedded Items:
1. All sleeves, inserts, anchors and embedded items required for adjoining work or for its support shall be placed prior to concreting. Embedded items shall be positioned accurately and supported against displacement. Voids in sleeves, inserts and anchor bolt slots shall be filled temporarily with a readily removable material to prevent entry of concrete into the voids.
- G. Grouting Column Bases:
1. The grout shall be mixed and placed in strict accordance with manufacturer's instructions.
 2. Care shall be taken in the grouting to insure that there is full bearing between the base plates and the grout.
- 3.4 DEFECTIVE WORK:
- A. Work considered to be defective may be ordered to be replaced, in which case the Contractor shall remove the defective work at his expense. Work considered to be defective shall include, but not be limited to, the following:
1. Concrete in which defective or inadequate reinforcing steel has been placed.
 2. Concrete incorrectly formed, or not conforming to details and dimensions on the drawings or with the intent of these documents, or concrete the surfaces of which are out of plumb or level.
 3. Concrete below specified strength.
 4. Concrete containing wood, cloth or other foreign matter, rock pockets, voids, honeycombs, cracks or cold joints not scheduled or indicated on the drawings.
- 3.5 CORRECTION OF DEFECTIVE WORK
- A. The Contractor shall, at his expense, make all such corrections as directed by the engineer.
- B. Concrete work containing rock pockets, voids, honeycombs, cracks or cold joints not scheduled or indicated on the drawings shall be chipped out until all unconsolidated material is removed.

**SECTION 03 30 00
CAST-IN-PLACE CONCRETE
END OF SECTION**

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section Includes: Provisions for cold-formed steel framing. Work includes, but is not necessarily limited to the following:
 - 1. Interior non-load bearing wall framing.
 - 2. Exterior non-load bearing wall framing.
 - 3. Soffit framing.
 - 4. Framing accessories.
- B. Related Sections:
 - 1. Section 092300 - Gypsum Board Systems

1.2 REFERENCES

- A. Requirements of the GENERAL CONDITIONS and DIVISION NO. 1 apply to all Work in this Section.
- B. Published specifications, standards, tests, or recommended methods of trade, industry, or governmental organizations apply to Work of this Section where cited by abbreviations noted below (latest editions apply).
 - 1. American Society for Testing and Materials (ASTM).
 - 2. Federal Specifications (FS).
 - 3. American Iron and Steel Institute (AISI): "S100 – North American Specification for the Design of Cold-Formed Steel Structural Members".
 - 4. Metal Lath Association (MLA): "Specifications for Metal Lath and Furring".
 - 5. Steel Structures Painting Council (SSPC): "Painting Manual".
 - 6. Oregon Structural Specialty Code (OSSC)

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Comply with fire-resistance ratings as indicated and as required by governing authorities and codes.
 - 2. Provide materials, accessories, and application procedures which have been listed by an approved testing agency or tested according to ASTM E119 for the type of construction shown.

- 3. Comply with requirements of OSSC Section 2210 for design and identification of cold-formed steel.
- 4. Cold-formed steel framing products shall have a current ICC-ES evaluation report where applicable.
- B. Steel stud system shall conform to referenced AISI documents.
- C. Installer: Company specializing in performing the work of this Section with minimum 3 years documented experience.

1.4 SUBMITTALS

- A. Submit in accordance with provisions of Section 013300, "Submittals".
- B. Product Data: Manufacturer's ICC-ES report, specifications and installation instructions for steel studs, fasteners, and accessories.
- C. Experience of installer if requested by Architect.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Procedures: In accordance with Section 016000, "Materials and Equipment".
- B. Protect framing from rusting and damage.
- C. Deliver in manufacturer's unopened containers or bundles fully identified with name, brand, type and grade.
- D. Store inside a dry, ventilated space, and protect framing from rust and damage.

1.6 JOB CONDITIONS

- A. Coordinate stud sizes and layouts with the work of the various trades. Where ductwork, conduit, piping, casework, and other such items exceed indicated available space, increase stud sizes or make other minor modifications as necessary to accommodate the work at no change in cost of the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Angeles Metal Systems, Western Metal Systems, or equal product substituted per Section 016200.

2.2 MATERIALS

- A. Sheet Steel: Structural framing members shall conform to ASTM A1003 and shall be manufactured from ASTM A653 galvanized steel. Minimum yield strength shall be as indicated on the structural drawings.
- B. Studs and Tracks:

1. 54 mil and heavier: AS I M A653 SS, 50 ksi minimum yield.
 2. 43 mil and lighter: ASTM A653 SS, 33 ksi minimum yield.
 3. Members shall have a minimum G60 galvanized coating unless noted otherwise.
 4. Cee section studs are to have a punched web, unless otherwise noted.
- C. Cold-Rolled Furring Channels: As specified in Section 09 22 00, "Metal Support Systems".
- D. Low-Velocity Fasteners:
1. Tempered-steel pins with special corrosive-resistant plating or coating. Hilti 0.157-in diameter X-U, or approved equal, installed in accordance with the manufacturer's current ICC-ES evaluation report.
 2. Pins shall have guide washers to accurately control penetration, minimum 1-1/4 inch.
 3. Fastening shall be accomplished by low-velocity, piston-driven, powder-actuated tool.
- E. Touch-up Primer for Galvanized Surfaces: SSPC Paint 20 zinc rich.
- F. Metal Screws: Self-drilling and self-tapping; No. 8 pan head and larger as noted on Drawings.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate details and requirements of other Work which adjoins or fastens to studs and requires backing or special support framing included in this Section.
1. Items requiring backing or support include, but are not necessarily limited to casework, wall-specialties, and similar items.
 2. Obtain Architect's approval of backing method proposed to satisfy requirements of this Section which differs from methods noted or shown.

3.2 EXAMINATION

- A. Examine all parts of the supporting structure and the conditions under which studs will be installed.
- B. Notify the Architect, in writing, of any conditions detrimental to the proper and timely completion of the Work.
- C. Do not proceed with the installation of steel studs until unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. Tracks shall be securely anchored to supporting structure, with fasteners specified at not more than 24 inches on center, or as indicated in the Contract Drawings.

- B. Complete, uniform, and level bearing support shall be provided for the bottom track at each bearing/stud location. Install full metal shims below bottom track at stud locations as needed, or set bottom track in high-strength grout.
- C. Abutting or intersecting pieces of track shall be securely anchored to a common structural element or spliced together.
 - 1. Do not splice studs.
- D. Studs shall sit squarely in the top and bottom runner track with firm abutment against track webs.
 - 1. Studs shall be aligned or plumbed and securely fastened to the flanges of both top and bottom track.
- E. Framed wall openings shall include a header and multiple studs at each edge of opening as indicated on Drawings.
- F. Form corners and intersections of partitions with three studs. Provide additional studs as indicated or required.
- G. Do not cut or notch stud flanges or cut additional opening in stud web.
- H. Tolerance: Install members to provide surface plane with maximum variation of 1/4 inch in 10 feet in any direction.

3.4 INSTALLATION OF FIRE-RATED ASSEMBLIES

- A. Install studs which are components of fire-rated wall assemblies as indicated.

3.5 BACKING IN STUD PARTITIONS

- A. Securely fasten cut sections of unpunched stud or 2x wood blocking to the stud framing with screws to provide backing as indicated on the architectural drawings.
- B. Verify that any predrilling of backing and attachment of spacers to prevent crushing of collateral material is done prior to application of collateral material.
- C. If it is determined by the Architect that backing was not provided for any items as required, the Contractor shall remove the finish material and install backing. The Contractor shall patch and refinish surface to match adjacent area and finish.

END OF SECTION

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire retardant treated wood materials.
- B. Concealed wood blocking, nailers, and supports.

1.02 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- B. AWPA U1 - Use Category System: User Specification for Treated Wood; 2025.
- C. ITS (DIR) - Directory of Listed Products; Current Edition.
- D. PS 20 - American Softwood Lumber Standard; 2025.
- E. UL (DIR) - Online Certifications Directory; Current Edition.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
 - 2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

2.02 FIRE-RETARDANT TREATMENT (FRT)

- A. Factory-treat wood members in accordance with AWPA U1 and use category indicated.
- B. Kiln-dry after treatment (KDAT) to maximum moisture content of 19 percent for sawn material and 15 percent for plywood.
- C. Fabrication of FRT Wood:
 - 1. Ripping or milling of boards, lumber, and timber after treatment is not permitted.
 - 2. Field cutting to length and drilling of holes in boards, lumber, and timber are permitted without additional treatment.
 - 3. Field cutting and drilling of holes in plywood are permitted.
- D. Label or brand FRT wood with classification mark of UL (DIR) or ITS (DIR) or other approved inspection agency, the treatment plant, name of treatment, species of wood, flame spread and smoke developed index, method of drying after treatment, and treating standard.

2.03 ACCESSORIES

- A. Metal and Finish of Fasteners:
 - 1. Fire-Retardant-Treated Wood:
 - a. Nails, timber rivets, wood screws, and lag screws: Hot-dip galvanized steel complying with ASTM A153/A153M Class D.
 - 2. Untreated Wood: Unfinished steel.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

3.02 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to authorities having jurisdiction may be used in lieu of solid wood blocking.
- C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.

3.04 CLEANING

- A. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.
- B. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 06 41 00 - ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wood casework with transparent finish (Custom wood finished doors).
- B. Wood casework with laminate cladding (See drawings for configuration and material locations).
- C. Shop finishing.
- D. Cabinet and drawer hardware.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry.
- B. Section 12 36 00 - Countertops.

1.03 ABBREVIATIONS AND ACRONYMS

- A. AWI: Architectural Woodwork Institute.
- B. HPDL: High-pressure decorative laminate.
- C. HDF: High-density fiberboard.
- D. WI: Woodwork Institute.

1.04 REFERENCE STANDARDS

- A. ANSI A135.4 - Basic Hardboard; 2012 (Reaffirmed 2020).
- B. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications; 2022.
- C. ANSI/AWI 0400 - Factory Finishing; 2022.
- D. ANSI/AWI 0620 - Finish Carpentry/Installation; 2024.
- E. ANSI/AWI 0641 - Architectural Wood Casework; 2019.
- F. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.
- G. BHMA A156.9 - Cabinet Hardware; 2020.
- H. ISO 4586-3 - High-Pressure Decorative Laminates (HPL, HPDL) – Sheets Based on Thermosetting Resins (Usually Called Laminates) – Part 3: Classification and Specifications for Laminates Less than 2 mm Thick and Intended for Bonding to Supporting Substrates; 2018.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate schedule of climate-controlled rooms with schedule of storage of wood and wood-based materials requiring climate-controlled environments.
 - 2. Coordinate work of this section with installation of wood blocking, wood backing, metal strapping, and other anchorage that provides casework backing and structural support.
 - 3. Coordinate work of this section with rough-in electrical integrally-related with casework.

1.06 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. WI Quality Certification Submittal Requirements: Comply with AWMAC/WI (NAAWS)
- C. Product Data: Submit manufacturer's published, product descriptive data.
 - 1. HPDL Laminates: For each type, indicate description, thickness, and color.
 - 2. Hardware: For each type of cabinet and drawer hardware.
- D. Shop Drawings:
 - 1. General: Each sheet sequentially numbered and dated.
 - a. Sheet Size: 24 by 36 inches.
 - b. Contents: Indicate project name and project address.

2. WI Quality Certification Programs Requirements for Shop Drawings:
 - a. Comply with AWMAC/WI (NAAWS).
 3. Plans and Elevations: Plan and elevation views of each assembly type.
 - a. Drawing Scale: 3/8 inch = 1 foot, minimum.
 4. Detailed Section: Dimensioned section views of each casework configuration.
 - a. Drawing Scale: 1-1/2 inch = 1 foot, minimum.
 5. Details: Dimensioned casework assembly details with material thicknesses.
 - a. Drawing Scale: 3 inches = 1 foot, minimum.
- E. Samples:
1. WI Quality Certification Requirements for Samples: Comply with AWMAC/WI (NAAWS).
 2. Samples, Laminate-Clad Panels: For each laminate-clad type, submit two, laminate-clad sample panels; size: 8 by 8 inches; thickness: 3/4 inch.
 3. Samples for Initial Selection:
 - a. PVC Edgebanding: For each edgebanding type, submit one manufacturer's standard palettes, indicating full range of colors.
 4. Samples, Laminates: For each laminate type, submit two samples for each specified color.
- F. Certificates, WI Certification of Products: Before product delivery to site, provide three Woodwork Institute Certified Compliance Certificates indicating products to be delivered meet requirements of AWMAC/WI (NAAWS) for grades specified.
- G. Fabricator's Instructions: Provide fabricator's installation instructions for shop-fabricated units.
- H. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.

1.07 QUALITY ASSURANCE

- A. Fabricator/Installer Qualifications: Firm specializing in fabricating and installing products specified in this section with minimum five years of documented experience; with qualifications indicating ability to comply with requirements of this section.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Store products prior to installation on flat, level, clean surfaces; elevate products above floors and protect from sunlight.
- B. Relative Humidity Conditions for Storing Wood and Wood-Based Core Products:
1. Maintain relative humidity between 25 and 45 percent.
- C. Store non-wood-based products under cover and elevated above grade.
- D. For products other than wood and wood-based products, store and handle in accordance with fabricator's documented instructions.
- E. Handle materials and products to prevent damage to edges, ends, or surfaces.

1.09 FIELD CONDITIONS

- A. Ambient Conditions for Acclimation, Installation, and Post-Installation of Wood-Based Products:

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. EGGER: www.egger.com/#sle.
- B. PoliLam: www.polilam.com/#sle.
- C. Formica Corporation: www.formica.com/#sle.
- D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ARCHITECTURAL WOOD CASEWORK

- A. Casework Finish: Wood casework with laminate cladding.

- B. Provide casework and casework components in sizes and profiles as indicated on drawings.
 - 1. Interior Clearances: Comply with specified performance requirements.

2.03 PERFORMANCE REQUIREMENTS

- A. Woodwork Institute (WI) Performance Requirements:
 - 1. Comply with AWMAC/WI (NAAWS) general casework requirements, specified architectural wood casework finish or cladding type, and for specified grade indicated below.
 - 2. Grade: Premium.

2.04 WOOD CASEWORK WITH LAMINATE CLADDING

- A. Casework Construction:
 - 1. As indicated on drawings.
- B. Premium Grade - Laminate-Clad Wood Casework:
 - 1. Exposed Exterior Surfaces, Panels to Receive Laminate Cladding:
 - a. HPDL Panels; Surface Finish: As indicated on drawings.
 - 2. Exposed Interior Door Front Surfaces:
 - a. Same laminate materials and thicknesses as exposed exterior surfaces.
 - 1) Color to match color of semi-exposed surfaces.
 - 3. Exposed Interior Surfaces Except at Door Front Surfaces:
 - a. HPDL Panels: As indicated on drawings.
 - 4. Semi-Exposed Surfaces:
 - a. Fabricator's Option:
 - 1) HPDL Panels; Surface Finish: As indicated on drawings.
 - 2) TFL Panels; Surface Finish: As indicated on drawings.

2.05 EDGE TREATMENT APPLICATIONS

- A. Top Edges of Cabinets:
 - 1. Comply with specified performance requirements.
- B. Hinged Door Edges:
 - 1. Provide edgebanding on all four edges except for solid wood doors. See Drawings for details.

2.06 SOLID WOOD COMPONENTS

- A. Description: Components fabricated from solid wood; types include profiled units.
- B. Comply with specified performance requirements.

2.07 HPDL-CLAD PANELS

- A. Description: Panels consisting of High-Pressure Decorative Laminate (HPDL) faces applied to cores; panel layup with face ply, back ply, and core of either single ply or odd number of inner plies, to produce balanced construction panel.
 - 1. Panels subject to size limitations, minimum thickness requirements, and fabrication tolerances of specified grade in accordance with AWMAC/WI (NAAWS) requirements including successful casework integrity testing.
- B. HPDL Laminates Less than 0.08 inch Thick: Comply with ISO 4586-3.
 - 1. Horizontal Grades:
 - a. HPDL HGS.
 - 2. Vertical Grades:
 - a. HPDL VGS.
 - 3. Exposed Backer Materials:
 - a. Same materials, thickness and color as laminate face.
 - 4. Concealed Backer Materials:
 - a. Laminate materials as required for balanced construction panel and recommended by laminate manufacturer for application.

- 5. Products:
 - a. Formica Corporation: www.formica.com/#sle.
 - b. Wilsonart LLC: www.wilsonart.com/#sle.
- C. Panel Cores:
 - 1. Medium Density Fiberboard Core (MDF).
 - 2. Hardboard (HDF).

2.08 PANEL CORES

- A. Medium Density Fiberboard (MDF):
 - 1. Description: Composite panel composed of cellulosic fibers, additives, and bonding system cured under heat and pressure; comply with ANSI A208.2.
 - 2. Grade and Thickness: As required to meet performance requirements.
- B. Hardboard (HDF):
 - 1. Description: Panels manufactured from inter-felted lignocellulosic fibers consolidated under heat and pressure to 31 pcf density or greater; comply with ANSI A135.4.
 - 2. Surfaces: Smooth two sides (S2S).
 - 3. Class and Thickness: As required to meet specified performance requirements applications.

2.09 CONCEALED CABINET BASE COMPONENTS

- A. Cabinet Base Toe-Kick Subfronts:
 - 1. Materials and Size: Fabricator's choice subject to requirements of ANSI/AWI 0641.
- B. Cabinet Base Blocking and Stretchers:
 - 1. Materials and Size: Fabricator's choice subject to requirements of ANSI/AWI 0641.
- C. Cabinet Base Sleepers:
 - 1. Materials and Size: Fabricator's choice subject to requirements of ANSI/AWI 0641.

2.10 WOOD AND WOOD-BASED MATERIALS

- A. AWMAC/WI (NAAWS) Wood Moisture Content Requirements:
 - 1. Most of US and Canada: Between 5 and 10 percent.
- B. AWMAC/WI (NAAWS) General Requirements for Wood:
 - 1. Comply with AWMAC/WI (NAAWS) and with specified performance requirements.

2.11 CABINET AND DRAWER HARDWARE

- A. Hinges, Number of Hinges for Each Cabinet Door:
 - 1. Comply with specified performance requirements.
- B. Hinges, Self-Closing, Integrated Damper Hinges:
 - 1. Description: Self-closing hinges with integrated damper mechanisms.
 - 2. Features: Provide soft-closing integrated damper hinges.
 - 3. Opening Range: Between 115 to 150 to degrees.
- C. Cabinet Latches:
 - 1. Description: Fastening devices with holding capacities that keep cabinet doors closed until specific actions release doors for opening; provide remote door release mechanism.

2.12 CASEWORK ACCESSORY COMPONENTS

- A. Edgebanding: PVC, flat, matte finish; width to match component thickness.
 - 1. Color: As selected by Architect from manufacturers' standard range.
- B. Glass and Glazing Applications:
- C. Grommets: Plastic, with matching slotted caps; round.
 - 1. Applications: Where indicated on drawings.
 - 2. Shape: Round.
 - 3. Inside Diameter: 3 inches.

4. Color: White.

2.13 FABRICATION

- A. Shop-fabricate casework to dimensions, profiles, and details indicated on drawings.
- B. Fabricate to maximum extents plausible, including doors and hardware; fabricate units in sizes transportable through building openings.
- C. Wood Casework with Laminate Cladding: Apply laminates in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline.
- D. Edgebanding: Apply where specified; do not use more than one piece for any single length.
- E. Hardware: Install hardware in accordance with hardware manufacturer's written instructions; use fasteners supplied by hardware manufacturer.
- F. WI Certified Compliance Labels: Indicate compliance with WI Certified Compliance Program by applying WI Certified Compliance Labels on each casework elevation.

2.14 SHOP FINISHING

- A. Surface Preparation: Comply with:
- B. Shop Finishing: Shop finish architectural wood casework.
 - 1. Comply with AWMAC/WI (NAAWS) for specified grade.

2.15 SOURCE QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify casework and materials required for installation have been delivered, handled and stored as specified.
- B. Verify location and sizes of rough-in electrical associated with work of this section.

3.02 PREPARATION

- A. Acclimate casework to environments indicated for installation.

3.03 INSTALLATION

- A. Install and secure work of this section in accordance with specified performance requirements.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.

3.05 ADJUSTING

- A. Adjust hardware for smooth operation in accordance with hardware manufacturer's documented instructions.

3.06 CLEANING

- A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.
- B. Clean exposed surfaces of casework and hardware.

3.07 PROTECTION

- A. Protect installed casework from subsequent construction operations.

END OF SECTION

EUGENE AIRPORT
CONCOURSE A PASSENGER BOARDING
BRIDGE UPGRADES
EUGENE, OREGON

SECTION 06 41 00
ARCHITECTURAL WOOD
CASEWORK

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SECTION 07 21 00 - THERMAL INSULATION - ROCKWOOL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Mineral fiber blanket insulation.

1.02 RELATED REQUIREMENTS

- A. Section 05 40 00 - Cold-Formed Metal Framing: Metal stud walls.

1.03 REFERENCE STANDARDS

- A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.
- B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2024.
- C. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).
- D. ASTM C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings; 2025.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.
- F. EN 15804 - Sustainability of Construction Works - Environmental Product Declarations - Core Rules for the Product Category of Construction Products; 2022 (Corrigendum 2021).
- G. ISO 14025 - Environmental Labels and Declarations - Type III Environmental Declarations - Principles and Procedures; 2006.
- H. UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.
- I. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials and accessories in insulation manufacturer's original packaging with identification labels intact and in sizes to suit project.
 - 1. Ensure insulation materials are not exposed to moisture during delivery.
 - 2. Replace wet or damaged insulation materials.
- B. Store materials off ground in dry location and protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer; store in original packaging until installed.
- C. Packaging Waste Management: Remove waste packaging materials from site and dispose of packaging materials at appropriate recycling facilities. Collect and separate for disposal paper and plastic material in appropriate on-site storage containers for recycling.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Thermal Insulation:
 - 1. ROCKWOOL: www.rockwool.com/#sle.
 - 2. Owens Corning.
 - 3. Johns Manville.

2.02 MINERAL FIBER BLANKET INSULATION MATERIALS

- A. Mineral Fiber Blanket Thermal Insulation: Semi-rigid stone wool insulation that is noncombustible; Type 1 in accordance with ASTM C665.
 - 1. Flame Spread Index (FSI): 25 or less, when tested in accordance with ASTM E84 or UL 723.
 - 2. Smoke Developed Index (SDI): 50 or less, when tested in accordance with ASTM E84 or UL 723.
 - 3. Facing: Unfaced.
 - 4. Steel Studs: See Section 05 40 00.
 - a. Blanket Overall Size: 2-1/2 inches thick by 16-1/4 inches wide by 48 inches long, nominal.
 - b. Thermal Resistance: R-value of 10 at 75 degrees F, minimum, when tested in accordance with ASTM C518.
 - 5. Board Edges: Square.
 - 6. Density: Greater than 2 pcf, nominal.
 - 7. Moisture Resistance: Absorption of less than 0.03 percent by weight.
 - 8. Metallic Corrosion Resistance: Noncorrosive/passed, when tested in accordance with ASTM C665 for steel, and ASTM C795 for stress corrosion cracking tendency of austenitic stainless steel.
 - 9. Melting Point: 2,150 degrees F, minimum.
 - 10. Fungi Resistance: Zero mold growth when tested in accordance with ASTM C1338.
 - 11. Environmental Product Declaration (EPD): Material included on UL-certified EPD in accordance with EN 15804 and ISO 14025; see 01 60 00 - Product Requirements for additional information.
 - 12. Low-Emitting VOC Material Certification: Greenguard Gold certified and listed in UL (GGG).
 - 13. Products:
 - a. ROCKWOOL; COMFORTBATT.
 - b. Owens Corning; Termafiber Ultrabatt.
 - c. Johns Manville; TempControl Mineral Wool Batts.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
- B. Verify substrate surfaces are flat, free of honeycombs, fins, or irregularities.

3.02 INSTALLATION

- A. Install insulation in accordance with manufacturer's written installation instructions.
- B. Ensure that insulation installation maintains continuity of thermal protection to building interior spaces.
- C. Do not compress insulation to fit into spaces.

3.03 PROTECTION

- A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 25 00 - WEATHER BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Water-resistive barriers.

1.02 RELATED REQUIREMENTS

- A. Section 07 21 00 - Thermal Insulation: Weather barrier installed in conjunction with batt insulation.

1.03 DEFINITIONS

- A. Weather Barriers: Materials or assemblies forming water-resistive barriers, air barriers, vapor retarders, or combination of one or more assemblies.
- B. Water-Resistive Barriers: Materials or assemblies installed behind exterior wall coverings; designed to prevent liquid water from further penetration into exterior wall assembly.

1.04 REFERENCE STANDARDS

- A. ASTM D779 - Standard Test Method for Determining the Water Vapor Resistance of Sheet Materials in Contact with Liquid Water by the Dry Indicator Method; 2016 (Reapproved 2022).
- B. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

PART 2 PRODUCTS

2.01 WATER-RESISTIVE BARRIERS

- A. Description: Materials installed behind exterior wall coverings; designed to prevent liquid water from further penetration into exterior wall assembly. Primary materials include mechanically applied sheets; accessory materials include flashings and seam tapes.
- B. Water-Resistive Breathable Barrier: Woven, polyolefin fabric sheet in accordance with ASTM D779, 60-minute water resistance.
 - 1. Water Vapor Permeance: 50 perms, minimum, when tested in accordance with ASTM E96/E96M, method B.
 - 2. Air Penetration: 0.004 cfm per sq ft at 75 Pa, when tested in accordance with ASTM E2178. Type I per ASTM E1677.
 - 3. Water Penetration Resistance: 210 cm when tested in accordance with AATCC Test Method 127.
 - 4. Products:
 - a. DuPont Building Innovations; Tyvek StuccoWrap: www.construction.tyvek.com.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ACCESSORIES

- A. Seal and Perimeter Tapes: As recommended by water-resistive barrier manufacturer.
- B. Flashings and Sealants: As recommended by water-resistive barrier manufacturer for application.
- C. Building Insulation: See Section 07 21 00.

2.03 FASTENERS

- A. Air- and Moisture-Sealing Insulation Fasteners: Preassembled fastener units consisting of sealing washer, screw, and gasketing tube.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces and conditions comply with requirements of this section.

3.02 PREPARATION

- A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

3.03 INSTALLATION

- A. Install materials in accordance with manufacturer's installation instructions.
- B. Install continuous water-resistive barriers where indicated on drawings, with sheets lapped to shed water.
- C. Mechanically Fastened Sheets:
 - 1. Install sheets in shingle fashion to shed water; align horizontally.
 - 2. Overlap seams as recommended by manufacturer, 6 inches, minimum.
 - 3. Overlap at outside and inside corners as recommended by manufacturer, 12 inches, minimum.
 - 4. Install water-resistive barrier over jamb flashings.
 - 5. Install head flashings under water-resistive barrier.
 - 6. At framed openings with frames having nailing flanges, extend sheet into opening and over flanges; at head of opening, seal sheet over flange and flashing.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Owner's Inspection and Testing: Cooperate with Owner's testing agency.
 - 1. Allow access to work areas and staging.
 - 2. Notify Owner's testing agency in writing of schedule for work of this section to allow sufficient time for testing and inspection.
 - 3. Do not cover work of this section until testing and inspection is accepted.
- C. Do not cover installed water-resistive barriers until required inspections have been completed.

3.05 PROTECTION

- A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

SECTION 07 26 00 - VAPOR RETARDERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Vapor retarders.

1.02 RELATED REQUIREMENTS

1.03 DEFINITIONS

- A. Vapor Retarder: Airtight barrier made of material that is relatively water vapor impermeable, to degree specified, with seams and joints sealed to adjacent surfaces.
- B. Vapor Retarder Class: A measure of a material or assembly's ability to limit the amount of moisture that passes through that material or assembly. Vapor retarder class is defined using Procedure A, Desiccant Method at 73 degrees F and 50 percent Relative Humidity (RH), in accordance with ASTM E96/E96M and ICC (IBC)-2018, as follows:
 - 1. Class I: 0.1 perm or less.
 - 2. Class II: Greater than 0.1 perm to 1.0 perm.
 - 3. Class III: Greater than 1.0 perm to 10 perms.

1.04 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.
- B. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.
- C. ICC (IBC)-2018 - International Building Code; 2018.

PART 2 PRODUCTS

2.01 VAPOR RETARDERS

- A. Vapor Retarder Sheet: Polyamide nylon sheet intended for use with unfaced, vapor-permeable insulation such as fiberglass and mineral wool in wall and ceiling cavities.
 - 1. Thickness: 2 mil, 0.002 inch.
 - 2. Water Vapor Permeance: 1.0 perm, maximum, when tested in accordance with ASTM E96/E96M using Desiccant Method.
 - 3. Surface Burning Characteristics: Smoke developed index of 450 or less, and flame spread index of 25 or less, Class A, when tested in accordance with ASTM E84.
 - 4. Seam Lap and Perimeter Adhesive: Provide manufacturer's recommended method using either tape or sealants.

2.02 ACCESSORIES

- A. Sealants, Tapes, and Accessories for Sealing Vapor Retarder and Adjacent Substrates: As indicated, complying with vapor retarder manufacturer's installation instructions.
- B. Vapor Retarder Tape: Coated polyester film with acrylic adhesive backing; pressure sensitive.
 - 1. Products:
 - a. Henry, a Carlisle Company; Henry Sheathing Tape: www.henry.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Sheet Membrane Mounting Tape: Double-sided strip of pressure-sensitive tape, acrylic adhesive reinforced with embedded fiber-strand carrier layer and plastic backing.
 - 1. Width: 3/4 inch.
 - 2. Roll Length: 164 feet.
 - 3. Thickness: 14 mil, 0.014 inch.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install materials in accordance with manufacturer's installation instructions.
- B. Vapor Retarders: Install continuous airtight barrier over surfaces indicated, with sealed seams and sealed joints to adjacent surfaces.
- C. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's installation instructions.
- D. Mechanically Fastened Sheets - Vapor Retarder On Interior:
 - 1. When insulation is installed within assembly, install vapor retarder over insulation.
 - 2. Anchor to metal framing using seam tape, adhering at least one-half of tape width to metal substrate.
 - 3. Seal seams, laps, perimeter edges, penetrations, tears, and cuts with self-adhesive tape, providing an airtight seal.
 - 4. Locate laps at framing members; at laps fasten one sheet to framing member then tape overlapping sheet to first sheet in shingle fashion to shed water.
 - 5. Seal entire perimeter to structure, window and door frames, and other penetrations.
 - 6. Where conduits, pipes, wires, ducts, outlet boxes, and other items are installed within insulation cavity, pass vapor retarder sheet behind these items and over insulation to maintain airtight seal.
- E. Openings and Penetrations in Exterior Vapor Retarders:
 - 1. At openings with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches wide; do not seal sill flange.
 - 2. At openings with nonflanged frames, seal vapor retarder to each side of framing at opening using flashing at least 9 inches wide, and covering entire depth of framing.
 - 3. At head of openings, install flashing under vapor retarder extending at least 2 inches beyond face of jambs; seal vapor retarder to flashing.
 - 4. At interior face of openings, seal gaps between window/door frame and rough framing using appropriate joint sealant over backer rod.
 - 5. Service and Other Penetrations: Form flashing around penetrating items and seal to surface of vapor retarder.

3.02 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Owner's Inspection and Testing: Cooperate with Owner's testing agency.
 - 1. Allow access to work areas and staging.
 - 2. Notify Owner's testing agency in writing of schedule for work of this section to allow sufficient time for testing and inspection.
 - 3. Do not cover work of this section until testing and inspection is accepted.

3.03 PROTECTION

- A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

SECTION 07 92 00 - JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nonsag gunnable joint sealants.

1.02 REFERENCE STANDARDS

- A. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).
- B. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2025.
- C. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2022.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:
 - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
 - 2. List of backing materials approved for use with the specific product.
 - 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 - 4. Substrates the product should not be used on.
- C. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.
- D. Executed warranty.

1.04 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide 2-year manufacturer warranty for installed sealants and accessories that fail to achieve a watertight seal, exhibit loss of adhesion or cohesion, or do not cure. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Nonsag Sealants:
 - 1. Dow: www.dow.com/#sle.
 - 2. Henry, a Carlisle Company: www.henry.com/#sle.
 - 3. Pecora Corporation: www.pecora.com/#sle.
 - 4. Sika Corporation: usa.sika.com/#sle.
 - 5. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.

2.02 JOINT SEALANT APPLICATIONS

- A. Scope:
 - 1. Exterior Joints:
 - a. Seal open joints except open joints indicated on drawings as not sealed.
 - 2. Interior Joints:
 - a. Seal the following joints:
 - 1) Joints between door frames and adjacent construction.
- B. Exterior Joints: Use nonsag nonstaining silicone sealant, unless otherwise indicated.
- C. Interior Joints: Use nonsag polyurethane sealant, unless otherwise indicated.

2.03 JOINT SEALANTS - GENERAL

2.04 NONSAG JOINT SEALANTS

- A. Nonstaining Silicone Sealant: ASTM C920, Grade NS, Uses O; not expected to withstand continuous water immersion or traffic.
 - 1. Movement Capability: Plus and minus 25 percent, minimum.
 - 2. Nonstaining to Porous Stone: Nonstaining to light-colored natural stone when tested in accordance with ASTM C1248.
 - 3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
 - 4. Color: To be selected by Architect from manufacturer's standard range.
- B. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
 - 1. Movement Capability: Plus and minus 12.5 percent, minimum.
 - 2. Color: Match adjacent finished surfaces.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.

3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.03 INSTALLATION

- A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Provide joint sealant installations complying with ASTM C1193.
- C. Install bond breaker backing tape where backer rod cannot be used.
- D. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- E. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- F. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.
- C. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

END OF SECTION

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-fire-rated hollow metal doors and frames.
- B. Thermally insulated hollow metal doors with frames.

1.02 RELATED REQUIREMENTS

- A. Section 08 71 00 - Door Hardware.
- B. Section 09 91 23 - Interior Painting.

1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2026.
- C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2023.
- D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2025.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.
- F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2026.
- G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2025.
- H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.
- I. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- J. NAAMM HMMA 840 - Guide Specifications for Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2024.
- K. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.
- L. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2026.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
- D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

1.05 QUALITY ASSURANCE

- A. Maintain at project site copies of reference standards relating to installation of products specified.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Hollow Metal Doors and Frames:
 - 1. Deansteel Manufacturing Company, Inc; Hollow Metal Doors - SP Series: www.deansteel.com/#sle.
 - 2. Krieger Specialty Products; _____: www.kriegerproducts.com/#sle.
 - 3. Titan Metal Products, Inc; Builders Series 20 - 90 Minute Doors: www.titanmetalproducts.com/#sle.

2.02 PERFORMANCE REQUIREMENTS

- A. Requirements for Hollow Metal Doors and Frames:
 - 1. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
 - 2. Accessibility: Comply with ICC A117.1 and ADA Standards.
 - 3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
 - 4. Door Edge Profile: Manufacturers standard for application indicated.
 - 5. Typical Door Face Sheets: Flush.
- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

- A. Door Finish: Factory primed and field finished.
- B. Exterior Doors: Thermally insulated.
 - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 4 - Maximum-duty.
 - b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 - Full Flush.
 - d. Door Face Metal Thickness: 14 gauge, 0.067 inch, minimum.
 - 2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
 - a. Foam Plastic Insulation: Manufacturer's standard board insulation with maximum flame spread index (FSI) of 75, and maximum smoke developed index (SDI) of 450 in accordance with ASTM E84, and completely enclosed within interior of door.
 - 3. Door Thickness: 1-3/4 inches, nominal.
 - 4. Weatherstripping: See Section 08 71 00.

2.04 HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Exterior Door Frames: Full profile/continuously welded type.
 - 1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvanized) in accordance with ASTM A653/A653M, with A40/ZF120 coating.

2. Frame Metal Thickness: 16 gauge, 0.053 inch, minimum.
3. Frame Finish: Factory primed and field finished.
4. Weatherstripping: See Section 08 71 00.

2.05 FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.06 ACCESSORIES

- A. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.
- B. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 INSTALLATION

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Coordinate frame anchor placement with wall construction.
- C. Install door hardware as specified in Section 08 71 00.

3.03 TOLERANCES

- A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.
- B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.04 ADJUSTING

- A. Adjust for smooth and balanced door movement.

END OF SECTION

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SECTION 08 11 13
HOLLOW METAL DOORS AND
FRAMES

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SECTION 08 71 00 - DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Hardware for hollow metal doors.
- B. Electrically operated and controlled hardware.
- C. Thresholds.
- D. Weatherstripping and gasketing.

1.02 RELATED REQUIREMENTS

- A. Section 08 11 13 - Hollow Metal Doors and Frames.
- B. Section 28 13 00 - Access Control : Electronic access control devices and other security requirements.

1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. BHMA A156.1 - Standard for Butts and Hinges; 2025.
- C. BHMA A156.16 - Standard for Auxiliary Hardware; 2023.
- D. BHMA A156.18 - Standard for Materials and Finishes; 2020.
- E. BHMA A156.21 - Thresholds; 2025.
- F. BHMA A156.22 - Standard for Gasketing; 2021.
- G. BHMA A156.23 - Electromagnetic Locks; 2022.
- H. BHMA A156.24 - Delayed Egress Locking Systems; 2022.
- I. BHMA A156.26 - Standard for Continuous Hinges; 2025.
- J. BHMA A156.31 - Electric Strikes and Frame Mounted Actuators; 2024.
- K. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames; 2016.
- L. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- M. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- N. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.
- C. Shop Drawings - Door Hardware Schedule: Submit detailed listing that includes each item of hardware to be installed on each door. Use door numbering scheme as included in Contract Documents.
 - 1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
 - 2. Provide complete description for each door listed.
 - 3. Provide manufacturer name, product names, and catalog numbers; include functions, types, styles, sizes and finishes of each item.

- D. Shop Drawings - Electrified Door Hardware: Submit diagrams for power, signal, and control wiring for electrified door hardware that include details of interface with building safety and security systems. Provide elevations and diagrams for each electrified door opening as follows:
 - 1. Elevations: Submit front and back elevations of each door opening showing electrified devices with connections installed and an operations narrative describing how opening operates from either side at any given time.
 - 2. Diagrams: Submit point-to-point wiring diagram that shows each device in door opening system with related colored wire connections to each device.
- E. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
- F. Manufacturer's qualification statement.
- G. Specimen warranty.
- H. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer's Warranty: Provide warranty against defects in material and workmanship for period indicated. Complete forms in Owner's name and register with manufacturer.
 - 1. Locksets and Cylinders: Three years, minimum.
 - 2. Other Hardware: Two years, minimum.

PART 2 PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

- A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.
- B. Provide individual items of single type, of same model, and by same manufacturer.
- C. Provide door hardware products that comply with the following requirements:
 - 1. Applicable provisions of federal, state, and local codes.
 - 2. Accessibility: ADA Standards and ICC A117.1.
 - 3. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
 - 4. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified.
- D. Electrically Operated and/or Controlled Hardware: Provide necessary power supplies, power transfer hinges, relays, and interfaces as required for proper operation; provide wiring between hardware and control components and to building power connection in compliance with NFPA 70.
 - 1. See Section 28 10 00 for additional access control system requirements.
- E. Fasteners:
 - 1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
 - a. Aluminum fasteners are not permitted.
 - b. Provide phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.

2. Provide machine screws for attachment to reinforced hollow metal and aluminum frames.
 - a. Self-drilling (Tek) type screws are not permitted.

2.02 HINGES

- A. Hinges: Comply with BHMA A156.1, Grade 1.
 1. Continuous Hinges: Comply with BHMA A156.26.

2.03 ELECTRIC STRIKES

- A. Manufacturers:
 1. Adams Rite, HES, or Securitron; an Assa Abloy Group company: www.assaabloydss.com/#sle.
 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Electric Strikes: Comply with BHMA A156.31, Grade 1.
 1. Provide UL (DIR) listed burglary-resistant electric strike; style to suit locks.
 2. Provide non-handed 24 VDC electric strike suitable for door frame material and scheduled lock configuration.
 3. Provide transformer and rectifier as necessary for complete installation.
 4. Connect electric strikes into fire alarm where non-rated doors are scheduled to release with fire or sprinkler alarm condition.

2.04 ELECTROMAGNETIC LOCKS

- A. Electromagnetic Locks: Comply with BHMA A156.23, Grade 1.
 1. Holding Force: 300 lbs, minimum.
 2. Voltage: 12 VDC, and provide power supplies by same manufacturer as locks.
 3. Mounting: Surface mounted to door and frame on secure side, with fasteners, brackets, and spacer bars as required for application.
 4. See Security/IT drawings for additional requirements.

2.05 DELAYED-EGRESS ELECTROMAGNETIC LOCKS

- A. Delayed-Egress Electromagnetic Locks: Comply with BHMA A156.24, Grade 1.
 1. Holding Force: 600 lbs, minimum.
 2. Voltage: 12 VDC, and provide power supplies by same manufacturer as locks.
 3. Mounting: Surface mounted to door and frame on secure side, with fasteners, brackets, and spacer bars as required for application.

2.06 DOOR HOLDERS

- A. Door Holders: Comply with BHMA A156.16, Grade 1.
 1. Type: Lever, or kick down stop, with rubber bumper at bottom end.
 2. Material: Aluminum.

2.07 FLOOR STOPS

- A. Floor Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
 1. Type: Manual hold-open, with pencil floor stop.
 2. Material: Aluminum housing with rubber insert.

2.08 THRESHOLDS

- A. Thresholds: Comply with BHMA A156.21.
 1. Provide threshold at each exterior door, unless otherwise indicated.
 2. Type: Flat surface.
 3. Material: Aluminum.
 4. Threshold Surface: Fluted horizontal grooves across full width.
 5. Field cut threshold to profile of frame and width of door sill for tight fit.
 6. Provide non-corroding fasteners at exterior locations.

2.09 WEATHERSTRIPPING AND GASKETING

- A. Weatherstripping and Gasketing: Comply with BHMA A156.22.
 - 1. Head and Jamb Type: Adjustable.
 - 2. Door Sweep Type: Encased in retainer.
 - 3. Material: Aluminum, with brush weatherstripping.

2.10 SILENCERS

- A. Silencers: Provide at equal locations on door frame to mute sound of door's impact upon closing.
 - 1. Single Door: Provide three on strike jamb of frame.
 - 2. Material: Rubber, gray color.

2.11 FINISHES

- A. Finishes: Provide door hardware of same finish, unless otherwise indicated.
 - 1. Primary Finish: 630; satin stainless steel, with stainless steel 300 series base material (former US equivalent US32D); BHMA A156.18.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.
- B. Verify that electric power is available to power operated devices and of correct characteristics.

3.02 INSTALLATION

- A. Install hardware in accordance with manufacturer's instructions and applicable codes.
- B. Use templates provided by hardware item manufacturer.
- C. Do not install surface mounted items until application of finishes to substrate are fully completed.
- D. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list; unless noted otherwise in Door Hardware Schedule or on drawings.
- E. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

3.03 FIELD QUALITY CONTROL

- A. Perform field inspection and testing under provisions of Section 01 40 00 - Quality Requirements.

3.04 ADJUSTING

- A. Adjust work under provisions of Section 01 70 00 - Execution and Closeout Requirements.
- B. Adjust hardware for smooth operation.
- C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.05 CLEANING

- A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.
- B. Clean adjacent surfaces soiled by hardware installation.
- C. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

3.06 PROTECTION

- A. Protect finished Work under provisions of Section 01 70 00 - Execution and Closeout Requirements.

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**SECTION 08 71 00
DOOR HARDWARE**

- B. Do not permit adjacent work to damage hardware or finish.

END OF SECTION

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SECTION 09 21 16 - GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Gypsum wallboard.
- B. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.

1.03 REFERENCE STANDARDS

- A. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing; 2020.
- B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- C. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).
- D. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2025.
- E. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020 (Reapproved 2024).
- F. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.
- G. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2024.
- H. GA-216 - Application and Finishing of Gypsum Panel Products; 2024.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the installation of gypsum board assemblies with size, location, and installation of service utilities.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data:
 - 1. Provide data on gypsum board, accessories, and joint finishing system.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store gypsum products and accessories indoors and keep above freezing. Elevate boards above floor, on nonwicking supports, in accordance with manufacturer's recommendations.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
- B. Seismic Performance: Ceiling systems designed to withstand the effects of earthquake motions in accordance with ASCE 7 for Seismic Design Category D, E, or F and complying with the following:
 - 1. Local authorities having jurisdiction.

2.02 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
 - 1. American Gypsum Company: www.americangypsum.com/#sle.
 - 2. CertainTeed Corporation: www.certainteed.com/#sle.
 - 3. Georgia-Pacific Gypsum: www.gpgypsum.com/#sle.
 - 4. Gold Bond Building Products, LLC provided by National Gypsum Company: www.goldbondbuilding.com/#sle.

5. USG Corporation: www.usg.com/#sle.
6. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 1. Application: Use for vertical surfaces, unless otherwise indicated.
 2. Thickness:
 - a. Multi-Layer Assemblies: Thicknesses as indicated on drawings.
 3. Paper-Faced Products:
 - a. American Gypsum Company; FireBloc Type X Gypsum Wallboard: www.americangypsum.com/#sle.
 - b. CertainTeed Corporation; Type X Drywall: www.certainteed.com/#sle.
 - c. Georgia-Pacific Gypsum; ToughRock Fireguard X: www.gpgypsum.com/#sle.
 - d. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond Fire-Shield Gypsum Board: www.goldbondbuilding.com/#sle.
 - e. USG Corporation; Sheetrock Brand Firecode X Panels 5/8 in. (15.9 mm): www.usg.com/#sle.

2.03 GYPSUM BOARD ACCESSORIES

- A. Finishing Accessories: ASTM C1047, extruded aluminum alloy (6063 T5) or galvanized steel sheet ASTM A924/A924M G90, unless noted otherwise.
 1. Types: As detailed or required for finished appearance.
- B. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

- A. Metal Framing: Install in accordance with ASTM C1007/AISI S220 and manufacturer's instructions.
- B. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
- C. Blocking: Install wood blocking for support of:
 1. Framed openings.

3.03 BOARD INSTALLATION

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
 1. Exception: Tapered edges to receive joint treatment at right angles to framing.
- C. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of nonrated double-layer assemblies, which may be installed by means of adhesive lamination.

3.04 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.05 JOINT TREATMENT

- A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:

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1. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.
- B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 1. Feather coats of joint compound so that camber is maximum 1/32 inch.

3.06 PROTECTION

- A. Protect installed gypsum board assemblies from subsequent construction operations.

END OF SECTION

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SECTION 09 24 00 - CEMENT PLASTERING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Cement plastering.

1.02 RELATED REQUIREMENTS

- A. Section 05 40 00 - Cold-Formed Metal Framing: Structural metal framing for plaster.
- B. Section 07 25 00 - Weather Barriers: Water-resistive barrier.
- C. Section 09 91 23 - Interior Painting.

1.03 REFERENCE STANDARDS

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.
- B. ASTM C926 - Standard Specification for Application of Portland Cement-Based Plaster; 2026.
- C. ASTM C933 - Standard Specification for Welded Wire Lath; 2023.
- D. ASTM C1063 - Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster; 2025a.
- E. ASTM C1861 - Standard Specification for Lathing and Furring Accessories, and Fasteners, for Interior and Exterior Portland Cement-Based Plaster; 2023a.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide data on plaster materials and trim accessories.
- C. Samples:
 - 1. Submit two samples, 12 by 12 inch in size illustrating finish color and texture.
- D. Installer's Qualification Statement.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

1.06 FIELD CONDITIONS

- A. Exterior Plaster Work: Do not apply plaster when substrate or ambient air temperature is 40 degrees F or lower, or when temperature is expected to drop below 40 degrees F within 48 hours of application.

PART 2 PRODUCTS

2.01 CEMENT PLASTER APPLICATIONS

- A. Lath Plaster Base: Metal lath.
 - 1. Plaster Type: Factory prepared plaster mix.
 - 2. Number of Coats: Three.
 - 3. Finish: Acrylic. Match existing adjacent cement plaster finish and texture.

2.02 FACTORY PREPARED CEMENT PLASTER

- A. Exterior Portland cement plaster system made of scratch and brown base coat, leveling coat with reinforcing mesh, and acrylic finish coat; install in accordance with ASTM C926. Select system with finish, thickness and performance to match existing adjacent cement plaster finishes.
 - 1. Provide weather resistive barrier as part of the system, by the same manufacturer.
 - 2. Manufacturer - Basis of Design:
 - a. Sika Corporation; Parex Armourwall 300: www.parex.com/#sle.
 - 3. Other Acceptable Manufacturers:

- a. Dryvit Systems, Inc; Dryvit Stuccoat One-Coat System:
www.dryvit.com/systems/stucco/#sle.
- b. Sika Corporation; LaHabra FastWall 300-W HE:
www.usa.sika.com/en/construction/eifs-stucco.html/#sle.
- c. Sto Corp; Sto Powerwall: www.stocorp.com/#sle.
- d. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 ACCESSORIES

- A. Lath:
 1. Applications:
 - a. Exterior: Used as base to receive cement plaster.
 2. Welded Wire Lath: Prefabricated grid of parallel wires comply with ASTM C933.
 3. Weight: 1.95 lb/sq yd.
 4. Opening Size: 1 by 1-1/2 inches.
- B. Finishing Accessories: Comply with ASTM C1861.
 1. Types: As detailed or required for finished appearance.
 2. Materials: 6063-T5 extruded aluminum alloy and G60 galvanized steel sheet in accordance with ASTM A653/A653M.
 3. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed plaster edges.
 4. Products:
 - a. Same manufacturer as framing materials.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions are acceptable prior to starting this work.
- B. Verify lath is flat, secured to substrate, and joint and surface perimeter accessories are properly in place.

3.02 INSTALLATION

- A. Install lath over sheathing and water-resistive barrier in accordance with ASTM C1063 and manufacturer's instructions. Install drainage material with filter fabric mortar screen facing exterior.

3.03 MIXING

- A. Mix only as much plaster as can be used prior to initial set.
- B. Mix materials dry, to uniform color and consistency, before adding water.
- C. Protect mixtures from frost or freezing temperatures, contamination, and excessive evaporation.

3.04 APPLICATION

- A. Apply plaster in accordance with manufacturer's written instructions and comply with ASTM C926.
- B. Base Coats:
 1. Apply base coat(s) to fully embed lath and to specified thickness.
 2. Follow guidelines in ASTM C926 and manufacturer's written installation instructions for moist curing base coats and application of subsequent coats.
- C. Leveling Coat:
 1. Apply leveling coat to specified thickness.
- D. Finish Coats:
 1. Cement Plaster:
 - a. Apply with sufficient material and pressure to ensure complete coverage of base to specified thickness.

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- b. Apply desired surface texture while mix is still workable.
- 2. Primer and Acrylic Coatings:
 - a. Remove surface contaminants such as dust and dirt without damaging substrate.
 - b. Apply primer in accordance with manufacturer's instructions.
 - c. Apply finish coating in number of coats and to thickness recommended by manufacturer.

3.05 REPAIR

- A. Patching: Remove loose, damaged or defective plaster and replace with plaster of same composition; finish to match surrounding area.

END OF SECTION

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SECTION 09 91 23 - INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
 - 5. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, and lead items.
 - 6. Marble, granite, slate, and other natural stones.
 - 7. Floors, unless specifically indicated.
 - 8. Ceramic and other tiles.
 - 9. Glass.
 - 10. Concealed pipes, ducts, and conduits.

1.02 REFERENCE STANDARDS

- A. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; Current Edition.
- B. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
- C. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).
- D. SSPC-SP 2 - Hand Tool Cleaning; 2024.
- E. SSPC-SP 6/NACE No.3 - Commercial Blast Cleaning; 2006.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
 - 2. MPI product number (e.g., MPI #47).
 - 3. Cross-reference to specified paint system products to be used in project; include description of each system.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

2.01 MANUFACTURERS

- A. Paints:
 - 1. BEHR Paint Company: www.behr.com/#sle.
 - 2. Pittsburgh Paints: www.pittsburghpaints.com/#sle.
 - 3. Sherwin-Williams Company: www.sherwin-williams.com/#sle.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
 - 1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI categories, except as otherwise indicated.
 - 2. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 3. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- C. Colors: As indicated on drawings.

2.03 PAINT SYSTEMS - INTERIOR

- A. Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Walls, including gypsum board.
 - 1. Two top coats and one coat primer.
 - 2. Top Coat(s): High Performance Architectural Interior Latex; MPI 140.
 - a. Products:
 - 1) Sherwin-Williams ProMar 200 HP Series, Satin. (MPI #140)
 - 2) Substitutions: See Section 01 60 00 - Product Requirements
 - 3. Primer: As recommended by top coat manufacturer for specific substrate.
- B. Paint I-OP-MD-DT - Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals and wood:
 - 1. Medium duty applications include doors and door frames.
 - 2. Two top coats and one coat primer.
 - 3. Top Coat(s): Interior Light Industrial Coating, Water Based; MPI #151, 153, or 154.
 - a. Products:
 - 1) Sherwin-Williams Pro Industrial Acrylic Coating, Semi-Gloss. (MPI #153)
 - 2) Substitutions: See Section 01 60 00 - Product Requirements
 - 4. Primer: As recommended by top coat manufacturer for specific substrate.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.
- D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
 - 1. Gypsum Wallboard: 12 percent.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or repair existing paints or finishes that exhibit surface defects.
- D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- E. Seal surfaces that might cause bleed through or staining of topcoat.
- F. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- G. Galvanized Surfaces:
 - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
 - 2. Prepare surface according to SSPC-SP 2.
- H. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.
 - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
 - 3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning in accordance with SSPC-SP 6/NACE No.3. Protect from corrosion until coated.

3.03 APPLICATION

- A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- C. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- D. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- E. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection.

3.05 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

3.07 SCHEDULE - PAINT SYSTEMS

- A. Gypsum Board: Finish surfaces exposed to view, except _____.
 - 1. Interior Walls: I-OP, satin. Match existing adjacent in sheen and color.
- B. Steel Doors and Frames: Finish surfaces exposed to view; MI-OP-MD-DT, semi-gloss.

END OF SECTION

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SECTION 101400 – SIGNS & IDENTIFYING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section describes the fabrication and installation of interior signage scheduled in the drawings. The work includes electrical, lighting and power devices contained within or upon signage, such as lamps, wiring, sockets, etc. Match existing signage except as indicated herein and in the drawings.
- B. Design Requirements: Provide signage that complies with the Americans With Disabilities Act (ADA) Accessibility Guidelines.

1.3 SUBMITTALS

- A. Submittals shall be made in accordance with the requirements of section 01 33 00 Submittal Procedures, except as noted herein.
- B. Product Data:
 - 1. Submit manufacturer's product specifications, anchor details and installation instructions for products used in sign fabrication, including paint products, lighting and electrical devices.
 - 2. Submit qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects identifying project name, address, Designer and Owner.
- C. Shop Drawings:
 - 1. Submit complete shop drawings for fabrication and installation of signs and related work including plans, elevations and details of components and attachments to other work. Indicate materials and profiles of each member, fitting, joinery, finishes, fasteners, anchorages and accessory items.
 - 2. For structural elements, provide engineering to ensure durability and safety. Shop drawings to include details of material thickness, member sizes, internal bracing or frames, anchors, leveling, cuts, connections, camber,

holes and other pertinent data. Indicate welds by standard AWS symbols and show size, length and type of each weld.

3. Provide setting drawings, templates and directions for the installation of anchor bolts and other anchorages to be installed in work described in other sections.
- D. Material & Finish: Submit 3 samples of each sign component material showing finishes, colors and surface textures listed. Submit 1 set of samples each to Designer, Architect, and General Contractor. Component material samples must be approved before completed product samples are fabricated. Each submittal must be labeled with all applicable sign types.
1. Vinyl: All vinyl as indicated on 2/A852. 3" x 3" min sample.
 2. Direct Print Colors: All colors as indicated on 2/A852.
- E. Completed Product Samples: Upon approval of all material & finish samples, submit full-size sample units of completed product for the following sign types. Completed product samples must be approved before fabrication begins on remaining signs. Samples shall be retained by the Owner unless noted otherwise.
1. Sign Type A2: Gate ID, Exterior. Completed sign. Approved product may be installed. Use sign A2-201 for layout.
- F. Sign Layouts: Submit layout to architectural scale large enough to review letterspacing for each sign scheduled.
- G. Maintenance Data: Include cleaning recommendations. Provide information on methods and products for field paint repair and graffiti removal.
- 1.4 CODES, ORDINANCES AND REGULATIONS
- A. The completed installation shall conform to all applicable Federal, State and local codes, ordinances and regulations.
 - B. Obtain all necessary permits and inspections required by the governing authorities having jurisdiction over this work. Include associated fees in initial proposal.
 - C. Furnish to the Architect a certificate of approval from the inspection authority at the completion of the work prior to the application for final payment.
 - D. Where specified materials or methods exceed minimum standards allowed by applicable codes, the more stringent requirement shall apply.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: For each sign form and graphic image process indicated furnish products from manufacturers regularly engaged in work of this magnitude and scope for minimum of five years.
- B. Qualifications for Welding Work: Qualify welding processes and welding operators in accordance with the American Welding Society (AWS) "Standard Qualification Procedure".
- C. Uniformity of Manufacturers: For each sign form and graphic image process indicated furnish products of a single manufacturer.
- D. Fabrication Observation: During pre-construction meeting, discuss construction milestones for fabrication observation, review and approval. Fabricator shall supply review schedule and notify Owner 15 days prior to shop visits, so that the work may be observed prior to delivery to the job site. Photos identified with sign type shall be part of meeting record.
- E. Periodic Shop Visits: In addition to scheduled fabrication observation, allow review of signage by Owner during fabrication process.

1.6 PERFORMANCE REQUIREMENTS

- A. Expansion & Contraction: Design, fabricate and install component parts to provide for expansion and contraction of the material over a temperature range of 100 degrees F. (83.3 degrees C.), without buckling, sealant joint failure, glass breakage, undue stress on members and anchors, or other detrimental effects.
- B. Fabrication Tolerances: Sign panels shall show no visual distortion when viewed in installed position.
- C. Panel Alignment at Butt Joints: Sign panels shall align parallel and flat without visible variation when viewed from the normal viewing distance.
- D. Installation Alignment: Signs will be reviewed by Owner for acceptance. Criteria will include plumbness, trueness, alignments and relationships with adjacent work.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible, to insure proper fitting of work
- B. Interface with Adjacent Systems: The Contractor is responsible for visiting the site with the General Contractor, prior to any installation activities to verify the availability of the site, the existence of support structures or appurtenances and the location of the particular installation.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials: Deliver work to project site when adjacent finishes are complete and ready for immediate installation.
- B. Handling Materials and Equipment: Handle finished product in careful manner in order not to damage or mar surfaces of finished product or adjacent finished surfaces.

1.9 OWNER PROVIDED INFORMATION

- A. The Owner shall provide Bilingual translations where noted.

1.10 DESIGNER PROVIDED ARTWORK

- A. Production ready artwork shall be provided where noted on drawings as vector (outline) files saved in either EPS or Illustrator format. All fonts (text) shall be converted to curves or outline.
- B. Image files will be provided as TIFF or JPG unless otherwise noted.

PART 2 - PRODUCTS

2.1 METALS

- A. Steel: Provide steel in form indicated complying with the following American Society for Testing Materials (ASTM) requirements:
 - 1. Tube: ASTM A 500, Grade B.
 - 2. Shapes and Plates: ASTM A 36.
 - 3. Sheet: ASTM A 240, Type 304.
- B. Aluminum: Provide aluminum in the form indicated complying with the following American Society for Testing Materials (ASTM) requirements:
 - 1. Sheets: ASTM B 209, 5052-H32.
 - 2. Extruded Bar and Shapes: ASTM B221, Alloy 6063-T6.
 - 3. Extruded Structural Pipe and Tube: ASTM B429, Alloy 6063-T6.

2.2 MISCELLANEOUS PRODUCTS AND MATERIALS

- A. Fasteners: Of same basic metal and alloy as fastened metal, unless otherwise indicated. Do not use metals which are corrosive or otherwise incompatible with metals joined.
 - 1. Fastening devices between dissimilar materials shall be 300 Series non-magnetic stainless steel.
 - 2. Material: Galvanically compatible with adjacent materials.
 - 3. Finish: Where exposed to view match adjacent material.
 - 4. Provide concealed fasteners for interconnection of metal work components and for their attachment to other work except where exposed fasteners are indicated on the drawings.
 - 5. Provide socket flat-head machine screws or bolts for exposed fasteners, unless otherwise indicated.
- B. Welding Electrodes and Filler Metal: Type and alloy of filler metal and electrodes as recommended by producer of metal to be welded, complying with applicable AWS specifications, and as required for color match, strength and compatibility in the fabricated items

2.3 GRAPHIC COMPONENTS AND PROCESSES

- A. General:
 - 1. All graphics, including text, symbols and arrows shall be executed in such a manner that all edges and corners are true and clean.
 - 2. Type Sizes: As indicated on drawings for particular units.
 - 3. Typefaces: All work to precisely replicate the typefaces as indicated on drawings.
 - 4. Typographic Spacing: Match letter, word and line spacing as indicated on drawings for all text configurations.
 - 5. Symbols and Arrows: Match artwork as indicated on the drawings.
- B. Pressure Sensitive Vinyl Graphics:
 - 1. Provide pressure sensitive vinyl messages installed at finished surfaces in the sizes, mounting heights, letter-spacing and alignment indicated on drawings.

2. Sign messages shall be provided pre-spaced in type sizes, colors and typeface as shown on the drawings and specified herein. All lettering shall be executed in such a manner that all edges and corners of letter forms are true, clean, photographically precise and accurately reproduce the typeface. Messages shall be smooth and free of air bubbles, open cuts, bulging and foreign matter between message and application surface.
3. Material: 3-M or Oracal vinyl sheeting; or equal.
4. Color: As indicated on drawings.
5. Type & Finish: As indicated on drawings.

C. Digitally Printed Vinyl

1. Substrate: 3M file; or equal.
2. Printing: All pictorials to be printed consistently using solvent or UV Ink Jet Printer output.
3. Lamination: 3M overlaminate; or equal. Lamination to be performed on laminator with proper heat, speed and pressure to ensure maximum adhesion.
4. Resolution: true 1200 x 1200 dpi.
5. Delivery & Storage: Store in flat position to avoid damage to end of rolls. Store in clean, dry storage area with temperature maintained above 55 degrees with normal humidity. Do not cross stack this material.
6. Install Conditions: Install area shall have a constant minimum temperature of not less than 60 degrees for at least seven days prior to and throughout the installation period for seven days after.
7. Installation: Graphics shall be installed by certified installer per manufacturer recommendation to preserve warranty.
8. Warranty: Minimum of 5 years against fading, cracking, chipping and peeling.

D. Direct-Printed Graphics:

1. Construction/substrate: as indicated on drawings.
2. Printing: All pictorials to be printed on UV Ink Jet Printer output at 6 color CMYK + Lt. Magenta + Lt. Cyan for maximum color gamut.
3. Resolution: true 1200 x 1200 dpi or better.

4. Double passes which show as double images, faint or fuzzy line and edge quality will not be accepted.
5. Warranty: Minimum of 5 years against fading, cracking, chipping for interior use.

2.4 METAL FABRICATION

A. General:

1. Use materials of size and thickness indicated or, if not indicated, as required to produce strength and durability in finished product for use intended. Work to dimensions shown or accepted on shop drawings, using proven details of fabrication and support. Use type of materials shown or specified for various components of work.
2. For exposed work fabricate true to line and level with accurate angles and surfaces and straight sharp edges. Exposed edges shall be square unless otherwise shown. Ease corners and edges where exposed to public touch. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work
3. Provide metal work composed of metals of the forms and types which comply with requirements of referenced standards and which are free from surface blemishes where exposed to view in the finished unit. Exposed-to-view surfaces exhibiting pitting, seam marks, roller marks, "oil canning", stains, discolorations or other imperfections on finished units will not be accepted.
4. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type shown or, if not shown, socket flat-head screws or bolts.
5. Provide for anchorage of type shown, coordinated with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.
6. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware and similar items.

B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Welded Construction:

1. Select type of weld for best appearance. Use concealed and plug welds as indicated on drawings.
2. Comply with American Welding Standards (AWS) Code for procedures, appearance and quality of welds, and methods used in correcting welding work. Select weld sizes, sequence and equipment to limit distortions to allowable tolerances. Surface "bleed" of back side welding on exposed surfaces will not be accepted.
3. Assemble and weld structural system by methods which will produce true alignment of axes without warp. Grind butt welds flush; dress all exposed welds, feather edges onto base material and polish as required for smooth painted surfaces.
4. Weld corners and seams continuously, complying with AWS recommendations. All exposed welds shall be clean, consistent and uniform in appearance. Grind and finish exposed welds smooth and flush to match adjacent contours and finish. Remove loose rust, mill scale, and spatter, slag or flux deposits.

D. Miscellaneous Trim and Hardware:

1. Provide shapes and sizes as required for profiles shown. Except as otherwise noted, fabricate units from structural steel shapes, plates and bars, with continuously welded joints and smooth exposed edges. Use concealed field splices wherever possible. Provide cutouts, fittings and anchorages as required for coordination of assembly and installation with other work.
2. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels and other miscellaneous steel and iron shapes as required for supporting of signage.
3. Fabricate items to sizes, shapes and dimensions required.

E. Holes for Other Work:

1. Provide holes required for securing other work to structural system, and for the passage of other work through steel members, as shown on the final shop drawings.
2. Provide threaded nuts welded to framing, and other specialty items as shown to receive other work.
3. Drill holes 1/16" oversize for field alignment and fitting.
4. Cut, drill or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning.

F. Shop Assembly:

1. Fabricate units to configurations indicated on reviewed shop drawings.
 2. Provide required text and artwork as indicated on reviewed shop drawings.
 3. Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- G. Surface Preparation: After inspection and before finishing, clean metal work to be painted. Clean metal by "wheel abrader" process or other method to achieve results defined by Steel Structures Painting Council (SSPC) for "SP-6 Commercial Blast Cleaning".
- H. Preparation for Shipping and Handling: Provide strippable protective coating or wrapping.

2.5 METAL FINISHES

- A. General:
1. Complete cutting, fitting, forming, drilling and grinding of metal work prior to cleaning, finishing, surface treatment and application of finishes.
 2. Comply with National Association of Architectural Metal Manufacturers (NAAMM) "Metal Finishes Manual" for finish designations and application recommendations to match sheet finish specified above, except where more stringent requirements are indicated.
 3. Finish all joints, bends, abrasions, and other surface blemishes to match the sheet finish. Finish free of tool or construction marks, or dents.
 4. Spray apply sound deadening mastic (with flame spread of 75 or less) to concealed surfaces of formed metal and other areas of flat sheets not laminated to backing as indicated on drawings.
 5. Protect mechanical finishes on exposed surfaces from damage by application of removable temporary protective covering prior to shipment.

2.6 COATINGS FOR METAL AND ACRYLIC

- A. Acceptable Manufacturers and Products: Matthews Acrylic Polyurethane (MAP), or equal.
- B. Recommended System:

1. Aluminum: Matthews Acrylic Polyurethane (MAP), Ultra Low VOC product. Primers, catalysts and reducers are to be per manufacturer's recommendations. Match colors and gloss as indicated.
 2. Acrylic: Matthews Tie Bond, 74-777SP or as per manufacturer's recommendations. Followed by Matthews Acrylic Polyurethane (MAP), Ultra Low VOC product. Match colors and gloss as indicated.
 3. Clearcoat: Provide protective clearcoat over all painted surfaces after graphics have been applied. Use Matthews Acrylic Polyurethane (MAP), Super Satin Clear 290 228SP.
- C. Field Repair: Provide system recommended by manufacturer for field repair by untrained applicators employed by Owner.
- D. Application:
1. Substrates to be cleaned and surface prepared as recommended by paint manufacturer.
 2. The number of coats and paint film thickness required is the same regardless of the application method. Do not apply succeeding coats until previous coat has flashed off as recommended by coating manufacturer. Sand between coat applications where required to produce an even, smooth surface in accordance with coating manufacturer's directions.
 3. Apply additional coats when undercoats or other conditions show through final coat until the cured film is of uniform finish, color and appearance.
 4. Minimum Coating Thickness: Dry film thickness and application procedures to be in strict accordance with manufacturer's recommendations. Apply each material at not thinner than manufacturer's recommended spreading rate. Provide a total dry film thickness of entire coating system as recommended by manufacturer, unless otherwise indicated.
 5. Apply an even film, free of surface imperfections.
 6. Completed Work: Match approved samples for color, gloss, texture and coverage. Remove, refinish, or recoat work not in compliance with specified requirements.
 7. Provide protective clearcoat over all painted surfaces after graphics have been applied.
- E. Color Schedule: As indicated on drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that mounting surfaces to receive signage are properly prepared. Do not start work until conditions are satisfactory.

3.2 DEMOLITION

- A. Remove existing signs as listed on architectural demo plans and return to Owner.
- B. Cut, cap and/or reroute existing utilities impacted by removal of existing foundations.

3.3 PREPARATION

- A. Coordinate and furnish anchorages and setting drawings, diagrams, templates, instructions and directions for installation of items having integral anchors which are to be installed by others. Coordinate delivery of such items to construction site.
- B. Protect mounting surfaces and adjacent areas against damage and discoloration caused by work in this section.

3.4 INSTALLATION

- A. General: Locate sign units and accessories where shown or scheduled, using mounting methods of the type described and in compliance with the manufacturer's instructions. Install sign units level, plumb and at the height indicated, with sign surfaces free from distortion or other defects in appearance. Notify Owner of installation conflicts.
- B. Install sign units and components at the locations shown or scheduled, securely mounted.
- C. Install level, plumb and at the proper height. Cooperate with other trades for installation of sign units to finish surfaces. Repair or replace damaged units as directed by the Designer.
- D. Foam Tape Mounting: Use 3M product as specified for mounting signs to smooth, non-porous surfaces as indicated on the drawings. Do not use this method for vinyl-covered or rough surfaces. Position tape at back of sign for optimum performance and hidden from view.
- E. Silicone Adhesive Mounting: Use liquid silicone adhesive as specified to attach sign units to irregular, porous or vinyl-covered surfaces as indicated on the drawings. Use foam tape where recommended by the sign manufacturer to hold the sign in place until the adhesive has fully cured. Remove visible adhesive.

- F. Mechanical Fastener Mounting: Install signs securely to wall with fasteners and anchoring devices as indicated on drawings and as specified.
- G. VHB Adhesive Mounting: Install signs with full sheet VHB adhesive where indicated on the drawings. Trim adhesive flush to exposed edges of material being installed.
- H. Bracket Mounted Units: Provide fittings and hardware as appropriate for mounting signs from ceiling. Attach brackets and fittings securely to ceiling with fasteners and anchoring devices as indicated on drawings

3.5 PROTECTION

- A. Protect finishes from damage during construction period, field handling and installation by use of temporary protective coverings. Protect adjacent surfaces from damage during field fabrication and installation. Remove protective covering at time of substantial completion.
- B. Restore finishes damaged during installation and construction period so that no evidence remains of corrective work. Touch up any exposed fasteners and connecting hardware to match color and finish of surrounding surface. Touch up damaged surfaces carefully, using airbrush technique where necessary. Return items which cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units as required.

3.6 CLEANING

- A. Clean all exposed surfaces just prior to date of substantial completion in accord with manufacturer's written cleaning instructions. Protect units from damage until acceptance.

3.7 TEMPORARY COVERS

- A. Signs which are installed prior to their assigned function being open to public use shall be covered by the Contractor to conceal the face from view. Coverings shall be dark gray or black, paper or cardboard, neatly affixed to the sign face with matching or concealed adhesive. When coverings are removed, clean the signs and treat plastic faces with antistatic solution.

END OF SECTION 101400

SECTION 10 26 00 - WALL AND DOOR PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Protective wall panels.

1.02 RELATED REQUIREMENTS

- A. Section 09 21 16 - Gypsum Board Assemblies: Placement of supports in stud wall construction.

1.03 REFERENCE STANDARDS

- A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2026.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.
- C. ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies; 2023.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.
- C. Shop Drawings: Include plans, elevation, sections, and attachment details. Show design and spacing of supports for protective corridor handrails, required to withstand structural loads.
- D. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.
 - 1. Submit two samples of protective wall covering, 6 by 6 inches square.
- E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- F. Maintenance Data: Manufacturer's instructions for care and cleaning of each type of product. Include information about both recommended and potentially detrimental cleaning materials and methods.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.
- B. Store products in either horizontal or vertical position, in compliance with manufacturer's instructions.

1.06 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Protective Wall Panels:
 - 1. Construction Specialties, Inc; Acrovyn High-Impact Wall Panels: www.c-sgroup.com/#sle to match existing adjacent.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE CRITERIA

- A. Impact Strength: Unless otherwise noted, provide protection products and assemblies that have been successfully tested for compliance with applicable provisions of ASTM D256 and/or ASTM F476.

2.03 PRODUCT TYPES

- A. Protective Wall Panels:
 - 1. Thickness: 3/4 inch to match existing and 1 inch as indicated on drawings.
 - 2. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 55 or less, when tested in accordance with ASTM E84.
 - 3. Color and Pattern: As indicated on drawings.
 - 4. Texture: As indicated on drawings.
 - a. Texture Direction: Match Existing Adjacent.
 - 5. Edge Treatment: Aluminum Thin Trim to Match Existing.
 - 6. Mounting: Adhesive, direct attachment.

2.04 FABRICATION

- A. Fabricate components with tight joints, corners and seams.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.
- B. Verify that field measurements are as indicated on drawings.
- C. Verify that substrate surfaces for adhered items are clean and smooth.
- D. Start of installation constitutes acceptance of project conditions.

3.02 INSTALLATION

- A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.
- B. Position protective wall covering no less than 3/8 inch above base as indicated on drawings to allow for floor level variation.
 - 1. Wainscot Installation: Establish a level line at the specified height for entire length of run. Install by aligning top of edge of covering with this line.
 - 2. Apply adhesive with 1/8 inch V-notch trowel to an area of wall surface that can be completed within cure time of the adhesive.

3.03 TOLERANCES

- A. Maximum Variation From Required Height: 1/4 inch.
- B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch.

3.04 CLEANING

- A. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION

SECTION 12 36 00 - COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Countertops for architectural cabinet work.

1.02 REFERENCE STANDARDS

- A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.
- C. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.
- D. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- E. PS 1 - Structural Plywood; 2023.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Specimen warranty.
- C. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.
- D. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.
- E. Test Reports: Chemical resistance testing, showing compliance with specified requirements.
- F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
- G. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.
- B. Quality Certification:
 - 1. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
 - 2. Provide designated labels on shop drawings as required by certification program.
 - 3. Provide designated labels on installed products as required by certification program.
 - 4. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.06 FIELD CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

2.01 COUNTERTOPS

- A. Quality Standard: Premium Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.
 - 1. Flat Sheet Thickness: 1/2 inch, minimum.
 - 2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
 - a. Manufacturers:
 - 1) Dupont; Corian: www.corian.com/#sle. (Match Existing)
 - 2) Substitutions: See Section 01 60 00 - Product Requirements.
 - b. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
 - 3. Other Components Thickness: 1/2 inch, minimum.
 - 4. Exposed Edge Treatment: Built up to minimum 1-1/4 inch thick; square edge. Additional edge profiles and sizes as indicated on drawings.
 - 5. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.
 - 6. Fabricate in accordance with manufacturer's standard requirements.

2.02 MATERIALS

- A. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.
- B. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

2.03 ACCESSORIES

- A. Fixed Top-Mounted Countertop Support Brackets:
 - 1. Material: Steel.
 - 2. Finish: Manufacturer's standard, factory-applied, textured powder coat.

2.04 FABRICATION

- A. Fabricate tops in the largest sections practicable, with no top surface joints.
 - 1. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
- B. Solid Surfacing: Fabricate tops up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

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BRIDGE UPGRADES
EUGENE, OREGON**

**SECTION 12 36 00
COUNTERTOPS**

- A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- B. Seal joint between back/end splashes and vertical surfaces.

3.04 CLEANING

- A. Clean countertops surfaces thoroughly.

3.05 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL

DPART 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. Basic Requirements.
 - 2. Detailed Requirements.
 - 3. Demolition Requirements.
 - 4. Coordination.
 - 5. Quality Assurance.
 - 6. Codes, Ordinances, & Permits.
 - 7. Common requirements for electrical installation.
 - 8. Painting.
 - 9. Cleaning & Rubbish
 - 10. Sleeve Installation for electrical penetrations.
 - 11. Sleeve-seal installation.
 - 12. Firestopping.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Submit shop drawings, wiring diagrams, and descriptive literature on all equipment furnished in this contract. Contractor shall "approve" shop drawings as specified in Division 1 prior to submitting to Engineer for approval. Shop drawing submittals shall comply with Division 1 requirements.
 - 2. Make submittals as soon as practicable after the signing of the contract. Shipment shall not be released until drawings and literature have been finally approved.
 - 3. Shop drawings shall be checked by the Contractor for shape, dimensions, and details of attachment to the construction before submittal. Submitted shop drawings will be presumed to have been so checked by the Contractor.
 - 4. The literature shall be complete, giving materials, gauges, weights, finishes, etc., and in case of lighting fixtures, shall include ETL photometric curves.
 - 5. Number of copies required is the number of copies the Contractor desires returned, or the quantity listed in Division 1, whichever is greater.
 - 6. Wiring diagrams shall be furnished for all communication and control systems under this contract.
 - 7. In addition to the foregoing, the Contractor is to supply to the General Contractor, for delivery to the Owner, bound in a single set, a complete shop drawing portfolio of all equipment indicated under the specific specification section. Submit these near completion of the project arranged and indexed according to the CSI format.
 - 8. Submit electrical system protective device coordination study simultaneously with equipment shop drawings.
- B. Test reports: Submit written installation test reports for review and approval immediately after testing has been satisfactorily completed.
- C. Acceptance certificates: Submit written manufacturer, testing agency and/or local Code authority acceptance certificates with project closeout documentation.
- D. Warranty: Submit a written warranty statement detailing all system and equipment warranties.
- E. Operation & Maintenance Instructions:
 - 1. Refer to Division 1 for submittal and training requirements.

2. Furnish approved operation and maintenance instruction booklets covering each listed item of equipment installed under this contract. These booklets shall provide complete instructions on the proper operation, use and periodic maintenance, together with the source of replacement parts and service for the item of equipment covered.
 3. Operation and maintenance manuals shall include copies of test reports, acceptance certificates and warranty information.
 4. In addition to the foregoing, the Contractor shall demonstrate to the Owner's designated personnel the use of the systems listed herein and shall provide a digital typewritten copy of a general operation procedure. Include locations and functions of switches, circuit breakers, fuses, etc.
 5. After final acceptance of all work and occupancy of the building, the Contractor shall have on the job, a qualified representative to make final adjustments of electrical systems and to instruct the Owner's representative in operating procedures, adjustment, and maintenance of system components, and to acquaint the Owner's representative with locations and functions of circuit breakers, fuses, switches, control devices, etc.
- F. Record Drawings:
1. Refer to Division 1 for submittal requirements.
 2. The contractor will make a record layout of actual locations of equipment, devices, routing of conduits and locations of pull boxes for the following facilities:
 - a. Electrical feeders to substations and branch circuit panels
 - b. All branch circuit wiring
 - c. Voice/data conduit system
 - d. Fire alarm system
 - e. Empty conduits for use by others
 3. The information shall be neatly marked and the digital prints shared with the Architect/Engineer.
- G. Contractor's Warranty:
1. All work shall be warranted to be free of defects and to function properly for one year from the date of final acceptance or beneficial occupancy, whichever shall occur first. Defects appearing within the warranty period shall be repaired to the satisfaction of the Architect/Engineer. Refer to Division 1 for additional requirements.
 2. The warranty shall not obligate the Contractor for failure resulting from accident or from improper operation or care on the part of the Owner.
 3. Extended warranties and manufacturer based warranties shall be signed by the warranty holder.

1.4 BASIC REQUIREMENTS

- A. Before bidding, the Contractor shall diligently study and compare all contract documents and promptly report to the Architect/Engineer any discrepancies or deficiencies discovered by or made known to the Contractor.
- B. Discrepancies: Whenever a discrepancy or inconsistency exists between related information indicated on the contract drawings and/or specifications (such as differences between product descriptions and catalog numbers) this contractor shall obtain additional clarification and direction from the Architect/Engineer before proceeding. For bidding purposes, this contractor shall include warranty terms the labor and materials necessary to comply with the alternative that results in the greatest cost to the Contract.
- C. Deficiencies: The Contractor and subcontractors shall resolve all known deficiencies and inadvertent omissions, including non-compliance with applicable codes, with the Architect/Engineer prior to ordering materials or proceeding with the work. Any work performed prior to receipt of instruction from the Architect/Engineer will be done so at the Contractor's risk.
- D. Manufacturer's Catalog Numbers: Product series, model, or catalog numbers, whether indicated on drawings or specifications, shall not be considered complete. This Contractor shall not order any product based solely upon the stated catalog number. Furnish products including

accessories and options necessary to match the full product description and its intended purpose and application based on all information available from the contract documents.

1.5 DETAILED REQUIREMENTS

- A. Equipment and material specifications are minimum general requirements.
- B. In cases where construction requirements and/or special features not mentioned are stated in subsequent sections, on the drawings, or by local Code, the higher standard shall apply.
- C. Coordinate with local utility companies for requirements and specifications. Provide and install completely coordinated
 - 1. Coordinate exact dimensions, locations, and other requirements for actual electrical equipment to be installed.
- D. Coordinate rough-in work and other electrical provisions for smoke dampers provided under Division 23. Provide electric power and fire alarm connections as required for operation of smoke dampers in accordance with the specifications.
- E. Coordinate rough-in work and other electrical provisions for temperature sensors, CO2 sensors, humidistats, thermostats, and other wall-mounted BMS wired devices shown on the mechanical drawings. Refer to the mechanical plans and the mechanical symbols list to identify such items. Install a junction box with a plaster ring with pathway to equipment, unless otherwise indicated on mechanical drawings or specifications. Coordinate exact requirements with the contractor providing the wired device.
- F. Electrical installations shall not hinder the regular maintenance of or replacement of mechanical equipment. Conduit and cabling shall not be installed beneath suspended mechanical units. Coordinate and plan installations.

1.6 DEMOLITION REQUIREMENTS

- A. This contractor shall visit the site to verify existing conditions and limitation information prior to submitting a bid. Bid submittal shall mean the Contractor has visited the project site and has verified existing conditions and the scope of work.
- B. Remove, relocate, and extend existing installations to accommodate new construction on existing project site.
- C. Existing wiring to be removed under this contract within the defined scope of demolition shall be regarded as scrap materials to be recycled by this Contractor. Scrap value shall be determined by the Contractor and accounted for in the Contractor's bid. All other demolished electrical items (e.g., light poles, luminaires, switchgear, etc.) shall be regarded as the Owner's property. The Owner reserves the right to identify which items shall be salvaged-and, thus, carefully removed by this Contractor and placed in storage on site as directed by the Owner. The Contractor shall be responsible for the proper disposal of all demolished materials that the Owner does not want to salvage. Coordinate exact requirements directly with Owner.
- D. Verify that abandoned wiring and equipment serve only abandoned equipment or facilities. Extend conduit and wire to facilities, equipment, light poles, etc. that remain in operation. Extension of conduit and wire to equipment shall be compatible with the surrounding area.
 - 1. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel and/or junction boxes as appropriate.
 - 2. Remove exposed abandoned raceway, including abandoned raceway above accessible ceiling finishes. Cut raceway flush with walls and floors, and patch surfaces. Remove all associated clamps, hangers, supports, etc. associated with raceway removal.
 - 3. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
 - 4. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

- E. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
 - 1. Ballasts in light fixtures installed prior to 1980 shall be incinerated in EPA approved incinerator or disposed of in EPA certified containers and deposited in an EPA landfill certified for PCB disposal or recycled by permitted ballast recycler. Punctured or leaking ballasts must be disposed of according to Federal Regulations under the Toxic Substance Control Act. Provide Owner and Architect/Engineer with a Certificate of Destruction to verify proper disposal.
 - 2. HID and fluorescent lamps, determined by the Toxicity Characteristic Leachate procedure (TCLP), to be hazardous waste shall be disposed of in a permitted hazardous waste disposal facility or by a permitted lamp recycler.

1.7 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical 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 raceways, cables, and wireways will be clear of obstructions and of the working and access space of other equipment.
- B. Prior to bidding, this contractor shall determine conduit and cabling routings, including the means and methods of installation, maximum feeder/branch-circuit lengths, pull boxes, junction boxes, conduit bodies, fittings, and any other related work in accordance with the contract documents and the applicable building codes.
- C. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- D. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."
- E. Concrete Bases for Pad-Mounted Electrical Equipment:
- F. Coordinate requirements for concrete, reinforcement, and formwork with the General Contractor, as specified in Division 03.

1.8 QUALITY ASSURANCE

- A. Test Equipment Suitability and Calibration: Comply with NETA ATS, "Suitability of Test Equipment" and "Test Instrument Calibration."
- B. Tests & Adjustments
 - 1. Contractor shall perform at his own expense, except for electrical energy, any tests that the Architect/Engineer may order to prove the performance of any device(s) and/or equipment supplied under this contract.
 - 2. Such tests will be limited to non-destructive test and will involve only direct reading(s) of the parameter(s) involved, i.e., actual trip rating or time delay of a circuit breaker may be required but coordination study is beyond the scope of this requirement.
 - 3. Provide adjustments such as branch circuit re-arranging, circuit breaker trip settings, final selection of fuse sizes, motor starter overload element settings, and the like that may be indicated by the tests and/or to suit equipment to be installed.

1.9 CODES, ORDINANCES, & PERMITS

- A. All governmental codes and ordinances that are applicable and in effect at the time and location of this work are hereby referenced as an integral part of the specification to establish minimum standards of design detail, materials, and workmanship. Extra payment will not be allowed for

work or changes required by local code enforcement authorities and/or utility companies. This is not to preclude the establishment of non-conflicting higher standards as may be specified herein and/or indicated on the drawings. In case of conflict between any of the standards established herein and a governmental code or ordinance, refer to the Architect/Engineer and obtain instructions before proceeding with the work involved.

- B. Apply for, obtain, and pay for required permits and certificates of inspection
- C. Particular attention is directed to:
 - 1. National Electrical Code
 - 2. Local electric wiring ordinances
 - 3. IEEE National Electrical Safety Code

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. In all Division 26 Part 2 articles where titles introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified or prior approved product substitution. No product manufacturer will be accepted after this bid unless approved through a contractual change or written acceptance by Engineer. See "Substitutions" article herein.

2.2 PROPRIETARY REFERENCES

- A. Except where there is indication to the contrary, the intent of this specification is to be open to all brand names and suppliers that offer equipment that complies with the stated requirements of capacity, function, quality configuration, size, shape, and operating characteristics that are compatible with the design objectives of the system and interfacing equipment.
- B. Stated requirements are minimum in the case of unit output and maximum in the case of input requirements.
- C. The perceived operational limitations and maintenance requirements as well as the availability of suitable maintenance support will be evaluated in comparison to competing equipment as an important factor in deciding if an item of equipment is acceptable or not acceptable.
- D. The product manufacturers listed are manufacturers that are believed to be producers of like equipment or materials and locally represented, with service capability and otherwise meeting the requirements of the contract documents. Reference to a brand name is not to be construed as a representation that the named supplier actually has available the equipment or materials that meet the detailed requirements of the contract documents.
- E. Details of construction, control, or operation that are proprietary and not significant to the Owner's utilization of the equipment will not be used as a basis for qualifying or disqualifying any equipment.

2.3 SUBSTITUTIONS

- A. The materials, products and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance and quality to be met by any proposed substitution.
- B. No substitution will be considered prior to receipt of Bids unless written request for approval has been received by the Engineer at least 10 days prior to the date for receipt of Bids. Such requests shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitution including drawings, performance and test data, and other information necessary for an evaluation. A statement setting forth changes in other materials, equipment or other portions of the work including changes in the work of other contracts that incorporation of the proposed substitution would require shall be included. The burden of proof of the merit of the proposed substitution is upon the proposer. The Engineer's decision of approval or disapproval of a proposed substitution shall be final. Refer to Division 1 for additional requirements.

- C. If the Engineer approves a proposed substitution prior to receipt of bids, such approval will be set forth in an addendum. Bidders shall not rely upon approvals made in any other manner.
- D. No substitutions will be considered after the contract award unless specifically provided in the contract documents.

2.4 UL LABEL

- A. All materials, devices, etc. installed under this contract shall bear the UL label, or be UL listed as applicable except those specified items not covered by existing UL Standards.

2.5 SLEEVES FOR RACEWAYS 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 and no side more than 16 inches, thickness shall be 0.052 inch.

2.6 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
 - e. Link-Seal
 - f. O-Z/Gedney, EGS Electrical Group, LLC.
 - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - 3. Pressure Plates: Plastic, Carbon steel, or Stainless steel. Include two for each sealing element.
 - 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating or Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 EXECUTION

3.1 REBATES

- A. The work of this contract may include equipment, controls or systems to be furnished and/or installed that qualify for rebate(s) under local utility company energy conservation and efficiency programs.
- B. In such instance(s), the Contractor shall cooperate with the Owner by providing information and filings as necessary for the Owner to receive the rebate(s).

3.2 BUILDING CONSTRUCTION

- A. Refer to the general construction drawings, which are bound with the drawings of this work, for construction details, elevations, etc.

3.3 INSPECTION OF SITE

- A. Determine information regarding existing construction by the site inspection prior to bidding.
- B. By submitting a bid for this work, contractor agrees they have inspected the existing site and familiarized themselves with existing conditions and how they relate to the contract documents.

3.4 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Examine the site and all the drawings before proceeding with the layout and installation of this work. Verify all door swings and clearances to cabinets, etc. before locating switch and outlet boxes. Locate conduits, boxes, etc., essentially as shown on the drawings, but in exact layout determined on the job to suit actual conditions. Locate work so it does not interfere with access to service for any equipment. Confer and cooperate with other trades on the job so all parts will be installed in proper relationship. Precise location of parts to coordinate with other work is the responsibility of the Contractor.
- B. Obtain and follow manufacturer's installation instructions in the installation of all electrical equipment. Observe all restrictions imposed by the equipment manufacturer, UL label, NEC, or other applicable code in regard to setting; anchoring; hanging; clearances; electric, magnetic or thermal separation; shielding; weather and moisture protection. In case of conflict between the specifications herein and instructions or code governing the installation, notify the Architect/Engineer and receive his instructions before proceeding.
- C. Arrange exposed work as closely as practicable to wall or ceiling surfaces and in accurate alignment with exposed features of structure and/or trim. Locate concealed work so fittings, connectors, and other projections will clear surfaces. Where the option of more than one material is given, selection shall be confined to those which may be properly installed.
- D. Install all work in a neat and orderly manner by tradesperson thoroughly qualified in the trade or duties they are to perform. Rough work will be rejected.
- E. The Contractor is responsible for correct size and location of chases, slots, and openings require and will be liable for any cutting or patching made necessary by his failure to make proper arrangements in this respect.
- F. Maintain a competent full-time superintendent on the job to oversee and coordinate work with other trades, receive instructions from the Architect/Engineer, make layout of work to suit actual conditions, and to satisfy requirements of the drawings, specifications, and good workmanship.

3.5 PAINTING

- A. Exposed electrical work in finished areas, walls, ceilings, etc. will be painted by the General Contractor if the Electrician has the work in place and properly cleaned before the General Contractor's painter starts work. If the Electrician fails to do this, they shall paint such work as directed.
- B. Exposed electrical work in unfinished areas will require painting unless noted otherwise.
- C. Protect the manufacturer's finish on equipment that is so finished. Clean and/or touch-up as necessary to repair damage at the end of the job.
- D. Paint exposed work installed under this contract with suitable primer and two coats of approved enamel, colors as specified or directed.
- E. Protect the manufacturer's finish on equipment that is so finished. Clean and/or touch-up as necessary to repair damage at the end of the job.

3.6 CLEANING & RUBBISH

- A. During the work, keep the premises clear of unnecessary accumulation of debris.
- B. Plug or cap open ends of conduits to prevent the entrance of dirt and/or moisture during construction. Protect boxes, panel enclosures, etc. against the entrance of mortar, plaster, moisture, and other foreign material during construction, and thoroughly clean these spaces before pulling wires, and again, if necessary, before installing covers of fronts.
- C. On completion of the work, remove all rubbish and debris resulting from the work or the work of subcontractors and dispose of same.
- D. All equipment, fixtures, etc. shall be thoroughly cleaned of accumulated dust, plaster, or other dirt and left in a satisfactory condition for use.

3.7 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways 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 2 inches above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway 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 raceway 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 raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."
- K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel or cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch 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 annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.8 SLEEVE-SEAL INSTALLATION

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

3.9 FIRESTOPPING

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

END OF SECTION

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Single conductor building wire.
- B. Metal-clad cable.
- C. Wiring connectors.
- D. Firestop sleeves.

1.2 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 07 84 00 - Firestopping.
- C. Section 26 05 05 - Selective Demolition for Electrical: Disconnection, removal, and/or extension of existing electrical conductors and cables.
- D. Section 26 05 26 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.
- E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- F. Section 28 46 00 - Fire Detection and Alarm: Fire alarm system conductors and cables.
- G. Section 31 23 16 - Excavation.
- H. Section 31 23 16.13 - Trenching: Excavating, bedding, and backfilling.
- I. Section 31 23 23 - Fill: Bedding and backfilling.

1.3 REFERENCE STANDARDS

- A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013 (Reapproved 2018).
- B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2011 (Reapproved 2017).
- C. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2020).
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- E. NECA 120 - Standard for Installing Armored Cable (AC) and Metal-Clad Cable (MC); 2012.
- F. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2009.
- G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.
- I. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.
- J. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.
- K. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.
- L. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.

2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
3. Notify Architect/Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.
- C. Sustainable Design Documentation: Submit manufacturer's product data on conductor and cable showing compliance with specified lead content requirements.
- D. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.

1.6 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.8 FIELD CONDITIONS

- A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.1 CONDUCTOR AND CABLE APPLICATIONS

- A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
- B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
- C. Metal-clad cable is permitted only as follows:
 1. Where not otherwise restricted, may be used:
 - a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires or outlet boxes within millwork as noted on plans.
 - 1) Maximum Length: 6 feet.

2.2 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
- D. Comply with NEMA WC 70/ICEA S-95-658.
- E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
- F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
- G. Conductors for Grounding and Bonding: Also comply with Section 26 05 26.

- H. Conductors and Cables Installed in Cable Tray: Listed and labeled as suitable for cable tray use.
- I. Conductor Material:
 - 1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
 - 2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
- J. Minimum Conductor Size:
 - 1. Branch Circuits: 12 AWG.
 - a. Exceptions:
 - 1) 20A, 120 V circuit longer than 100 ft: 10 AWG. for voltage drop.
 - 2) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.
- K. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- L. Conductor Color Coding:
 - 1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
 - 2. Color Coding Method: Integrally colored insulation.
 - a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
 - 3. Color Code:
 - a. 480Y/277 V, 3 Phase, 4 Wire System:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
 - 4) Neutral/Grounded: Gray.
 - b. 208Y/120 V, 3 Phase, 4 Wire System:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - 4) Neutral/Grounded: White.
 - c. Equipment Ground, All Systems: Green.
 - d. Travelers for 3-Way and 4-Way Switching: Pink.
 - e. For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.
 - f. For control circuits, comply with manufacturer's recommended color code.

2.3 SINGLE CONDUCTOR BUILDING WIRE

- A. Description: Single conductor insulated wire.
- B. Conductor Stranding:
 - 1. Feeders and Branch Circuits: Stranded.
- C. Insulation Voltage Rating: 600 V.
- D. Insulation:
 - 1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2.
 - a. Installed Underground: Type XHHW-2.

2.4 METAL-CLAD CABLE

- A. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.

- B. Conductor Stranding:
 - 1. Size 10 AWG and Smaller: Stranded.
 - 2. Size 8 AWG and Larger: Stranded.
- C. Insulation Voltage Rating: 600 V.
- D. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.
- E. Grounding: Full-size integral equipment grounding conductor.

2.5 WIRING CONNECTORS

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.
- B. Connectors for Grounding and Bonding: Comply with Section 26 05 26.

2.6 ACCESSORIES

- 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. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that work likely to damage wire and cable has been completed.
- C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.
- D. Verify that field measurements are as indicated.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

- A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.3 INSTALLATION

- A. Circuiting Requirements:
 - 1. Unless dimensioned, circuit routing indicated is diagrammatic.
 - 2. When circuit destination is indicated without specific routing, determine exact routing required.
 - 3. Arrange circuiting to minimize splices.
 - 4. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
 - 5. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
 - 6. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is permitted, under the following conditions:
 - a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
 - b. Increase size of conductors as required to account for ampacity derating.
 - c. Size raceways, boxes, etc. to accommodate conductors.
 - 7. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
- B. Install products in accordance with manufacturer's instructions.

- C. Perform work in accordance with NECA 1 (general workmanship).
- D. Install metal-clad cable (Type MC) in accordance with NECA 120.
- E. Installation in Raceway:
 - 1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
 - 2. Pull all conductors and cables together into raceway at same time.
 - 3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
 - 4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
- F. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.
- G. Support cables in accordance with Section 26 05 29 - Hangers and Supports for Electrical Systems.
- H. Terminate cables using suitable fittings.
 - 1. Metal-Clad Cable (Type MC):
 - a. Use listed fittings.
 - b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
- I. Install conductors with a minimum of 6-inches of slack at each outlet.
- J. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
- K. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
- L. Make wiring connections using specified wiring connectors.
 - 1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
 - 2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
 - 3. Do not remove conductor strands to facilitate insertion into connector.
 - 4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
- M. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
- N. Insulate ends of spare conductors using vinyl insulating electrical tape.
- O. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.
- P. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.
- Q. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

END OF SECTION

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Grounding and bonding requirements.
- B. Conductors for grounding and bonding.
- C. Connectors for grounding and bonding.
- D. Ground bars.

1.2 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding.
- C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

- A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System; 2012.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Verify exact locations of underground metal water service pipe entrances to building.
 - 2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
 - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

1.6 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Comply with UL 467 for grounding and bonding materials and equipment.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.1 GROUNDING AND BONDING REQUIREMENTS

- A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.
- B. Do not use products for applications other than as permitted by NFPA 70 and product listing.

- C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
- D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- E. Grounding System Resistance:
 - 1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.
 - 2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
- F. Grounding Electrode System:
 - 1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
 - a. Provide continuous grounding electrode conductors without splice or joint.
 - b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
 - 2. Metal In-Ground Support Structure:
 - a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.
 - 3. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
- G. Bonding and Equipment Grounding:
 - 1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
 - 2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
 - 3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
 - 4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
 - 5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
 - 6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
 - 7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
 - a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
 - b. Metal gas piping.
- H. Communications Systems Grounding and Bonding:
 - 1. Provide bonding jumper in raceway from building grounding electrode system to each communications room or backboard and provide ground bar for termination.
 - a. Bonding Jumper Size: As indicated.
 - b. Raceway Size: 3/4 inch trade size unless otherwise indicated or required.
 - c. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
 - d. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

2.2 GROUNDING AND BONDING COMPONENTS

- A. General Requirements:
 - 1. Provide products listed, classified, and labeled as suitable for the purpose intended.
 - 2. Provide products listed and labeled as complying with UL 467 where applicable.
- B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 05 26:
 - 1. Use insulated copper conductors unless otherwise indicated.
 - a. Exceptions:
 - 1) Use bare copper conductors where installed underground in direct contact with earth.
 - 2) Use bare copper conductors where directly encased in concrete (not in raceway).
 - b. Where bare copper conductors are used for grounding systems, they shall comply with the following:
 - 1) Solid Conductors: ASTM B 3.
 - 2) Stranded Conductors: ASTM B 8.
 - 3) Tinned Conductors: ASTM B 33.
 - 4) Bonding Cable: 28 KCMIL, 14 strands of No. 17 AWG conductors, 1/4 inch in diameter.
 - 5) Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6) Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
 - 7) Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- C. Connectors for Grounding and Bonding:
 - 1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
 - 2. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.
 - 3. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
 - 4. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
- D. Ground Bars:
 - 1. Description: Copper rectangular ground bars with mounting brackets and insulators.
 - 2. Size: As indicated.
 - 3. Holes for Connections: As indicated or as required for connections to be made.
- E. Grounding Bus:
 - 1. Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that work likely to damage grounding and bonding system components has been completed.
- B. Verify that field measurements are as indicated.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).

- C. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- E. Grounding and Bonding for Piping:
 - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 - 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- F. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.
- G. Make grounding and bonding connections using specified connectors.
 - 1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
 - 2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
 - 3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
 - a. Applications:
 - 1) Underground connections (except at test wells and as otherwise indicated).
 - 2) Connections to structural steel.
 - 4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 - a. Applications:
 - 1) Pipe and equipment grounding conductor terminations.
- H. Identify grounding and bonding system components in accordance with Section 26 05 53.

3.3 EQUIPMENT GROUNDING:

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.

3.4 GROUNDING AT THE SERVICE:

- A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.5 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Tests and Inspection: After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions
2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal. Make tests at ground rods before any conductors are connected.
 - a. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
3. Prepare test and inspection reports. Report measured ground resistances that exceed the following values:
 - a. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
 - b. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
4. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.
5. Grounding system will be considered defective if it does not pass tests and inspections.

END OF SECTION

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.2 RELATED REQUIREMENTS

- A. Section 26 05 33.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.
- B. Section 26 05 33.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.
- C. Section 26 51 00 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

1.3 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- C. MFMA-4 - Metal Framing Standards Publication; 2004.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
 - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
 - 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
 - 4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 30 00.

1.5 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.

1.6 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Comply with applicable building code.

- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
 2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
 3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
 4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
 5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
 - a. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
- C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
- D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
1. Comply with MFMA-4.
 2. Channel Material:
 - a. Galvanized steel.
 3. Minimum Channel Dimensions: 1-5/8 inch width by 13/16 inch height.
- E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
- F. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
 2. Concrete: Use preset concrete inserts.
 3. Solid or Grout-Filled Masonry: Use expansion anchors.
 4. Hollow Masonry: Use toggle bolts.
 5. Hollow Stud Walls: Use toggle bolts.
 6. Steel: Use beam clamps complying with MSS SP-96.
 7. Sheet Metal: Use sheet metal screws.
 8. Wood: Fasten with lag screws or through bolts.
 9. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
 - a. Comply with MFMA-4.
 - b. Channel Material: Use galvanized steel.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.

- C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Do not provide support from piping, ductwork, or other systems.
- D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- G. Equipment Support and Attachment:
 - 1. Strength and support assemblies: where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
 - 2. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
 - 3. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 4. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
 - 5. Use slotted-channel racks attached to substrate to support equipment surface-mounted on hollow stud walls and nonstructural building surfaces.
 - 6. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 - 7. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
 - 8. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.
 - 9. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.
- H. Conduit Support and Attachment: Also comply with Section 26 05 33.13.
- I. Interior Luminaire Support and Attachment: Also comply with Section 26 51 00.
- J. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.
- K. Secure fasteners according to manufacturer's recommended torque settings.
- L. Remove temporary supports.

END OF SECTION

SECTION 26 05 33.13 - CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Galvanized steel rigid metal conduit (RMC).
- B. Intermediate metal conduit (IMC).
- C. Flexible metal conduit (FMC).
- D. Liquidtight flexible metal conduit (LFMC).
- E. Electrical metallic tubing (EMT).
- F. Rigid polyvinyl chloride (PVC) conduit.
- G. Reinforced thermosetting resin conduit (RTRC).
- H. Conduit fittings.
- I. Accessories.

1.2 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete encasement of conduits.
- B. Section 07 84 00 - Firestopping.
- C. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
- D. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
 - 1. Includes additional requirements for fittings for grounding and bonding.
- E. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- F. Section 26 05 33.16 - Boxes for Electrical Systems.
- G. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- H. Section 27 05 26 - Pathways for Communication Systems: Additional requirements for communications systems conduits.
- I. Section 31 23 16 - Excavation.
- J. Section 31 23 23 - Fill: Bedding and backfilling.

1.3 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2015.
- B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.
- C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit; 2018.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2020.
- F. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2017.
- G. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
- H. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2020.
- I. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2016.
- J. NEMA TC 14 (SERIES) - Reinforced Thermosetting Resin Conduit and Fittings Series; 2015.
- K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

- M. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.
- N. UL 360 - Liquid-Tight Flexible Metal Conduit; Current Edition, Including All Revisions.
- O. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.
- P. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.
- Q. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.
- R. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
 - 2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
 - 3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
 - 4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.5 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.
- C. Shop Drawings:
 - 1. Indicate proposed arrangement for conduits to be installed within structural concrete slabs, where permitted.
 - 2. Include proposed locations of roof penetrations and proposed methods for sealing.
- D. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2 inch (53 mm) trade size and larger.

1.6 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 CONDUIT APPLICATIONS

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.
- B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the

most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.

- C. Underground:
 - 1. Under Slab on Grade: Use rigid PVC conduit.
 - 2. Exterior, Direct-Buried: Use rigid PVC conduit.
 - 3. Exterior, Embedded Within Concrete: Use rigid PVC conduit.
 - 4. Where rigid polyvinyl (PVC) or reinforced thermosetting resin conduit (RTRC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.
 - 5. Where rigid polyvinyl (PVC) conduit larger than 2-1/2 inch trade size is provided, use reinforced thermosetting resin conduit (RTRC) for sweeps and bends.
- D. Concealed Within Masonry Walls: Use electrical metallic tubing (EMT).
- E. Concealed Within Hollow Stud Walls: Use electrical metallic tubing (EMT).
- F. Concealed Above Accessible Ceilings: Use electrical metallic tubing (EMT).
- G. Interior, Damp or Wet Locations: Use intermediate metal conduit (IMC).
- H. Exposed, Interior, Not Subject to Physical Damage, Located within unfinished spaces (mechanical rooms/storage rooms): Use electrical metallic tubing (EMT).
- I. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit.
 - 1. Locations subject to physical damage include, but are not limited to:
 - a. Where exposed below 8 feet, except within electrical and communication rooms or closets.
 - b. Where exposed below 20 feet in warehouse areas.
- J. Exposed, Exterior: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
- K. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
- L. Connections to Vibrating Equipment:
 - 1. Dry Locations: Use flexible metal conduit.
 - 2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
 - 3. Maximum Length: 6 feet unless otherwise indicated.
 - 4. Vibrating equipment includes, but is not limited to:
 - a. Transformers.
 - b. Motors.
 - c. Pneumatic Equipment
 - d. Electric Solenoids.
 - e. Hydraulic equipment.
 - f. Fans.
- M. Fished in Existing Walls, Where Necessary: Use flexible metal conduit.

2.2 CONDUIT REQUIREMENTS

- A. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified.
- B. Fittings for Grounding and Bonding: Also comply with Section 26 05 26.
- C. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.
- D. Provide products listed, classified, and labeled as suitable for the purpose intended.
- E. Minimum Conduit Size, Unless Otherwise Indicated:
 - 1. Branch Circuits: 3/4 inch (21 mm) trade size.
 - 2. Branch Circuit Homeruns: 1 inch (27 mm) trade size.
 - 3. Control Circuits: 1/2 inch (16 mm) trade size.

4. Flexible Connections to Luminaires: 3/8 inch (12 mm) trade size.
 5. Underground, Interior: 3/4 inch (21 mm) trade size.
 6. Underground, Exterior: 1 inch (27 mm) trade size.
- F. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.3 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
- B. Fittings:
1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 2. Material: Use steel.
 3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.4 INTERMEDIATE METAL CONDUIT (IMC)

- A. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.
- B. Fittings:
1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 2. Material: Use steel.
 3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.5 FLEXIBLE METAL CONDUIT (FMC)

- A. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.
- B. Fittings:
1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 2. Material: Use steel.

2.6 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.
- B. Fittings:
1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 2. Material: Use steel.

2.7 ELECTRICAL METALLIC TUBING (EMT)

- A. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
- B. Fittings:
1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 2. Material: Use steel.
 3. Connectors and Couplings: Use compression (gland) or set-screw type.
 - a. Do not use indenter type connectors and couplings.

2.8 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

- A. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.
- B. Fittings:
 - 1. Manufacturer: Same as manufacturer of conduit to be connected.
 - 2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.9 REINFORCED THERMOSETTING RESIN CONDUIT (RTRC)

- A. Applications:
 - 1. Underground, Direct-Buried: Use belowground (BG), DB (direct burial) RTRC or aboveground (AG) RTRC.
 - 2. Underground, Embedded in Concrete: Use belowground (BG), EB (encased burial) RTRC, belowground (BG), DB (direct burial) RTRC, or aboveground (AG) RTRC.
- B. Description: NFPA 70, Type RTRC reinforced thermosetting resin conduit complying with NEMA TC 14 (SERIES).
- C. Supports: Per manufacturer's recommendations.
- D. Fittings: Same type and manufacturer as conduit to be connected.

2.10 ACCESSORIES

- A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil.
- B. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.
- C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- D. Epoxy Adhesive for RTRC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- E. Pull Strings: Use polypropylene or monofilament plastic line with average breaking strength of not less than 200 pound-force. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceway stub ups designated as spare.
- F. Sealing Compound for Sealing Fittings: Listed for use with the particular fittings to be installed.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive conduits.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
- D. Install intermediate metal conduit (IMC) in accordance with NECA 101.
- E. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
- F. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.
- G. Conduit Routing:
 - 1. Unless dimensioned, conduit routing indicated is diagrammatic.

2. When conduit destination is indicated without specific routing, determine exact routing required.
 3. Conceal all conduits unless specifically indicated to be exposed.
 4. Install raceways square to enclosures and terminate with locknuts.
 5. Conduits in the following areas may be exposed, unless otherwise indicated:
 - a. Electrical rooms.
 - b. Mechanical equipment rooms.
 - c. Within joists in areas with no ceiling.
 6. Unless otherwise approved, do not route conduits exposed:
 - a. Across floors.
 - b. Across roofs.
 - c. Across top of parapet walls.
 - d. Across building exterior surfaces.
 7. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
 8. Arrange conduit to maintain adequate headroom, clearances, and access.
 9. Arrange conduit to provide no more than the equivalent of three 90 degree bends between pull points.
 10. Arrange conduit to provide no more than 150 feet between pull points.
 11. Maintain minimum clearance of 6 inches between conduits and piping for other systems, unless noted otherwise.
 12. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
 - a. Heaters.
 - b. Hot water piping.
 - c. Flues.
 13. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- H. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
 2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
 3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
 4. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
 5. Use conduit clamp to support single conduit from beam clamp or threaded rod.
 6. Support conduits within 12 inches of connected enclosure.
- I. Connections and Terminations:
1. Use approved conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
 2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
 3. Use suitable adapters where required to transition from one type of conduit to another.
 4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
 5. Terminate threaded conduits in boxes and enclosures using threaded hubs for dry locations and raintight hubs for wet locations.
 6. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.

7. Secure joints and connections to provide maximum mechanical strength and electrical continuity.
 8. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- J. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
 2. Make penetrations perpendicular to surfaces unless otherwise indicated.
 3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
 4. Conceal bends for conduit risers emerging above ground.
 5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
 6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
 7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
 8. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.
- K. Underground Installation:
1. Provide trenching and backfilling in accordance with Section 31 23 16 and Section 31 23 23.
 2. Provide underground warning tape in accordance with Section 26 05 53 along entire conduit length.
- L. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
 2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
 3. Where calculated in accordance with NFPA 70 for reinforced thermosetting resin conduit (RTRC) conduit installed above ground to compensate for thermal expansion and contraction.
 4. Where conduits are subject to earth movement by settlement or frost.
- M. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
1. Where conduits pass from outdoors into conditioned interior spaces.
 2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
 3. Where conduits penetrate coolers or freezers.
- N. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.
- O. Provide grounding and bonding in accordance with Section 26 05 26.

END OF SECTION

SECTION 26 05 33.16 - BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.
- B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.
- C. Boxes and enclosures for integrated power, data, and audio/video.

1.2 RELATED REQUIREMENTS

- A. Section 08 31 00 - Access Doors and Panels: Panels for maintaining access to concealed boxes.
- B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- C. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- D. Section 26 05 33.13 - Conduit for Electrical Systems:
 - 1. Conduit bodies and other fittings.
 - 2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.
- E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- F. Section 26 27 26 - Wiring Devices:
 - 1. Wall plates.
 - 2. Additional requirements for locating boxes for wiring devices.
- G. Section 27 10 00 - STRUCTURED CABLING: Additional requirements for communications systems outlet boxes.

1.3 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.
- C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
- D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
- E. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013 (Reaffirmed 2020).
- F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- H. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- I. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.
- J. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

1.4 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

2.1 BOXES

- A. General Requirements:
 - 1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
 - 2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
 - 3. Provide products listed, classified, and labeled as suitable for the purpose intended.
 - 4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
 - 5. Provide grounding terminals within boxes where equipment grounding conductors terminate.
- B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
 - 1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
 - 2. Use cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
 - 3. Use cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit or exposed intermediate metal conduit (IMC) is used.
 - 4. Use suitable concrete type boxes where flush-mounted in concrete.
 - 5. Use suitable masonry type boxes where flush-mounted in masonry walls.
 - 6. Use raised covers suitable for the type of wall construction and device configuration where required.
 - 7. Use shallow boxes where required by the type of wall construction.
 - 8. Do not use "through-wall" boxes designed for access from both sides of wall.
 - 9. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
 - 10. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
 - 11. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
 - 12. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
 - 13. Minimum Box Size, Unless Otherwise Indicated:
 - a. 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size
 - 14. Wall Plates: Comply with Section 26 27 26.
- C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
 - 1. Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
 - 2. NEMA EN 10250 Environment Type, Unless Otherwise Indicated:
 - a. Indoor Clean, Dry Locations: Type 1, painted steel.
 - b. Outdoor Locations: Type 3R, painted steel.
 - c. Wet or Damp locations: Type 4 Stainless Steel.
 - 3. Junction and Pull Boxes Larger Than 100 cubic inches:
 - a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
 - 4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
 - a. Provide lockable hinged covers, all locks keyed same as panelboards unless otherwise indicated.
 - b. Back Panels: Painted steel, removable.
 - 5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.

3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive boxes.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide separate boxes for emergency power and normal power systems.
- E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.
- F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.
- G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.
- H. Box Locations:
 - 1. Mount at heights indicated on drawings. If mounting heights are not individually indicated, locate boxes to be accessible. Provide access panels in accordance with Section 08 31 00 as required where approved by the Architect.
 - 2. Unless dimensioned, box locations indicated are approximate.
 - 3. Locate boxes as required for devices installed under other sections or by others.
 - a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 27 26.
 - b. Communications Systems Outlets: Comply with Section 27 10 00.
 - 4. Locate boxes so that wall plates do not span different building finishes.
 - 5. Locate boxes so that wall plates do not cross masonry joints.
 - 6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
 - 7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
 - 8. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
 - 9. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 05 33.13.
 - 10. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
 - a. Concealed above accessible suspended ceilings.
 - b. Within joists in areas with no ceiling.
 - c. Electrical rooms.
 - d. Mechanical equipment rooms.
- I. Box Supports:
 - 1. Secure and support boxes in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
 - 2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
 - 3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.

4. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
 5. Do not support boxes by conduit alone.
- J. Install boxes plumb and level.
- K. Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
 2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
 3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.
- L. Install boxes as required to preserve insulation integrity.
- M. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.
- N. Close unused box openings.
- O. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
- P. Provide grounding and bonding in accordance with Section 26 05 26.
- Q. Identify boxes in accordance with Section 26 05 53.

END OF SECTION

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Electrical identification requirements.
- B. Identification nameplates and labels.
- C. Wire and cable markers.
- D. Voltage markers.
- E. Underground warning tape.
- F. Floor marking tape.
- G. Warning signs and labels.

1.2 RELATED REQUIREMENTS

- A. Section 09 91 13 - Exterior Painting.
- B. Section 09 91 23 - Interior Painting.
- C. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.
- D. Section 26 27 26 - Wiring Devices - Lutron: Device and wallplate finishes; factory pre-marked wallplates.
- E. Section 27 10 00 - STRUCTURED CABLING: Identification for communications cabling and devices.

1.3 REFERENCE STANDARDS

- A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2011 (Reaffirmed 2017).
- B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.
- B. Sequencing:
 - 1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
 - 2. Do not install identification products until final surface finishes and painting are complete.

1.5 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.1 IDENTIFICATION REQUIREMENTS

- A. Existing Work: Unless specifically excluded, identify existing elements to remain that are not already identified in accordance with specified requirements.
- B. Identification for Equipment:
 - 1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components. Provide unique identification for all branch loads served.

- a. Switchboards:
 - 1) Identify ampere rating.
 - 2) Identify voltage and phase.
 - 3) Use identification nameplate to identify main overcurrent protective device.
 - 4) Use identification nameplate to identify load(s) served for each branch device.
- b. Panelboards:
 - 1) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
 - 2) Use typewritten circuit directory in location provided by panelboard manufacturer to identify load(s) served for panelboards with a door. Identify spares and spaces.
 - 3) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.
- c. Enclosed switches and circuit breakers:
 - 1) Identify power source and circuit number. Include location when not within sight of equipment.
 - 2) Identify load(s) served. Include location when not within sight of equipment.
2. Emergency System Equipment:
 - a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.
 - b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.
3. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
4. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
5. Use field-painted floor markings to identify required equipment working clearances within mechanical or electrical equipment rooms. Do not install within finished spaces..
 - a. Field-Painted Floor Markings: Coordinate floor marking standard with owner, to match existing
6. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
 - a. Service equipment.
- C. Identification for Conductors and Cables:
 1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 05 19.
 2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
- D. Identification for Boxes:
 1. Use voltage markers to identify highest voltage present.
 2. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.
 - a. For exposed boxes in public areas, use only identification labels.
 3. Use warning labels to identify electrical hazards for boxes containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".
- E. Identification for Devices:
 1. Wiring Device and Wallplate Finishes: Comply with Section 26 27 26.
 2. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles.

- a. For receptacles in areas as directed by Architect, provide identification on inside surface of wallplate. Verify with Architect prior to label application.

2.2 IDENTIFICATION NAMEPLATES AND LABELS

- A. Identification Nameplates:
 1. Materials:
 - a. Indoor Clean, Dry Locations: Use plastic nameplates.
 - b. Outdoor Locations: Use stainless steel or aluminum nameplates suitable for exterior use.
 2. Plastic Nameplates: Two-layer or three-layer laminated electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
 - a. Exception: Provide minimum thickness of 1/8 inch when any dimension is greater than 4 inches.
 3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
 4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
 5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.
- B. Identification Labels:
 1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
 - a. Use only for indoor locations.
 2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.
- C. Format for Equipment Identification:
 1. Minimum Size: 1.5 inches by 3 inches.
 2. Legend:
 - a. System designation where applicable:
 - 1) Emergency Power System: Identify with text "EMERGENCY".
 - 2) Fire Alarm System: Identify with text "FIRE ALARM".
 - b. Equipment designation or other approved description.
 - c. Other information as indicated.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height:
 - a. System Designation: 1/2 inch.
 - b. Equipment Designation: 1/2 inch.
 - c. Other Information: 1/4 inch.
 5. Color:
 - a. Normal Power System: White text on black background.
- D. Format for Receptacle Identification:
 1. Minimum Size: 3/8 inch by 1.5 inches.
 2. Legend: Power source and circuit number or other designation indicated.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height: 3/16 inch.
 5. Color: Black text on clear background.
- E. Format for Fire Alarm Device Identification:
 1. Minimum Size: 3/8 inch by 1.5 inches.
 2. Legend: Designation indicated and device zone or address.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height: 3/16 inch.
 5. Color: Red text on white background.

2.3 VOLTAGE MARKERS

- A. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.
- B. Minimum Size:
 - 1. Markers for Equipment: 1 1/8 by 4 1/2 inches.
 - 2. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.
 - 3. Markers for Junction Boxes: 1/2 by 2 1/4 inches.
- C. Legend:
 - 1. Markers for Voltage Identification: Highest voltage present.
 - 2. Markers for System Identification:
 - a. Emergency Power System: Text "EMERGENCY".
- D. Color: Black text on orange background unless otherwise indicated.

2.4 WARNING SIGNS AND LABELS

- A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.
- B. Warning Signs:
 - 1. Materials:
 - a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
 - b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
 - 2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
 - 3. Minimum Size: 7 by 10 inches unless otherwise indicated.
- C. Warning Labels:
 - 1. Materials: Use factory pre-printed or machine-printed self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
 - 2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
 - 3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 EXECUTION

3.1 PREPARATION

- A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, drawings, shop drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout project.
- C. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
 - 1. Surface-Mounted Equipment: Enclosure front.
 - 2. Flush-Mounted Equipment: Enclosure front.
 - 3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
 - 4. Elevated Equipment: Legible from the floor or working platform.
 - 5. Branch Devices: Adjacent to device.
 - 6. Interior Components: Legible from the point of access.
 - 7. Boxes: Outside face of cover.
 - 8. Conductors and Cables: Legible from the point of access.

- 9. Devices: Outside face of cover or as directed by Architect.
- D. Install identification products centered, level, and parallel with lines of item being identified.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Unless labels and nameplates are provided with self-adhesive means of attachment, fasten them with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
- G. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
- H. Secure rigid signs using stainless steel screws.
- I. Mark all handwritten text, where permitted, to be neat and legible.
- J. Conductors To Be Extended in the Future: Attach write-on tags to conductors and list source.
- K. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- L. Equipment To Be Labeled:
 - 1. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a self-adhesive, engraved, laminated acrylic or melamine label.
 - 2. Enclosures and electrical cabinets.
 - 3. Access doors and panels for concealed electrical items.
 - 4. Switchboards.
 - 5. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
 - 6. Emergency system boxes and enclosures.
 - 7. Motor-control centers.
 - 8. Enclosed switches.
 - 9. Enclosed circuit breakers.
 - 10. Enclosed controllers.
 - 11. Variable-speed controllers.
 - 12. Push-button stations.
 - 13. Power-transfer equipment.
 - 14. Contactors.
 - 15. Remote-controlled switches, dimmer modules, and control devices.
 - 16. Lighting control panels and devices.

END OF SECTION

SECTION 26 24 13 - SWITCHBOARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Low-voltage (600 V and less) switchboards and associated accessories for service and distribution applications.
- B. Overcurrent protective devices for switchboards.

1.2 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- C. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendments (2022).
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- C. NECA 400 - Standard for Installing and Maintaining Switchboards; 2007.
- D. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less; 2013.
- E. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.
- F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
 - 4. Coordinate with manufacturer to provide shipping splits suitable for the dimensional constraints of the installation.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for switchboards, enclosures, overcurrent protective devices, and other installed components and accessories.
 - 1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.

- C. Project Record Documents: Record actual installed locations of switchboards and final equipment settings.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Enclosure Keys: Two of each different key.

1.6 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Switchboards:
 - 1. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
- B. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- D. Source Limitations: Furnish switchboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.2 OVERCURRENT PROTECTIVE DEVICES

- A. Circuit Breakers:
 - 1. Interrupting Capacity:
 - a. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
 - 2. Molded Case Circuit Breakers:
 - a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
 - 1) Provide thermal magnetic circuit breakers unless otherwise indicated.
 - 2) Provide electronic trip circuit breakers where indicated.
 - b. Minimum Interrupting Capacity:
 - 1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
 - 2) 14,000 rms symmetrical amperes at 480 VAC.
 - c. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
 - 1) Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
 - d. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
 - 1) Provide the following field-adjustable trip response settings:
 - (a) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
 - (b) Long time delay.
 - (c) Short time pickup and delay.
 - (d) Instantaneous pickup.
 - (e) Ground fault pickup and delay where ground fault protection is indicated.

- e. Provide the following features and accessories where indicated or where required to complete installation:
 - 1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
 - 2) Pad-Lock Provision: For locking circuit breaker handle in OFF position.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of the switchboards and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive switchboards.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install switchboards in accordance with NECA 1 (general workmanship), NECA 400, and NEMA PB 2.1.
- C. Arrange equipment to provide required clearances and maintenance access, including accommodations for any drawout devices.
- D. Where switchboard is indicated to be mounted with inaccessible side against wall, provide minimum clearance of 1/2 inch between switchboard and wall.
- E. Provide required support and attachment in accordance with Section 26 05 29.
- F. Anchor switchboard to building structure at the top of the switchboard if required or recommended by the manufacturer.
- G. Install switchboards plumb and level.
- H. Unless otherwise indicated, mount switchboards on properly sized 4 inch high concrete pad constructed in accordance with Section 03 30 00.
- I. Provide grounding and bonding in accordance with Section 26 05 26.
- J. Install all field-installed devices, components, and accessories.
- K. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- L. Set field-adjustable circuit breaker tripping function settings as indicated.
- M. Provide filler plates to cover unused spaces in switchboards.
- N. Identify switchboards in accordance with Section 26 05 53.
- O. Support and secure conductors within the switchboard according to NFPA 70.
- P. Install filler plates in unused spaces of panel-mounted sections.

3.3 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Before energizing switchboard, perform insulation resistance testing in accordance with NECA 400 and NEMA PB 2.1.
- C. Inspect and test in accordance with NETA ATS, except Section 4.
- D. Perform inspections and tests listed in NETA ATS, Section 7.1.
- E. Molded Case and Insulated Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than 225 amperes. Tests listed as optional are not required.

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- F. Test shunt trips to verify proper operation.
- G. Correct deficiencies and replace damaged or defective switchboards or associated components.

3.4 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of switchboard covers and doors.

3.5 CLEANING

- A. Clean dirt and debris from switchboard enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred surfaces to match original factory finish.

END OF SECTION

SECTION 26 27 26 - WIRING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Receptacles.
- B. Wall plates.

1.2 RELATED REQUIREMENTS

- A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.
- B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- C. Section 26 05 33.16 - Boxes for Electrical Systems.
- D. Section 26 05 33.23 - Surface Raceways for Electrical Systems: Surface raceway systems, including multioutlet assemblies.
- E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- F. Section 26 09 23 - Lighting Control Devices: Devices for automatic control of lighting, including occupancy sensors, in-wall time switches, and in-wall interval timers.

1.3 REFERENCE STANDARDS

- A. FS W-C-596 - Connector, Electrical, Power, General Specification for; 2014h (Validated 2022).
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- C. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.
- D. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2015).
- E. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2016.
- F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.
- H. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.
- I. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
 - 2. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
 - 3. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.
 - 4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.
- B. Sequencing:
 - 1. Do not install wiring devices until final surface finishes and painting are complete.

1.5 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1.6 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Products: Listed, classified, and labeled as suitable for the purpose intended.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.1 WIRING DEVICE APPLICATIONS

- A. Provide wiring devices suitable for intended use and with ratings adequate for load served.
- B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.
- C. Provide weather resistant GFCI receptacles with specified weatherproof in use covers for receptacles installed outdoors or in damp or wet locations.
- D. Provide tamper resistant receptacles.
- E. Provide GFCI protection for receptacles installed within 6 feet of sinks.
- F. Provide GFCI protection for receptacles serving electric drinking fountains.
- G. Unless noted otherwise, do not use combination switch/receptacle devices.

2.2 WIRING DEVICE FINISHES

- A. Provide wiring device finishes as described below unless otherwise indicated.
- B. Wiring Devices, Unless Otherwise Indicated: White withstainless steel wall plate, Verification during submittal process.

2.3 MANUFACTURERS:

- A. Hubbell Incorporated: www.hubbell.com/#sle.
- B. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
- C. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.
- D. Eaton (Arrow Hart).
- E. Substitutions: See Section 01 60 00 - Product Requirements.

2.4 SOURCE LIMITATIONS

- A. Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.5 PRODUCT GRADE:

- A. Receptacles: Unless indicated otherwise, Commercial specification grade.

2.6 RECEPTACLES

- A. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
 - 1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
 - 2. NEMA configurations specified are according to NEMA WD 6.
- B. Convenience Receptacles:
 - 1. Standard Convenience Receptacles: 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
 - 2. Weather Resistant Convenience Receptacles: 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

3. Tamper Resistant Convenience Receptacles: 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.
- C. GFCI Receptacles:
 1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
 - a. Provide test and reset buttons of same color as device.
 2. Standard GFCI Receptacles: duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
 3. Weather Resistant GFCI Receptacles: duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.
 4. Tamper Resistant GFCI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.

2.7 WALL PLATES

- A. Wall Plates: Comply with UL 514D.
 1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
 2. Size: Standard.
 3. Screws: Metal with slotted heads finished to match wall plate finish.
- B. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel unless indicated otherwise by architect during submittal process.
- C. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.
- D. Weatherproof Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.
- E. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130.
- B. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of wiring devices provided under this section. Unless otherwise indicated, measurements are to center line of device.
 1. Mounting Heights: Unless otherwise indicated, as follows:
 - a. Receptacles: 18 inches above finished floor or 6 inches above counter where indicated.
 2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
 3. Where multiple receptacles are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
 4. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.
- C. Install wiring devices in accordance with manufacturer's instructions.
- D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- E. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.
4. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
5. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.
 - d. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
- F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.
- G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- H. For isolated ground receptacles, connect wiring device grounding terminal only to identified branch circuit isolated equipment grounding conductor. Do not connect grounding terminal to outlet box or normal branch circuit equipment grounding conductor.
- I. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.
- J. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.
- K. Install wiring devices plumb and level with mounting yoke held rigidly in place.
- L. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.
- M. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- N. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.
- O. Identify wiring devices in accordance with Section 26 05 53.
 1. Unless instructed differently by Architect, Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.2 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect each wiring device for damage and defects.
- C. Test each receptacle to verify operation and proper polarity.
 1. Line voltage: Acceptable range is 105 to 132 V.
 2. Ground Impedance: Values of up to 2 ohms are acceptable.
 3. Voltage Drop: Under 15A load, a value of 6 percent or higher is unacceptable.
- D. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.
 1. Test for tripping values specified in UL 1436 and UL 943

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**SECTION 26 27 26
WIRING DEVICES**

- E. Correct wiring deficiencies and replace damaged or defective wiring devices.
- F. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete

3.3 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.

3.4 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

SECTION 27 05 00
SUPPLEMENTAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes common work results for the following systems:

1. Structured cabling for voice and data
2. Grounding and bonding
3. Cable pathways
4. Cable management
5. Outfitting of communication equipment rooms.

1.2 RELATED WORK SPECIFIED UNDER OTHER DIVISIONS

- A. Foundations and pads required for equipment furnished under this Division.
- B. Field painting, except such painting as is required to maintain shop coat painting and factory finish painting.
- C. Flashing of conduits into roofing and outside walls.
- D. Heating, ventilating, and air conditioning equipment.
- E. Electrical service to equipment rooms.
- F. Cutting and patching for low voltage systems work, except for errors and omissions under this Division.

1.3 RELATED WORK - OWNER FURNISHED EQUIPMENT AND SYSTEMS

- A. Telephone system electronics.
- B. Data network electronics.
- C. Computer workstations, servers, printers, and other peripherals.

1.4 DEFINITIONS AND TERMS

- A. Trade association names and communications terminology are frequently abbreviated. The following acronyms or abbreviations may be referenced within this Section:
1. ANSI American National Standards Institute
 2. ASTM American Society for Testing Materials
 3. BICSI Building Industry Consulting Service International
 4. Designer Firm acquired by the Owner to design the Division 27 communications systems (synonymous with Consultant and Design Engineer).

- 5. FCC Federal Communications Commission
- 6. FM Factory Mutual
- 7. NEC National Electrical Code
- 8. NECA National Electrical Contractors Association
- 9. NEMA National Electric Manufacturers Association
- 10. NESC National Electrical Safety Code
- 11. NFPA National Fire Protection Association
- 12. OSHA Occupational Safety and Health Administration
- 13. RCDD Registered Communications Distribution Designer
- 14. RFP Request for Proposal
- 15. TDMM Telecommunications Distribution Methods Manual
- 16. TIA Telecommunications Industries Association
- 17. TR Telecommunications Room
- 18. UL Underwriters Laboratories
- 19. UTP Unshielded twisted pair

1.5 STANDARDS

- A. The Contractor's performance of the Work shall comply with applicable federal, state, and local laws, rules, and regulations. The Contractor shall give required notices, shall procure necessary governmental licenses, permits, and inspections and shall pay without burden to the Owner, all fees and charges in connection therewith unless specifically provided otherwise. In the event of a violation, the Contractor shall pay all fines and penalties, including attorney's fees and other defense costs and expenses in connection therewith.
- B. Federal Communications Commission
 - 1. Equipment requiring FCC registration or approval shall have received such approval and shall be appropriately identified.
- C. Codes, Standards, and Ordinances
 - 1. Design, manufacture, test, and install telecommunications cabling networks per manufacturer's requirements and in accordance with state codes, local codes, requirements of authorities having jurisdiction, and particularly the following standards:
 - a. NECA 1 – Standard for Good Workmanship in Electrical Construction, 2015
 - b. ANSI/TIA Standards:
 - 1) ANSI/TIA-568.0-E – Generic Telecommunications Cabling for Customer Premises, 2020
 - 2) ANSI/TIA-568.1-E – Commercial Building Telecommunications Infrastructure Standard, 2020
 - 3) ANSI/TIA-568.2-D – Balanced Twisted Pair Telecommunications Cabling and Components Standard, 2018
 - 4) ANSI/TIA-568.3-E – Optical Fiber Cabling and Components Standard, 2022
 - 5) ANSI/TIA-568.4-E - Broadband Coaxial Cabling and Components Standard, 2022
 - 6) ANSI/TIA-569-E – Telecommunications Pathways and Spaces, 2019
 - 7) ANSI/TIA-606-D – Administration Standard for Telecommunications Infrastructure, 2021
 - 8) ANSI/TIA-607-E – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises, 2019

- 9) ANSI/TIA-526.7-A – Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant, 2015
- 10) ANSI/TIA-526.14-D – Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant, 2023
- 11) ANSI/TIA-758-B – Customer-Owned Outside Plant Telecommunications Infrastructure Standard, 2012
- 12) ANSI C80.1 Rigid Steel Conduit, Zinc-Coated
- 13) ANSI C80-3 Electrical Metallic Tubing, Zinc-Coated
- c. NFPA-70 – National Electrical Code, 2017
- d. Install cabling in accordance with the most recent edition of BICSI® publications:
 - 1) BICSI – Telecommunications Distribution Methods Manual, 15th Edition
 - 2) BICSI – Information Technology Systems Installation Methods Manual, 7th Edition
- e. NEMA 250 Enclosures for Electrical Equipment (1000 V Maximum)
- f. NEMA-VE-1 – Metal Cable Tray Systems, 2009
- g. NEMA-VE-2 – Metal Cable Tray Installation Guidelines, 2006
- h. FCC 47 Part 68 Code of Federal Regulations, Title 47, Telecommunications
- i. IEEE National Electrical Safety Code (NESC); 2007
- j. ISO/IEC 11801 Information Technology - Generic Cabling for Customer Premises
- k. UL 1459 Underwriters Laboratories Standard for Safety – Telephone Equipment
- l. UL 1863 Underwriters Laboratories Standard for Safety – Communications Circuit Accessories
- m. ASTM E. 814 – Standard Test Method for Fire Tests of Penetration Firestop Systems
- n. American Society for Testing and Materials (ASTM): ASTM E. 814 – Standard Test Method for Fire Tests of Penetration Firestop Systems
- o. Underwriters Laboratories, Inc. (UL): UL 1479 – Tests of Through-Penetration Firestop Systems
- p. Americans with Disabilities Accessibility Guidelines, 2010.
- q. Code of Federal Regulations, Title 29, Chapter XVII, Part 1910 (OSHA).
- r. International Building Code (IBC).
- s. Applicable codes and directives of authorities having jurisdiction.
- 1) References to codes and standards called for in the Specifications refer to the latest edition, amendments, and revisions to the codes and standards in effect on the date of these Specifications.

- D. Federal, state, and local codes, rules, regulations, and ordinances governing the Work, are as fully part of the specifications as if herein repeated or hereto attached. If the Contractor should note items in the drawings or the specifications, construction of which would be code violations, promptly call them to the attention of the Owner's Representative in writing. Where the requirements of other sections of the specifications are more stringent than applicable codes, rules, regulations, and ordinances, the specifications shall apply.

1.6 QUALITY ASSURANCE

- A. General: The Contractor must meet all requirements or employ sub-contractors to meet all requirements as applicable to the project infrastructure requirements. No more than one level of sub-contractors is allowed. The Contractor must provide all sub-contractor information and

verification of requirements prior to acceptance of bid, or on-demand by the Airport ITS Department or the Project Designer.

- B. Contractor Experience: Current, active, and valid State Contractors License. Provide a copy of the Contractors License in the bid submission.
 - 1. Five, minimum, continuous years of experience.
 - 2. Five (minimum) completed projects similar in scope and cost. Provide a list of projects, including references, in the bid submission.
 - 3. Technicians qualified for the work. Provide evidence in the bid submission of Technician qualifications. Evidence shall consist of current BICSI and manufacturer certifications, manufacturer training certificates, industry training, relevant project experience, etc.
- C. The Contractor or approved sub-contractor shall be a Panduit Certified Installer capable of providing coverage under the Panduit Certification Plus System Warranty Program and Corning Cable Systems Network of Preferred Installers. The Contractor shall offer proof of certification by submitting a copy of the certification with the Bid.
- D. The Contractor shall have an experienced Project Manager on-site at all times when work is in progress on any project. The individual who represents the Contractor shall be the single point of contact between the Contractor and the Owner and shall be responsible for the entire project. This representative shall be able to communicate with the Owner or designated representative whenever requested throughout the life of the project.
- E. The Contractor shall have at least one (1) Registered Communications Distribution Designer (RCDD) on staff. The Contractor shall offer proof of RCDD certification by submitting a copy of the certification with the Bid. The Contractors RCDD shall be part of the Contractors team throughout the project to assist with shop drawings and other related technical issues.
- F. The Contractor's RCDD shall review all required work before commencing. The Contractor's RCDD shall oversee the installation and will have the end responsibility for the quality of the installation work performed. All submitted designs and or changes to the design shall be approved and signed off by the Contractor's RCDD.
- G. Installation and testing crews shall have completed all appropriate training in copper and fiber cabling installation as required by the manufacturer.
 - 1. The Contractor's installation technicians on site must have completed BICSI ITS Technician and Panduit/Corning training (as applicable to the project) within two years prior to the start of the job and hold current certifications for this training.
 - 2. The Contractor's installers on site, NOT including ITS Technicians, must have completed, at minimum, BICSI ITS Installer 2 (Copper or Fiber) within two years prior to the start of the job and hold current certifications for this training. One technician holding both the ITS Technician and ITS Installer does not satisfy this requirement.
 - 3. BICSI Certified Technicians and Installers must carry current certification cards at all times while on the jobsite and present them for verification at the request of EUG IT Infrastructure Team.
- H. All personnel performing the work of this Section shall be thoroughly familiar with the cabling methods outlined in the latest release of the BICSI TDMM (Building Industry Consulting Services International Telecommunications Distribution Methods Manuals).

- I. The Contractor shall provide all new UTP cable, optical fiber cable, innerduct, racks, cabinets, patch panels, cover plates, outlet boxes, related hardware, distribution, termination equipment, and any other appurtenances and equipment associated with this project.
- J. The Contractor shall be responsible for the proper placement of all cabling, racks, cabinets, patch panels, cover plates, outlet boxes, and related hardware, as well as all distribution, and termination equipment.
- K. The Contractor shall obtain the approval of the Design Consultant for the final layout of telecommunications rooms (TRs) and tenant wiring closets prior to the installation of any materials or equipment. Shop drawings showing proposed room layouts shall be submitted for approval before beginning installation.
- L. The Contractor shall be responsible to the Owner for the acts and omissions of its employees, subcontractors and their agents and employees, and other persons performing any of the work under a contract with the Contractor.
- M. The installed cabling systems shall not generate nor be susceptible to any harmful electromagnetic emission, radiation, or induction that degrades cabling systems.
- N. Expansion Capability: Unless otherwise indicated, provide spare positions in-wall fields, cross-connects, and terminal strips, and space in cable pathways to accommodate fifty (50) percent future growth in campus distribution and riser.
- O. Backward Compatibility: The provided solution shall be backward compatible with lower category ratings such that if higher category components are used with lower category components, the permanent link and channel measures shall meet or exceed the lower channel's specified parameters.
- P. Component Compliance: The provided solution's components shall each meet the minimum transmission specifications listed herein such that no individual component will be less than specifications for permanent and channel, regardless of the fact that tests for permanent and channel ultimately meet required specifications.
- Q. Pre-installation inspection: Visually inspect all cables, cable reels, and shipping cartons to detect possible cable damage incurred during shipping and transport.
- R. Test optical fiber cable while on reels. Use an optical time-domain reflectometer (OTDR) to verify the cable length and locate cable defects, splices, and connectors, including the loss value of each.
- S. Test each pair of UTP cable for open and short circuits. Test results to be submitted to the Owner.
- T. Visibly damaged goods are to be returned to the supplier and replaced at no additional cost to the Owner.

1.7 PRE-INSTALLATION CONFERENCE

- A. Arrange and schedule a pre-installation conference prior to beginning any work of this section.
- B. Agenda: Clarify questions in writing related to work to be performed, scheduling, coordination, etc. with the Consultant and/or Project Manager/Owner Representative.

- C. All individuals, who will be in an on-site supervisory capacity, shall be required to attend the pre-installation conference. This includes project managers, site supervisors and lead installers. Individuals who do not attend the conference will not be permitted to supervise the personnel that install, terminate, or test communications cables on the project. The Contractor's RCDD that will oversee the installation is required to attend the pre-installation conference.
- D. The manufacturer that will be providing the extended warranty is required to have a representative attend the pre-installation conference.

1.8 SEQUENCE AND SCHEDULING

- A. The Contractor shall comply with all scheduling requests established by the Owner, both prior to commencing Work, and during construction. The Contractor shall provide a detailed schedule of work to be performed. This schedule shall be submitted with the bid and if accepted will be used to track work status.
- B. Work should be scheduled not to interfere with day-to-day operations within the facility. Operations vary by area and should be given careful consideration in relation to the schedule.
- C. The successful Contractor for all or any portion of the work will be responsible for achieving a complete and fully functional installation on or before the contract scheduled completion date.
- D. Submit schedule for installation of equipment and cabling. Indicate delivery, installation, and testing for conformance to specific job completion dates. As a minimum, dates are to be provided for bid award, installation start date, completion of station cabling, completion of riser cabling, completion of testing and labeling, cutover, completion of the final punch list, the start of demolition, Owner acceptance, and demolition completion.

1.9 SUBMITTALS

- A. Comply with provisions of Division 01.
- B. Before any work commences, submit the following items for approval by the Designer and Owner:
 - 1. Detailed bill-of-materials listing all manufacturers, part numbers, and quantities that the Contractor proposes to use in this project.
 - 2. Letter of approval or other certification from the manufacturer indicating the Contractor is a manufacturer certified installer of the proposed cabling system(s) (submit with a list of materials).
 - 3. Manufacturer datasheets for proposed products to be used on this project.
 - 4. Manufacturer instructions for storage, handling, protection, examination, preparation, operation, and installation of all products. Include any application conditions or limitations of use stipulated by any product testing agency.
 - 5. All applicable Material Safety Data Sheets.
 - 6. All factory test information of cables prior to installation of the product.
 - 7. All proposed labeling materials and nomenclature for approval.
 - 8. Shop Drawings for other Division 27 sections.
 - 9. Shop Drawings:
 - a. Indicate locations where space is limited for installation and access.

- b. Submit floor plans, elevations, and details indicating major equipment and end device locations of equipment to be provided by this Contractor to interface to new and existing systems.

1.10 ALTERNATES, SUBSTITUTIONS AND CHANGE ORDERS

- A. If a proposed alternate material is equal to or exceeds specified requirements, the Contractor shall provide the manufacturer's specifications in writing for written approval prior to the purchase and installation of proposed materials. The proposed material substitution shall not void or change the manufacturer's warranty.
- B. Under no circumstances shall the Owner be required to prove that an item proposed for substitution is not equal to the specified item. It shall be mandatory that the Contractor submits to Designer all evidence to support the contention that the item proposed for substitution is equal to the specified item. The Owner's decision as to the equality of substitution shall be final and without further recourse.
- C. In the event that the Design Consultant is required to provide additional design services as a result of a substitution of equivalent materials or equipment by the Contractor, or changes by the Contractor in dimension, weight, power requirements, etc., of the equipment and accessories, furnished, or if the Design Consultant is required to examine and evaluate any changes proposed by the Contractor for the convenience of the Contractor, then the Design Consultant's expenses in connection with such additional services shall be paid by the Contractor and may be deducted from any moneys owed to the Contractor.
- D. The Contractor shall provide complete cabling infrastructure according to these written specifications and drawings. If the Owner changes the scope of work to be performed by the Contractor, it shall be in writing. The Contractor shall respond to these changes with a complete material list, labor, and taxes in writing presented to the Owner for approval. The Contractor shall not proceed with additional scope of work without a signed approval by the Owner.
- E. Additional work performed by the Contractor will not be paid by Owner without signed approval of these changes prior to implementing changes. Submit a copy of signed change order upon billing.

1.11 USE OF THE SITE

- A. Use of the site shall be at the Owner's direction in matters in which the Owner deems it necessary to place restrictions.
- B. Access to building wherein the Work is performed shall be as directed by the Owner.
- C. The Owner will occupy the premises during the entire period of construction for conducting his or her normal business operations. Cooperate with the Owner to minimize conflict and to facilitate the Owner's operations.
- D. Schedule necessary shutdowns of plant services with the Owner and obtain written permission from the Owner. Refer to article - CONTINUITY OF SERVICES herein.
- E. Proceed with the Work without interfering with ordinary use of streets, aisles, passages, exits, and operations of the Owner.

- F. All Contractor personnel must check in with the facilities engineering department and/or the General Contractor upon arrival and upon departure.
- G. The Contractor shall furnish an adequate supply of technicians and materials at all times, and shall perform the work in the most appropriate, expeditious, and economical manner consistent with the interests of the Owner.
- H. The Contractor shall not unreasonably encumber the site with any material or equipment. Operations shall be confined to areas permitted by law, permits, and contract documents.
- I. While working at the facility, the Contractor shall not block any entrances, egresses, or other passageways that are necessary for normal, safe operation. It should be noted that the Contractor is responsible to provide any lifts, hand trucks, etc. that it will need to transport its materials and equipment throughout the site.
- J. The Contractor shall protect all buildings, walls, floors, and property from damage resulting from the installation. Any and all damage to property shall be repaired by the Contractor at its expense. If the Contractor enters an area that has damage (not caused by the Contractor), the Contractor shall immediately bring this to the attention of the Owner's Representative so the area can be appropriately noted.
- K. Following each day's work, the Contractor shall clean up the areas in which it has been working and dump all trash in the appropriate designated areas.

1.12 DELIVERY AND STORAGE

- A. Insofar as possible, deliver items in manufacturers' original unopened packaging. Where this is not practical, cover items with protective materials, to keep them from being damaged. Use care in loading, transporting, unloading, and storage to keep items from being damaged.
- B. Store items in a clean dry place and protect from damage.
- C. Storage space on project site may be limited. Contractor shall coordinate delivery and arrange storage of materials and equipment with the Owner.
- D. Components sensitive to damage in a harsh environment shall be stored off-site and delivered as needed.
- E. Provide protective covering during construction to prevent damage or entrance of foreign matter.
- F. Contractor is responsible for on-site security of tools, test equipment and materials.
- G. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

1.13 CONTRACTOR CLOSE OUT SUBMITTALS

- A. Submit Closeout documentation within 30 days of substantial completion and in accordance with Division 1 of the Project Manual and any applicable supplements. The number of submittal sets required is the greater of either the requirements of Division 1 of the Project Manual, or a minimum of five (5) sets.

1. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues.
2. Test reports on all copper and optical fiber cables (electronic file format and hard copy).
3. As-built cable schedules with recorded cable routing and lengths of each designated run.
4. As built documentation of all cabling systems.
5. As built documentation of telecommunication room (TR) modifications and associated cabinet elevations.

B. Warranty and Maintenance:

1. Test Report Binder(s).
2. Record Drawings.

1.14 RECORD DRAWINGS

- A.** Keep a hard copy set of project drawings at the job site exclusively for recording deviations from the Construction Drawings.
- B.** Project Record Documents required include:
1. Marked-up copies of Contract Drawings.
 - a. Record locations and depths of buried and concealed conduits from fixed, easily identifiable objects, such as building walls. Where conduits are concealed in walls, indicate distances off of building corners or other building features not likely to be disturbed by future alterations.
 - b. Mark deviations in a different color so that work of various systems can be easily identified.
 2. Newly prepared Drawings.
 3. Marked-up copies of Specifications, Addenda and Change Orders.
 4. Marked-up Project Data submittals.
 5. Record Samples.
 6. Field records for variable and concealed conditions.
 7. Record information on Work that is recorded only schematically.
 8. As-built drawings.
- C.** Post changes and modifications to the Documents as they occur. Drawings will be updated electronically and submitted to the Owner in accordance with the schedule provided for this by the Owner. Do not wait until the end of the Project. Design Consultant will periodically review Project Record Documents to assure compliance with this requirement.
- D.** At every quarter, submit Project Record Documents to Design Consultant for the Owner's records.
1. Upon completion of the as built drawings, the Design Consultant will review the as built work with the Contractor.
 2. If the as built work is not complete, the Contractor will be so advised and shall complete the work as required.
- E.** Project Record Drawings shall also be submitted in electronic format. Electronic drawing format shall be Autodesk Revit 2020. The Owner shall have the right and capability to manipulate all electronic file drawings and documentation.

- F. When Work is completed, record all deviations in an electronic format usable to the Owner. Coordinate this format with the Owner.
- G. Submit two copies of completed record drawings on electronic media, such as thumb drive, to Owner's Representative for distribution.
- H. Submit a complete test plan (and subsequent test data) per ANSI/TIA-568 for all cabling.
 - 1. Submit (1) hardbound copies of all cable test results and one electronic compact disc.
 - 2. Submit calibration reports for all test equipment, the calibration shall be performed by a manufacturer certified calibration facility and be dated no more than sixty (60) days prior to the start of testing.

1.15 WARRANTY

- A. Materials and workmanship shall meet or exceed industry standards and be fully guaranteed for a minimum of fifteen (15) years from Final Acceptance. Cable integrity and associated terminations shall be thoroughly inspected, fully tested and guaranteed as free from defects, transpositions, opens, shorts, tight kinks, damaged jacket insulation, etc.
 - 1. All labor must be thoroughly competent and skilled, and all work shall be executed in strict accordance with the best practice of the trades.
 - 2. The Contractor shall be responsible for and make good, without expense to the Owner, any and all defects arising during this warranty period that are due to imperfect materials, appliances, improper installation or poor workmanship.
- B. The Contractor shall submit a copy of all manufacturer warranty information.
- C. The structured cabling system manufacturer of the cable products to be submitted shall provide a minimum fifteen (15) year extended product warranty and application assurance (system performance warranty). The warranty shall provide the following:
 - 1. Ensure against all product defects.
 - 2. Ensure that all copper and fiber approved cabling and components meet or exceed the specifications of ANSI/TIA-568 and ISO/IEC IS 11801.
 - 3. Ensure that the installation of copper and fiber components will meet or exceed the loss and bandwidth requirements of ANSI/TIA-568 and ISO/IEC IS 11801 for a fifteen-year period.
 - 4. Cover the repair or replacement of defective products, and the labor for repair or replacement of such defective products.
 - 5. Application assurance that shall cover the failure of the cabling system to support the application which it was designed to support, as well as additional applications introduced in the future by recognized standards or user forums that use the ANSI/TIA-568 or ISO/IEC IS 11801 component and link/channel specifications.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. All materials and equipment used in carrying out these specifications are to be new and have a UL or FM listing, or a listing by other recognized testing laboratory when such listings are available.
 - 1. This listing requirement applies to the entire assembly.
 - 2. Application and installation of all equipment and materials shall be in accordance with such labeling and listing. Any modifications to equipment to suit the intent of the specifications shall be performed in accordance with these requirements.
- B. Equipment shall meet all applicable FCC Regulations.
- C. Model numbers and manufacturers included in this specification are listed to establish as standard of product quality.
- D. The listing of a manufacturer as "acceptable" does not indicate acceptance of a standard or catalogued item of equipment. All equipment and systems must conform to the Specifications.
- E. Other qualified manufacturers may be substituted only with the Owner's written consent. To request a substitution, the Contractor shall submit complete technical data, samples, and if requested, results of independent testing laboratory tests of proposed equipment.
 - 1. If proposed System includes equipment other than specified model numbers, submit a list of major items and their quantities, with a one-line schematic diagram for review.
 - 2. Material not specifically identified within this document, but which is required for the successful implementation of the intended system(s), shall be of the same class and quality as the specified material and equipment.
 - 3. Include a list of previously installed projects using proposed equipment that are similar in nature to specified system.
- F. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for the final assembled unit.
 - 1. All components of an assembled unit need not be products of the same manufacturer.
 - 2. Constituent parts, which are alike, shall be from a single manufacturer.
 - 3. Components shall be compatible with each other and with the total assembly for intended service.
 - 4. The Contractor shall guarantee for a minimum of fifteen (15) years, the performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.
- G. Components of equipment shall bear the manufacturer's name or trademark, model number and serial number on a nameplate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.
- H. Major items of equipment that serve the same function must be the same make and model.
- I. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that a complete and fully operational system will result.

- J. Maximum standardization of components shall be provided to reduce spare part requirements.

PART 3 - EXECUTION

3.1 PREPARATION

- A. System installation and construction methods shall conform to the Owner's requirements, requirements of the State of North Carolina and all applicable building codes.
- B. Before construction work commences, the Contractor shall visit the site and identify the exact routing for all horizontal and backbone pathways.
- C. The maximum allowable Category 6/6A UTP cable distance (as measured by electronic UTP test equipment) between the wall outlet and the serving port on the Ethernet switch in the serving IDF is 90 meters. Planned horizontal cable conduit runs that will result in a cable run that exceeds 90 meters shall be pointed out to Designer before they are installed for appropriate redesign or waiver.
- D. The Contractor shall use existing conduit and surface raceway where possible and practicable. All work shall be concealed above ceilings and in walls, below slabs, and elsewhere throughout building. If concealment is impossible or impractical, Designer shall be notified before starting that part of the work. In areas with no ceilings, install only after Design Consultant reviews and comments on arrangement and appearance.
- E. Provide easy, safe, and code mandated clearances at equipment racks and enclosures, and other equipment requiring maintenance and operation. All TR cabinets and racks shall be mounted a minimum of 36-inches from the wall, any wall mounted equipment, other cabinets, equipment, or power panels (or per NEC for voltages exceeding 120VAC).
- F. Where required, the Contractor shall be responsible for cutting, patching, coring, and associated work for the complete cabling system at no additional cost to the Owner. Cut and drill from both sides of walls to eliminate splaying. Patch adjacent existing work disturbed by installation of new work. Cut openings in prefabricated construction units in accordance with manufacturer's instructions.
- G. All conduit and sleeve openings used by the Contractor shall be waterproofed or fireproofed in compliance with state and local building and fire codes.
- H. The Contractor shall patch all openings remaining around and inside all conduit, sleeves, and cable penetrations to maintain the integrity of any fire rated wall, ceiling, floor, etc. The firestop system shall consist of a dielectric, water resistant, non-hardening, permanently pliable/re-enterable putty along with the appropriate damming materials (where required). The sealant must be capable of being removed and reinstalled, must adhere to all penetrants and common construction materials, and shall be capable of allowing normal wire/cable movement without being displaced.
- I. All building conduits and sleeves installed and/or used under these Specifications shall be firestopped, or re-firestopped, upon cable placement through such passageways.
- J. The Contractor shall seal all foundation penetrating conduits and all service entrance conduits and sleeves to eliminate the intrusion of moisture and gases into the building. This requirement also includes spare conduits designated for telecommunications use.

1. Spare conduits shall be plugged with expandable plugs.
2. All service entrance conduits through building shall be sealed or resealed upon cable placement.

3.2 INSPECTION

- A. The Contractor shall perform a detailed inspection of the site prior to submitting any technical data for approval.
- B. The Contractor shall verify that the proposed equipment and methods of installation are compatible with the existing conditions and prepare a corresponding written report of their findings.
- C. The Owner shall be notified in writing if modifications of the existing building are required in order to accommodate the new equipment. These modifications shall be made only upon receiving written approval from the Owner.
- D. Submit installation drawings for review and approval.

3.3 COORDINATION

- A. Insofar as it is possible to determine in advance, advise the General Contractor to leave proper chases and openings. Place all outlets, anchors, sleeves, and supports prior to pouring concrete or installation of masonry work. Should the Contractor neglect doing this, any cutting and/or patching required is to be done at this Contractor's expense. Visit site and be informed of conditions under which work must be performed. No subsequent allowance will be made because of error or failure to obtain necessary information to completely estimate and perform work involved.
- B. Carefully coordinate with other divisions to ensure proper power requirements, grounding, fireproofing and interlocking controls between the fire alarm system, security system, and other Owner-furnished systems. Coordinate with all the Telecommunications, Mechanical, and Electrical Drawings. Verify with Design Consultant the exact location and mounting height of all equipment in finished areas, such as equipment racks and telecommunications devices.
- C. Where more than one trade is involved in an area, space or chase, all shall cooperate and install their own work to utilize the space equally between them in proportion to their individual requirements. There will be no priority schedule for trades. If, after installation of any equipment, piping, ducts, conduit, and boxes, it is determined that ample maintenance and passage space has not been provided, rearrange work and/or furnish other equipment as required for ample maintenance space. Any changes in the size or location of the material or equipment supplied or proposed that may be necessary in order to meet field conditions or in order to avoid conflicts between trades, shall be brought to the immediate attention of Designer and approval received before such alterations are made.
- D. Notify other tradesmen of any deviations or special conditions necessary for the installation of work. Interferences between works of various Contractors to be resolved prior to installation. Work installed not in compliance with specifications and drawings and without properly checking and coordinating as specified above shall, if necessary, be removed and properly reinstalled without additional cost to Owner.

- E. The Owner or the Owner's Representative shall be the mediating authority in all deviation and disputes arising on project.
- F. Coordinate with local telephone and cable service providers to assure that proper points of service, demarcation location and grounding requirements are in accordance with contract drawings. Duct bank is to be provided by Division 26 and/or Civil. This Contractor shall be involved regarding discussions about services to the building.
 - 1. Coordinate with other trades to provide wall and ceiling access panels wherever required for access to communication equipment.
- G. Intent:
 - 1. These sections of specifications and drawings form a complete set of documents for communications systems for this project. Neither is complete without the other. Any item mentioned in one shall be as binding as though mentioned in both.
 - 2. The intent of these specifications and drawings is to form a guide for a complete systems installation. Where an item is reasonably necessary for a complete system but not specifically mentioned, such as pull boxes, fittings, expansion fittings, support hangers, etc. provide same without additional cost to Owner.
 - 3. Communication equipment room layouts indicated on drawings are diagrammatical only. Exact location of outlets and equipment to be coordinated and governed by project conditions. The Designer reserves the right to make any reasonable changes (approximately 6 feet) in location of junction boxes, or equipment prior to roughing in of such without additional cost to Owner.
- H. Deviations:
 - 1. No deviations from specifications and drawings to be made without full knowledge and consent of Designer.
 - 2. Should the Contractor find during progress of work that existing conditions make desirable a modification of the requirements of any particular item, report such item promptly to Designer for their decision and instructions.
- I. Main Horizontal Pathway/Raceway
 - 1. Unless otherwise noted on the drawings, all communications/low voltage systems cabling shall be routed above accessible corridor ceilings parallel to room walls and corridors via cable tray. Cabling shall be segregated by function as follows:
 - a. Voice/data cabling.
 - b. All other systems.

3.4 CONTINUITY OF SERVICES

- A. The Contractor shall not take any action that will interfere with, or interrupt, existing building services unless previous arrangements have been made with the Owner's Representative. Arrange the Work to minimize shutdown time.
- B. Owner's personnel will perform shutdown of operating systems. The Contractor shall give three (3) days' advance notice for systems shutdown.

- C. Should services be inadvertently interrupted, immediately furnish labor, including overtime, material, and equipment, necessary for prompt restoration of interrupted service.

3.5 PLYWOOD BACKBOARD AND WALL BACKING

- A. Contractor shall provide 4-foot wide, by 8-foot high, by 3/4-inch thick fire-retardant plywood backboard as indicated in all TRs. Plywood is to be painted with two coats of flat white fire-retardant paint on all six sides and installed as indicated on the drawings. The fire rating on the plywood shall be masked prior to painting and the mask removed after installation such that the fire rating is always visible for inspection.
- B. General Contractor is to provide appropriate backing in walls as required for mounting brackets and other wall mounted equipment per manufacturer requirements.
- C. Where work is to be done in an existing TR, the Contractor shall ensure plywood in the TR is flame retardant. If the existing plywood does not comply, the Contractor shall replace it with plywood compliant requirements above.

3.6 FIRESTOPPING

- A. Select appropriate type or types of through penetration firestop devices or systems appropriate for each type of communications penetration and base each selection on criteria specified herein.
- B. Selected systems shall not be less than the hourly time delay ratings indicated in the Contract Documents for each respective fire-rated floor, wall, or other partition of building construction. Firestop for each type of communications penetration shall conform to requirements of an independent testing laboratory design drawing or manufacturer's approved modification when used in conjunction with details shown on the Drawings.
- C. Perform all necessary coordination with trades constructing floors, walls, or other partitions of building construction with respect to size and shape of each opening to be constructed and device or system approved for use in each instance.
- D. Coordinate each firestop selection with adjacent Work for dimensional or other interference and for feasibility. In areas accessible to public, and other finished areas, firestop systems Work shall be selected, installed, and finished to the quality of adjacent surfaces of building construction being penetrated.
- E. Use materials that have no irritating or objectionable odors when firestopping is required in existing buildings and areas that are occupied.
- F. Provide damming materials, plates, wires, restricting collars, and devices necessary for proper installation of firestopping. Remove combustible installation aids after firestopping material has cured.
- G. All firestops shall be installed in accordance with the manufacturer's instructions in order to maintain the specific rating assigned by the independent testing laboratory.
- H. Existing raceways, cable trays, and cabling that penetrate existing building construction shall be firestopped to the extent necessary to fill cavities that may exist between existing building construction and existing communications penetrations or existing conduit sleeve, and between existing conduits and existing conduit sleeve.

- I. If required by inspecting authorities:
 - 1. Expose and remove firestopping to the extent directed by inspecting authority to permit his or her inspection.
 - 2. Reinstall new firestopping and restore Work where removed for inspection.

3.7 TESTS

- A. On completion of Work, installation shall be entirely free of damaged conductors, software errors, incomplete jack termination including labeling and faceplates and dust. Perform a thorough operation test in the presence of the Owner or their representative. Provide documentation of all test results as outlined in each system's specifications. Include labor, materials and instruments for above tests.
- B. Furnish to Owner, as a part of closing documents, a copy of such tests including identification of each cable. Provide the dedicated communication service ground test as required by each system's individual manufacturer, indicating compliance with their requirements.
- C. Prior to final observation and acceptance, test and leave in satisfactory operating condition, all systems and equipment including but not limited to the following:
 - 1. Grounding.
 - 2. Firestopping of all sleeves and conduits.
 - 3. Telephone and LAN systems.
 - 4. Turn in test results on cabling.

3.8 CLEANING

- A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, dust, and construction debris and repair damaged finish, including chips, scratches, and abrasions. This includes touching up paint removed for grounding.
- B. Contractor shall provide a clean work environment, free from trash/rubbish accumulated during and after cabling installation.
- C. Maintain construction materials and refuse within the area of work. Clean the work area at the end of each day.
- D. Contractor shall keep all liquids (drinks, Sodas, etc.) off finished floors, carpets, tiles, racks and equipment. If any liquid damage to above finishes or equipment occurs, Contractor shall provide professional services to clean or repair scratched/soiled finishes or damaged equipment at own expense.

3.9 INSPECTION FEES AND PERMITS

- A. Obtain and pay for all necessary permits and inspection fees required for communication systems installation. Work shall not start until all permit applications are approved.

3.10 OBSERVATIONS

- A. When field observation services are a part of the project scope, the Designer's office will provide periodic observation of the progress of Work specified herein. The purpose of the observation service is to ensure compliance of Contractor's Work with specifications and drawings. The Designer's office may also observe tests required of this Contractor as called for in other sections of the specifications.
- B. Specifications and drawings represent Work to be done in view of total project requirements. To eliminate possible conflict with other trades, final location of conduits, jacks, outlets, components, etc., is the responsibility of this Contractor. Contractor to provide all supervision required for his personnel to ensure that installation is made in accordance with specifications and drawings and all safety rules and regulations are observed. In event of conflicts of Work on project with other trades, Contractor is to make every reasonable effort to resolve conflict through meetings and discussions with other parties involved, by preparation of drawings, or other appropriate action. Only after this has been done shall the Designer's assistance be requested through the RFI process.
- C. When the Designer is requested to visit the project to aid in resolution of conflicts, or for witnessing tests, they shall be given a minimum of 48 hours' notice prior to time their presence is requested at job site.

3.11 WARRANTY-GUARANTEE

- A. The Designer reserves the right to accept or reject any part of the installation which does not successfully meet requirements as set out in these specifications.
- B. Contractor shall, and hereby does, guarantee all Work installed under this division shall be free from defects in workmanship and materials for a period of one year from date of final acceptance. This Contractor further agrees to repair or replace any defective material or workmanship which is or becomes defective within the terms of this warranty-guarantee.
- C. All surplus parts and pieces to the installation shall be maintained as a spare parts inventory at the building site. Parts replaced during the warranty period shall have a warranty matching that of the original part from the date of replacement.

END OF SECTION 27 05 00

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**SECTION 27 05 26
GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Division 01 Specification Sections, apply to this Section.
- B. Related Requirements:
 - 1. Section 27 05 00 "Supplemental Requirements for Communications."
 - 2. Section 27 05 28 "Pathways for Communication Systems."
 - 3. Section 27 05 29 "Hangers and Supports for Communications Systems."
 - 4. Section 27 05 44 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."
 - 5. Section 27 15 00 "Communications Horizontal Cabling."
 - 6. Section 27 42 19 "Public Information Display Systems."
- C. The current editions of the following documents are incorporated by reference into this Section and apply to all products used and all work performed pursuant to this Section:
 - 1. The National Electrical Code (NFPA 70)
 - 2. The National Life Safety Code (NFPA 101)
 - 3. The National Electrical Safety Code
 - 4. The National Electrical Installation Standards (NEIS)
 - 5. The BICSI TDMM (Telecommunications Distribution Methods Manual)
 - 6. The BICSI ITSIMM (Information Technology Systems Installation Methods Manual)
 - 7. UL 467 (Grounding and Bonding Equipment)
- D. All other codes, standards, or recommendations included in this Section are considered incorporated by reference in this Section

1.2 SUMMARY

- A. Section Includes:
 - 1. Grounding conductors.
 - 2. Grounding connectors.
 - 3. Grounding busbars.
 - 4. Grounding labeling.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. ITS: Information technology system.
- C. MGB: Main grounding busbar.
- D. NRTL: Nationally Recognized Testing Laboratory.
- E. PBB: Primary bonding busbar.

- F. RBB: Rack bonding busbar (ground bus in a rack or cabinet tied to the SBB or PBB).
- G. TBB: Telecommunication bonding backbone (connects PBB to SBBs)
- H. TBC: Telecommunication bonding conductor (connects PBB to MGB).
- I. TEBC: Telecommunication equipment bonding conductor (connects RBB to SBB or PBB).
- J. SBB: Secondary bonding busbar.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For communications equipment room signal reference grid. Include plans, elevations, sections, details, and attachments to other work.

1.5 INFORMATIONAL SUBMITTALS

- A. As-Built Data: Plans showing as-built locations of grounding and bonding infrastructure, including the following:
 - 1. TBC, RBB, SBB, PBB, and routing of their bonding conductors.
- B. Qualification Data: For Installer, installation supervisor, and field inspector.
- C. Qualification Data: For testing agency and testing agency's field supervisor.
- D. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in Section 01 78 00 "Closeout Submittals" include the following:
 - a. Result of the ground-resistance test measured at the point of TBC connection.
 - b. Result of the bonding-resistance test at each SBB, PBB and its nearest grounding electrode or building grounding structures.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: The Communications Contractor must meet ALL requirements or employ sub-contractors to meet all requirements as applicable to the project infrastructure requirement. No more than one level of sub-contractors is allowed. The Communications Contractor must provide all sub-contractor information and verification of requirements prior to acceptance of bid, or on demand by the Airport ITS Department or the Project Designer.
 - 1. Panduit Certified Installer capable of providing coverage under the Panduit Certification Plus System Warranty Program.
 - 2. Corning Cable Systems Network of Preferred Installers.

3. Uniprise Certified Installer Program capable of provide Warranty coverage under the CommScope Uniprise/Systimax program
4. 25% of the installation technicians on site must have completed BICSI ITS Technician and Panduit/CommScope training (as applicable to the project) within two years prior to the start of the job and hold current certifications for this training.
5. 25% of the installation technicians on site, NOT including ITS Technicians, must have completed, at minimum, BICSI ITS Installer 2 (Copper or Fiber) within two years prior to the start of the job and hold current certifications for this training.
6. One technician holding both the ITS Technician and ITS Installer does not satisfy the requirements.
7. The project manager for the project shall hold a BICSI RCDD credential.

PART 2 - PRODUCTS

2.1 SYSTEM COMPONENTS

- 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 UL 467 for grounding and bonding materials and equipment.
- C. Comply with ANSI/TIA-607-E.

2.2 CONDUCTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 1. Harger Lightning and Grounding.
 2. Panduit Corp.
 3. TE Connectivity Ltd.
- B. Comply with UL 486A-486B.
- C. Insulated Conductors: Stranded copper wire, green or green with yellow stripe insulation, insulated for 600 V, and complying with UL 83.
 1. Ground wire for custom-length equipment ground jumpers shall be No. 6 AWG, 19-strand, UL-listed, Type THHN wire.
 2. Cable Tray Equipment Grounding Wire: Minimum No. 6 AWG.
- D. Cable Tray Grounding Jumper:
 1. Not smaller than No. 6 AWG (26 kcmils) and no longer than 12 inches. If jumper is a wire, it shall have a crimped grounding lug with two holes and long barrel for two crimps. If jumper is a flexible braid, it shall have a one-hole ferrule. Attach with grounding screw or connector provided by cable tray manufacturer.
- E. Bare Copper Conductors:
 1. Solid Conductors: ASTM B 3.
 2. Stranded Conductors: ASTM B 8.
 3. Tinned Conductors: ASTM B 33.
 4. Bonding Cable: 28 kcmils (14 strands of No. 17 AWG conductor), and 1/4 inch in diameter.

5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Tinned-copper tape, braided conductors terminated with two-hole copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.3 CONNECTORS

- A. Irreversible connectors listed for the purpose. Listed by an NRTL as complying with NFPA 70 for specific types, sizes, and combinations of conductors and other items connected. Comply with UL 486A-486B.
- B. Manufacturers: Subject to compliance with requirements, provide products by the following:
 1. Burndy; Part of Hubbell Electrical Systems.
 2. Chatsworth Products, Inc.
 3. Harger Lightning and Grounding.
 4. Panduit Corp.
 5. Tyco Electronics Corp.
- C. Compression Wire Connectors: Crimp-and-compress connectors that bond to the conductor when the connector is compressed around the conductor. Comply with UL 467.
 1. Electroplated tinned copper, C and H shaped.
- D. Signal Reference Grid Connectors: Combination of compression wire connectors, access floor grounding clamps, bronze U-bolt grounding clamps, and copper split-bolt connectors, designed for the purpose.
- E. Busbar Connectors: Cast silicon bronze, solderless compression or exothermic-type, mechanical connector; with a long barrel and two holes spaced on 5/8- or 1-inch centers for a two-bolt connection to the busbar.
- F. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.4 GROUNDING BUSBARS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 1. Chatsworth Products, Inc.
 2. Harger Lightning and Grounding.
 3. Panduit Corp.
- B. Rack and Cabinet Grounding Busbars: Rectangular bars of hard-drawn solid copper, accepting conductors ranging from No. 14 to No. 2/0 AWG, NRTL listed as complying with UL 467, and complying with ANSI/TIA-607-E. Predrilling shall be with holes for use with lugs specified in this Section.
 1. RBB: Terminal block, with stainless-steel or copper-plated hardware for attachment to the rack or cabinet.
 2. Horizontal RBB: Designed for mounting in 19-inch equipment racks. Include a copper splice bar for transitioning to an adjoining rack, and stainless-steel or copper-plated hardware for attachment to the rack.
 3. Vertical RBB: 72 or 36 inches stainless-steel or copper-plated hardware for attachment to the rack.

- C. PBB: Predrilled, wall-mounted, rectangular bars of hard-drawn solid copper, 1/4 x 4-inch in cross section, length as indicated on Drawings. The busbar shall be NRTL listed for use as PBB and shall comply with ANSI/TIA-607-E.
 - 1. Predrilling shall be with holes for use with lugs specified in this Section.
 - 2. Mounting Hardware: Stand-off brackets that provide a 4-inch clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.
 - 3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.
- D. SBB: Predrilled rectangular bars of hard-drawn solid copper, 1/4-inch x 2-inch in cross section, length as indicated on Drawings. The busbar shall be for wall mounting, shall be NRTL listed as complying with UL 467, and shall comply with ANSI/TIA-607-E.
 - 1. Predrilling shall be with holes for use with lugs specified in this Section.
 - 2. Mounting Hardware: Stand-off brackets that provide at least a 2-inch clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.
 - 3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.
- E. Rack and Cabinet Grounding Busbars: Rectangular bars of hard-drawn solid copper, accepting conductors ranging from No. 14 to No. 2/0 AWG, NRTL listed as complying with UL 467, and complying with ANSI/TIA-607-E. Predrilling shall be with holes for use with lugs specified in this Section.
 - 1. RBB: Terminal block, with stainless-steel or copper-plated hardware for attachment to the rack or cabinet.
 - 2. Horizontal RBB: Designed for mounting in 19-inch equipment racks. Include a copper splice bar for transitioning to an adjoining rack, and stainless-steel or copper-plated hardware for attachment to the rack.
 - 3. Vertical RBB: 72 or 36 inches stainless-steel or copper-plated hardware for attachment to the rack.

2.5 LABELING

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Brother International Corporation.
 - 2. HellermannTyton.
 - 3. Panduit Corp.
 - 4. Dymo,
 - 5. Or as acceptable to the Owner.
- B. Comply with ANSI/TIA-606-D and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the ac grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of the electrical system.
- B. Inspect the test results of the ac grounding system measured at the point of TBC connection.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with connection of the TBC only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Bonding shall include the ac utility power service entrance, the communications cable entrance, and the grounding electrode system. The bonding of these elements shall form a loop so that each element is connected to at least two others.
- B. Comply with NECA 1.
- C. Comply with ANSI/TIA-607-E.
- D. Comply with IEEE 1100, "Recommended Practice for Power and Grounding Electronic Equipment."
 - 1. 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.
 - 2. Bond shields and drain conductors to ground at only one point in each circuit.
- E. Signal Ground:
 - 1. For each system, establish the signal ground and label that location as such.
 - 2. Bond the signal ground to the alternating-current (ac) power system service by connecting to one of the following listed locations, using insulated No. 6 AWG, stranded, Type THHN wire:
 - a. Grounding bar in an electrical power panelboard if located in the same room or space as the signal ground.
 - b. Telecommunications grounding busbar.

3.3 APPLICATION

- A. Conductors: Install solid conductor for No. 8 AWG and smaller and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
 - 1. The bonding conductors between the SBB and structural steel of steel-frame buildings shall not be smaller than No. 6 AWG.
 - 2. The bonding conductors between the PBB and structural steel of steel-frame buildings shall not be smaller than No. 6 AWG.

- B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2 AWG minimum.
- C. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 - 4. Connections to Structural Steel: Welded connectors.
- D. Conductor Support:
 - 1. Secure grounding and bonding conductors at intervals of not less than 36 inches.
- E. Grounding and Bonding Conductors:
 - 1. Install in the straightest and shortest route between the origination and termination point, and no longer than required. The bend radius shall not be smaller than eight times the diameter of the conductor. No one bend may exceed 90 degrees.
 - 2. Install without splices.
 - 3. Support at not more than 36-inch intervals.
 - 4. Install grounding and bonding conductors in 3/4-inch PVC conduit until conduit enters a telecommunications room. The grounding and bonding conductor pathway through a plenum shall be in EMT. Conductors shall not be installed in EMT unless otherwise indicated.
 - a. If a grounding and bonding conductor is installed in ferrous metallic conduit, bond the conductor to the conduit using a grounding bushing that complies with requirements in Section 27 05 28 "Pathways for Communications Systems General," and bond both ends of the conduit to SBB.

3.4 GROUNDING ELECTRODE SYSTEM

- A. The TBC between the PBB and the ac service equipment ground shall not be smaller than No. 1/0 AWG.

3.5 GROUNDING BUSBARS

- A. Indicate locations of grounding busbars on Drawings. Install busbars horizontally, on insulated spacers 2 inches minimum from wall, 12 inches above finished floor unless otherwise indicated.
- B. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

3.6 CONNECTIONS

- A. Bond metallic equipment in a telecommunications equipment room to the grounding busbar in that room, using equipment grounding conductors not smaller than No. 6 AWG.
- B. Stacking of conductors under a single bolt is not permitted when connecting to busbars.
- C. Assemble the wire connector to the conductor, complying with manufacturer's written instructions and as follows:

1. Use crimping tool and the die specific to the connector.
 2. Pre-twist the conductor.
 3. Apply an antioxidant compound to all bolted and compression connections.
- D. Primary Protector: Bond to the PBB with insulated bonding conductor.
- E. Interconnections: Interconnect all SBBs with the PBB using the TBB. If more than one PBB is installed, interconnect PBBs using the grounding equalizer conductor. The TBC and grounding equalizer conductor size shall not be less than 2 kcmils/linear foot of conductor length, up to a maximum size of No. 3/0 AWG unless otherwise indicated.
- F. Telecommunications Enclosures and Equipment Racks: Bond metallic components of enclosures to the RBB. Install RBB unless the enclosure and rack are manufactured with the busbar. Bond the equipment grounding busbar to the SBB No. 2 AWG TEBCs.
- G. Structural Steel: Where the structural steel of a steel frame building is readily accessible within the room or space, bond each SBB and PBB to the vertical steel of the building frame.
- H. Electrical Power Panelboards: Where an electrical panelboard for telecommunications equipment is located in the same room or space, bond each SBB to the ground bar of the panelboard.
- I. Shielded Cable: Bond the shield of shielded cable to the SBB in communications rooms and spaces in accordance with ANSI/TIA-607-E. Comply with ANSI/TIA-568.2-D when grounding screened, balanced, twisted-pair cables.
- J. Rack- and Cabinet-Mounted Equipment: Bond powered equipment chassis to the RBB. Power connection shall comply with NFPA 70; the TEBC in the power cord of cord- and plug-connected equipment shall be considered as a supplement to bonding requirements in this Section.
- K. Access Floors: Bond all metal parts of access floors to the SBB.
- L. Equipment Room Signal Reference Grid: Provide a low-impedance path between telecommunications cabinets, equipment racks, and the reference grid, using No. 6 AWG bonding conductors.
1. Install the conductors in grid pattern on 4-foot centers, allowing bonding of one pedestal from each access floor tile.
 2. Bond the SBB of the equipment room to the reference grid at two or more locations.
 3. Bond all conduits and piping entering the equipment room to the SBB at the perimeter of the room.
- 3.7 IDENTIFICATION
- A. In addition to items specified in Section 26 05 53 "Identification for Electrical Systems", include the following:
1. Labels shall be preprinted or computer-printed type.
 - a. Label PBB(s) with "fs-PBB," where "fs" is the telecommunications space identifier for the space containing the PBB.
 - b. Label SBB(s) with "fs-SBB," where "fs" is the telecommunications space identifier for the space containing the SBB.

- c. Label the TBC and each telecommunications backbone conductor at its attachment point: "WARNING! TELECOMMUNICATIONS BONDING CONDUCTOR. DO NOT REMOVE OR DISCONNECT!"

3.8 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. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 - 2. Test the bonding connections of the system using an ac earth ground-resistance tester, taking two-point bonding measurements in each telecommunications equipment room containing a PBB and a SBB and using the process recommended by BICSI TDMM. Conduct tests with the facility in operation.
 - a. Measure the resistance between the busbar and the nearest available grounding electrode. The maximum acceptable value of this bonding resistance is 100 milliohms.
 - 3. Test for ground loop currents using a digital clamp-on ammeter, with a full-scale of not more than 10 A, displaying current in increments of 0.01 A at an accuracy of plus/minus 2.0 percent.
 - a. With the grounding infrastructure completed and the communications system electronics operating, measure the current in every conductor connected to the PBB and in each SBB. Maximum acceptable ac current level is 1 A.
- D. Excessive Ground Resistance: If resistance to ground at the TBC exceeds 5 ohms, notify Architect promptly and include recommendations to reduce ground resistance.
- E. Retest: Grounding system will be considered defective if it does not pass tests and inspections. Contractor to submit corrective action for approval..
- F. Reports: Prepare test and inspection reports and submit for approval.

END OF SECTION 27 05 26

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**SECTION 27 05 26
GROUNDING AND BONDING FOR
COMMUNICATIONS SYSTEMS**

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**SECTION 27 05 28
PATHWAYS FOR COMMUNICATIONS SYSTEMS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Division 01 Specification Sections, apply to this Section.
- B. Related Requirements:
 - 1. Section 27 05 00 "Supplemental Requirements for Communications."
 - 2. Section 27 05 26 "Grounding and Bonding for Communications Systems."
 - 3. Section 27 05 29 "Hangers and Supports for Communications Systems."
 - 4. Section 27 05 44 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."
 - 5. Section 27 15 00 "Communications Horizontal Cabling."
 - 6. Section 27 42 19 "Public Information Display Systems."
- C. The current editions of the following documents are incorporated by reference into this Section and apply to all products used and all work performed pursuant to this Section:
 - 1. The National Electrical Code (NFPA 70)
 - 2. The National Life Safety Code (NFPA 101)
 - 3. The National Electrical Safety Code
 - 4. The National Electrical Installation Standards (NEIS)
 - 5. The BICSI TDMM (Telecommunications Distribution Methods Manual)
 - 6. The BICSI ITSIMM (Information Technology Systems Installation Methods Manual)
 - 7. UL 467 (Grounding and Bonding Equipment)
- D. All other codes, standards, or recommendations included in this Section are considered incorporated by reference in this Section
- E. Conflicts
 - 1. Between referenced requirements: Comply with the one establishing the more stringent requirements.
 - 2. Between referenced requirements and contract documents: Comply with the one establishing the more stringent requirements.

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal conduits and fittings.
 - 2. Nonmetallic conduits and fittings.
 - 3. Optical-fiber-cable pathways and fittings.
 - 4. Metal wireways and auxiliary gutters.
 - 5. Hooks
 - 6. Power Poles
 - 7. Floor Ducts
 - 8. Boxes, enclosures, and cabinets.
- B. Related Requirements:

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1. Retain subparagraphs below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.
2. Electrical Drawings for "Grounding and Bonding for Electrical Systems."
3. Electrical Drawings for "Raceway and Boxes for Electrical Systems."

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing
- B. GRC: Galvanized rigid steel conduit.
- C. PVC: Polyvinyl chloride conduit.
- D. RNC: Rigid non-metallic conduit.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
 1. Surface pathways
 2. Wireways and fittings
 3. Boxes, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

- A. General: Comply with Section 01 40 00 "Quality Requirements."
- B. Coordination Drawings: Pathway routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
 1. Structural members in paths of pathway groups with common supports.
 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
- C. Qualification Data: For professional engineer.
- D. Reports: Source quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Scaled as built drawings identifying system routing, components and labeling.
 1. A laminated copy of the as built of the area served will be mounted in each closet.
- B. Scaled as built site plan of the entire site showing the updated backbone pathways.
 1. A laminated copy of the site as built will be mounted in the BEF.
- C. An electronic AutoCAD copy of the as built drawings delivered on CD.
- D. Warranty Documentation

1. Provide applicable warranty documentation.

1.7 WARRANTY

- A. All work referenced within the project specification will be warranted that all materials and equipment furnished under the contract are in good working order, free from defects, and in conformance with system specifications.
- B. All installations must conform to the manufacturer's official published specifications.
- C. The labor and material warranty shall begin at the systems acceptance date and remain in effect for a period of 1 year from that date.
- D. The contractor agrees to repair, adjust, and/or replace (as determined by the Owner to be in its best interest) any defective equipment, materials, or other parts of the system at the contractor's sole cost.
- E. The Owner will incur no costs for service or replacement of parts during the warranty period.
- F. All third-party warranties shall be passed through from the contractor to Owner.
- G. The Contractor will warrant and supply evidence that the installation of materials and hardware will be made in strict compliance with all applicable provisions of the National Electric Code, the rules and regulations of the Federal Communications Commission, and state and/or local codes or ordinances that may apply, as well as the requirements contained in the Owner's Standards.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 1. AFC Cable Systems, Inc.
 2. Allied Tube & Conduit.
 3. Alpha Wire Company.
 4. Anamet Electrical, Inc.
 5. Electri-Flex Company.
 6. O-Z/Gedney.
 7. Picoma Industries.
 8. Republic Conduit.
 9. Robroy Industries.
 10. Southwire Company.
 11. Thomas & Betts Corporation.
 12. Western Tube and Conduit Corporation.
 13. Wheatland Tube Company.
- B. General Requirements for Metal Conduits and Fittings:
 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Comply with ANSI/TIA-569-E.
- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

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1. Comply with NEMA FB 1.
 2. Coating Thickness: 0.040-inch, minimum.
- E. EMT: Comply with ANSI C80.3 and UL 797.
- F. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
1. Coordinate "Conduit Fittings for Hazardous (Classified) Locations" Subparagraph below with Drawings.
 2. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
 3. Fittings for EMT:
 - a. Material: steel.
 - b. Type: compression.
 4. Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where, installed, and including flexible external bonding jumper.
 5. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.
- G. Joint Compound for GRC, or EMT: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. AFC Cable Systems, Inc.
 2. Allied Tube & Conduit.
 3. Anamet Electrical, Inc.
 4. Arnco Corporation.
 5. CANTEX Inc.
 6. CertainTeed Corporation.
 7. Condux International, Inc.
 8. Electri-Flex Company.
 9. Kraloy.
 10. Lamson & Sessions; Carlon Electrical Products.
 11. Niedax-Kleinhuis USA, Inc.
 12. RACO; Hubbell.
 13. Thomas & Betts Corporation.
- B. General Requirements for Nonmetallic Conduits and Fittings:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Electrical Drawings for "Raceway and Boxes for Electrical Systems."
- C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- D. Rigid HDPE: Comply with UL 651A.
- E. Continuous HDPE: Comply with UL 651B.
- F. RTRC: Comply with UL 2420 for below ground, UL 2515 for above ground and NEMA TC 14.

- G. Fittings for RNC. Comply with NEMA TC 3; match to conduit or tubing type and material.
- H. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- I. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 OPTICAL-FIBER-CABLE PATHWAYS AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Alpha Wire Company.
 - 2. Arnco Corporation.
 - 3. Endot Industries Inc.
 - 4. IPEX.
 - 5. Lamson & Sessions; Carlon Electrical Products.
- B. Description: Comply with UL 2024; flexible-type pathway, approved for plenum, riser or general-use installation unless otherwise indicated.
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Comply with ANSI/TIA-569-E.

2.4 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Cooper B-Line, Inc.
 - 2. Hoffman.
 - 3. Mono-Systems, Inc.
 - 4. Square D.
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1, Type 3R, Type 4 or Type 12 unless otherwise indicated, and sized according to NFPA 70.
 - 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Comply with ANSI/TIA-569-E.
- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Hinged type, Screw-cover type or Flanged-and-gasketed type unless otherwise indicated.
- E. Finish: Manufacturer's standard enamel finish.

2.5 HOOKS

- A. Description: Prefabricated sheet metal cable supports for telecommunications cable.

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- D. manufacturers. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Erico Caddy (Preferred).
 - 2. Alternate products are acceptable with engineer's / owner's prior approval.
 - a. Provide comparable product data sheet in addition to preferred product data sheet to engineer.
 - 3. Unapproved products and submissions not dated 10 days prior to bid due date will not be accepted.
- C. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- D. Comply with ANSI/TIA-569-E.
- E. Galvanized steel.
- F. J shape.
- G. Maintain a 40% or less fill capacity at installation.
- H. Hooks to be spaced not in excess of 5 feet between supports.
- I. Minimum horizontal clearance from the access side of the support is 12".
- J. Minimum of 12" clearance on all sides from any fluorescent lighting fixtures.

2.6 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Adalet.
 - 2. Cooper Technologies Company; Cooper Crouse-Hinds.
 - 3. EGS/Appleton Electric.
 - 4. Erickson Electrical Equipment Company.
 - 5. Hoffman.
 - 6. Lamson & Sessions; Carlon Electrical Products.
 - 7. Milbank Manufacturing Co.
 - 8. Molex; Woodhead Brand.
 - 9. Mono-Systems, Inc.
 - 10. O-Z/Gedney.
 - 11. Quazite; Hubbell Power Systems, Inc.
 - 12. RACO; Hubbell.
 - 13. Robroy Industries.
 - 14. Spring City Electrical Manufacturing Company.
 - 15. Stahlin Non-Metallic Enclosures.
 - 16. Thomas & Betts Corporation.
 - 17. Wiremold / Legrand.
- B. General Requirements for Boxes, Enclosures, and Cabinets:
 - 1. Comply with ANSI/TIA-569-E.

2. Boxes, enclosures and cabinets installed in wet locations shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for use in wet locations.
- C. Sheet-Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy or aluminum, Type FD, with gasketed cover.
- E. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- F. Metal Floor Boxes:
 1. Material: Cast metal or sheet metal.
 2. Type: Fully adjustable or Semi-adjustable.
 3. Shape: Rectangular.
 4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- G. Nonmetallic Floor Boxes: Nonadjustable, round or rectangular.
 1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- I. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum or galvanized, cast iron with gasketed cover.
- J. Device Box Dimensions:
 1. 4-11/16 inches square by 2-1/2 inches deep for data outlet boxes
 2. 5 inches square by 3-1/2 inches deep for Audio/Video and TV outlet boxes
- K. Gangable boxes are not allowed.
- L. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- M. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 4 with continuous-hinge cover with flush latch unless otherwise indicated.
 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 2. Nonmetallic Enclosures:
 - a. Material: Plastic or Fiberglass.
 - b. Finished inside with radio-frequency-resistant paint.
 3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- N. Cabinets:
 1. NEMA 250, Type 4, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 2. Hinged door in front cover with flush latch and concealed hinge.
 3. Key latch to match panelboards.

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4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.7 POWER POLES

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 1. Wiremold / Legrand,
 2. Hubble,
 3. Panduit Corp., and
 4. Or as acceptable to the EUG
- B. Provide 2-compartment tele-power poles at the locations shown in the floor plans for routing power and data cables. The power poles shall be sized to accommodate power and data cables entering the dispatch consoles and conference tables.
- C. Materials: Aluminum with clear anodized finished.
- D. Fittings and accessories: Dividers, end-caps, covers, cutouts, wiring harness, devices, mounting materials, and other fittings shall match and made with tele-power pole as required for complete system.
- E. Listed and labeled as defined in NFPA 70, by an NRT, and marked for intended location and application.
- F. Comply with ANSI/TIA-569-E.

2.8 IN-FLOOR FLUSH-DUCT

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 1. Wiremold / Legrand,
 2. Hubble,
 3. Panduit Corp., and
 4. Or as acceptable to the EUG
- B. Provide flush-duct in-floor raceways at the locations shown in the floor plans for routing power and data cables. The flush-duct in-floor shall be sized to accommodate power and data cables entering the dispatch consoles and conference tables.
- C. Materials: Aluminum with clear anodized finished.
- D. Fittings and accessories: Dividers, end-caps, covers, cutouts, wiring harness, devices, mounting materials, and other fittings shall match and made with tele-power pole as required for complete system.
- E. Listed and labeled as defined in NFPA 70, by an NRT, and marked for intended location and application.
- F. Comply with ANSI/TIA-569-E.

3.1 PATHWAY APPLICATION

- A. Outdoors: Apply pathway products as specified below unless otherwise indicated:
 - 1. Exposed Conduit: GRC.
 - 2. Concealed Conduit, Aboveground: GRC, EMT or RNC, Type EPC-40-PVC.
 - 3. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R or Type 4X based on location.
- B. Indoors: Apply pathway products as specified below unless otherwise indicated:
 - 1. Exposed, Not Subject to Physical Damage: EMT.
 - 2. Exposed, Not Subject to Severe Physical Damage: EMT identified for such use.
 - 3. Exposed and Subject to Severe Physical Damage: GRC. Pathway locations include the following:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 - 4. Concealed in Ceilings and Interior Walls and Partitions: EMT innerduct.
 - 5. Damp or Wet Locations: GRC.
 - 6. Pathways for Optical-Fiber or Communications Cable in Spaces Used for Environmental Air: EMT.
 - 7. Pathways for Optical-Fiber or Communications-Cable Risers in Vertical Shafts: EMT.
 - 8. Pathways for Concealed General-Purpose Distribution of Optical-Fiber or Communications Cable: EMT.
 - 9. Boxes and Enclosures: NEMA 250 Type 1, except use NEMA 250 Type 4X stainless steel or nonmetallic in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Pathway Size: 1-inch trade size. Minimum size for optical-fiber cables is 1 inch.
- D. All telecommunications conduits for Horizontal data cabling shall be factory anodized BLUE.
- E. All Telecommunications conduits for backbone cabling shall be factory anodized ORANGE
- F. Pathway Fittings: Compatible with pathways and suitable for use and location.
 - 1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 - 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 - 3. EMT: Use compression fittings. Comply with NEMA FB 2.10.
- G. Install surface pathways only where indicated on Drawings.
- H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

- A. Comply with the following standards for installation requirements except where requirements on Drawings or in this Section are stricter:
 - 1. NECA 1.
 - 2. NECA/BICSI 568.
 - 3. NECA 101.
 - 4. ANSI/TIA-569-E.
 - 5. NECA 102.
 - 6. NECA 105.
 - 7. NECA 111.
- B. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.
- C. Keep pathways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.
- D. Complete pathway installation before starting conductor installation.
- F. Comply with requirements in Section 27 05 29 "Hangers and Supports for Communications Systems" for support and fasteners.
- G. Comply with requirements in Section 27 05 44 "Sleeves and Sleeve Seals for Communications Pathways and Cabling" for sleeves and sleeve seals for communications.
- H. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- I. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches of changes in direction. Utilize long radius elbows for all optical-fiber cables.
- J. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- K. Support conduit within 12 inches of enclosures to which attached.
- L. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT, or RMC for pathways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- M. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.
- N. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.
- O. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.
- P. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

- Q. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- R. Cut conduit perpendicular to the length. For conduits of 2-inch trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.
- S. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground pathways designated as spare above grade alongside pathways in use.
- T. Surface Pathways:
 - 1. Install surface pathway for surface telecommunications outlet boxes only where indicated on Drawings.
 - 2. Install surface pathway with a minimum 2-inch radius control at bend points.
 - 3. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight pathway section. Support surface pathway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- U. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid, and flexible, as follows:
 - 1. 1-Inch Trade Size and Larger: Install pathways in maximum lengths of 75 feet.
 - 2. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- V. Install pathway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway sealing fittings according to NFPA 70.
- W. Install devices to seal pathway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service pathway enters a building or structure.
 - 3. Where otherwise required by NFPA 70.
- X. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.
- Y. Expansion-Joint Fittings:
 - 1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
 - 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

- a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
 - d. Interstitial Spaces: 135 deg F temperature change.
3. Formula in first subparagraph below provides about 15 percent safety factor (extra expansion-contraction capability).
 4. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
 5. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 6. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- Z. Hooks:
1. Size to allow a minimum of 40 percent or less fill capacity without exceeding design capacity limits.
 2. Shall be supported by dedicated support wires. Do not use ceiling grid support wire or support rods.
 3. Hook spacing shall allow no more than 6 inches of slack. The lowest point of the cables shall be no less than 6 inches adjacent to ceilings, mechanical ductwork and fittings, luminaires, power conduits, power and telecommunications outlets, and other electrical and communications equipment.
 4. Space hooks no more than 5 feet o.c.
 5. Provide a hook at each change in direction.
- AA. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- BB. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- CC. Horizontally separate boxes mounted on opposite sides of walls, so they are not in the same vertical channel.
- DD. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- EE. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- FF. Set metal floor boxes level and flush with finished floor surface.
- GG. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR COMMUNICATIONS PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 27 05 44 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

3.4 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies.
- B. Provide materials classified by UL to provide fire stopping equal to time rating of construction being penetrated.
- C. Comply with ANSI/TIA-569-E, Annex A, "Firestopping."
- D. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.5 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage or deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 27 05 28

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SECTION 27 05 29
HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

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.
- B. Related Requirements:
 - 1. Section 27 05 00 "Supplemental Requirements for Communications."
 - 2. Section 27 05 26 "Grounding and Bonding for Communications Systems."
 - 3. Section 27 05 28 "Pathways for Communication Systems."
 - 4. Section 27 05 44 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."
 - 5. Section 27 15 00 "Communications Horizontal Cabling."
 - 6. Section 27 42 19 "Public Information Display Systems."
- C. The current editions of the following documents are incorporated by reference into this Section and apply to all products used and all work performed pursuant to this Section:
 - 1. The National Electrical Code (NFPA 70)
 - 2. The National Life Safety Code (NFPA 101)
 - 3. The National Electrical Safety Code
 - 4. The National Electrical Installation Standards (NEIS)
 - 5. The BICSI TDMM (Telecommunications Distribution Methods Manual)
 - 6. The BICSI ITSIMM (Information Technology Systems Installation Methods Manual)
 - 7. UL 467 (Grounding and Bonding Equipment)
- D. All other codes, standards, or recommendations included in this Section are considered incorporated by reference in this Section

1.2 SUMMARY

- A. Section Includes:
 - 1. Steel slotted support systems for communication raceways.
 - 2. Conduit and cable support devices.
 - 3. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Slotted support systems, hardware, and accessories.
 - b. Clamps.
 - c. Hangers.

- d. Sockets.
- e. Eye nuts.
- f. Fasteners.
- g. Anchors.
- h. Saddles.
- i. Brackets.

- 2. Include rated capacities and furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

- A. Scaled as built drawings identifying system routing, components, and labeling.
 - 1. A laminated copy of the as built of the area served will be mounted in each closet.
- B. Scaled as built site plan of the entire site showing the updated backbone pathways.
 - 1. A laminated copy of the site as built will be mounted in the BEF.
- C. An electronic AutoCAD copy of the as built drawings delivered on thumb drive, to Owner's Representative for distribution.
- D. Warranty Documentation
 - 1. Provide applicable warranty documentation.

1.5 WARRANTY

- A. All work referenced within the project specification will be warranted that all materials and equipment furnished under the contract are in good working order, free from defects, and in conformance with system specifications.
- B. All installations must conform to the manufacturer's official published specifications.
- C. The labor and material warranty shall begin at the systems acceptance date and remain in effect for a period of 1 year from that date.
- D. The contractor agrees to repair, adjust, and/or replace (as determined by the Owner to be in its best interest) any defective equipment, materials, or other parts of the system at the contractor's sole cost.
- E. The Owner will incur no costs for service or replacement of parts during the warranty period.
- F. All third-party warranties shall be passed through from the contractor to Owner.
- G. The Contractor will warrant and supply evidence that the installation of materials and hardware will be made in strict compliance with all applicable provisions of the National Electric Code, the rules and regulations of the Federal Communications Commission, and state and/or local codes or ordinances that may apply, as well as the requirements contained in the Owner's Communications Infrastructure Standards.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design hanger and support system.
- B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame Rating: Class 1.
 - 2. Self-extinguishing according to ASTM D635.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch-diameter holes at a maximum of 8 inches o.c. in at least one surface.
 - 1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
 - 2. Material for Channel, Fittings, and Accessories: Galvanized steel.
 - 3. Channel Width: Selected for applicable load criteria.
 - 4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 5. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
 - 6. Channel Dimensions: Selected for applicable load criteria.
- B. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Powder-Actuated Fasteners: Threaded-steel stud for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - 2. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - 3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
 - 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
 - 5. Toggle Bolts: Stainless-steel springhead type.
 - 6. Hanger Rods: Threaded steel.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:
 - 1. NECA 1.
 - 2. NECA/BICSI 568.
 - 3. ANSI/TIA-569-E.
 - 4. NECA 101.
 - 5. NECA 105.

- B. Provide materials classified by UL to provide fire stopping equal to time rating of construction being penetrated and for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- C. Comply with requirements for pathways specified in Section 27 05 28 "Pathways for Communications Systems."
- D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with two-bolt conduit clamps.

3.2 SUPPORT INSTALLATION

- A. Raceway Support Methods: In addition to methods described in NECA 1, EMT may be supported by openings through structure members, according to NFPA 70.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten communications items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
 - 4. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- D. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 05 40 00 "Cold-Formed Metal Framing" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor communications materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

END OF SECTION 27 05 29

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**SECTION 27 05 44
SLEEVES AND SLEEVE SEALS FOR COMMUNICATION PATHWAYS AND CABLING**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Division 01 Specification Sections, apply to this Section.
- B. Related Requirements:
 - 1. Section 27 05 00 "Supplemental Requirements for Communications."
 - 2. Section 27 05 26 "Grounding and Bonding for Communications Systems."
 - 3. Section 27 05 28 "Pathways for Communication Systems."
 - 4. Section 27 05 29 "Hangers and Supports for Communications Systems."
 - 5. Section 27 05 44 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."
 - 6. Section 27 15 00 "Communications Horizontal Cabling."
 - 7. Section 27 42 19 "Public Information Display Systems."
- C. The current editions of the following documents are incorporated by reference into this Section and apply to all products used and all work performed pursuant to this Section:
 - 1. The National Electrical Code (NFPA 70)
 - 2. The National Life Safety Code (NFPA 101)
 - 3. The National Electrical Safety Code
 - 4. The National Electrical Installation Standards (NEIS)
 - 5. The BICSI TDMM (Telecommunications Distribution Methods Manual)
 - 6. The BICSI ITSIMM (Information Technology Systems Installation Methods Manual)
 - 7. UL 467 (Grounding and Bonding Equipment)
- D. All other codes, standards, or recommendations included in this Section are considered incorporated by reference in this Section

1.2 SUMMARY

- A. Section Includes:
 - 1. Sleeves for pathway and cable penetration of non-fire-rated construction walls and floors.
 - 2. Sleeve-seal systems.
 - 3. Sleeve-seal fittings.
 - 4. Grout.
 - 5. Silicone sealants.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. LEED Submittals:
 - 1. Product Data for Credit EQ 4.1: For sealants, documentation including printed statement of VOC content.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Wall Sleeves:
 - 1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
 - 2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.
- C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.
- E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- F. Sleeves For Rectangular Openings
 - 1. Material: Galvanized-steel sheet.
 - 2. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
 - b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 WALL PENETRATIONS

- A. Pathways: Intra-Building: Non-Firewall Penetrations
 - 1. Penetrations through non-fire-rated walls can use 4" bushed and reamed sleeves as the transition through walls and cable tray runs or a non-listed penetrating device rated for smoke and noise. The number of sleeves will be dependent upon the quantity of cables to be supported while maintaining 40% or less fill capacity. 12" x 4" cable tray requires four 4" sleeves to penetrate walls without de-rating overall pathway capacity.
- B. Pathways: Intra-Building: Firewall Penetrations
 - 1. Firewall penetrations shall be made utilizing a fire-rated cable pathway, "Specified Technologies, Inc. EZ-Path Cable Pathway" or equivalent. The number of penetrations will be dependent upon the quantity of cables to be supported while maintaining a 40% or less fill capacity. Contractors shall follow the manufacturer's specific installation instructions

2.3 SLEEVE-SEAL SYSTEMS

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

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1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Advance Products & Systems, Inc.
 - b. CALPICO, Inc.
 - c. Metraflex Company (The).
 - d. Pipeline Seal and Insulator, Inc.
 - e. Proco Products, Inc.
2. Sealing Elements: EPDM or Nitrile (Buna N) rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel, Plastic or Stainless steel.
4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating or Stainless steel of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Presealed Systems.

2.5 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.6 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
 2. Sealant shall have VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
 - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint.
 - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall, so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and pathway or cable unless sleeve seal is to be installed.
 - 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
 - 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
 - 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Roof-Penetration Sleeves: Seal penetration of individual pathways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between pathway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at pathway entries into building.
- B. Install 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.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 27 05 44

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**SECTION 27 05 44
SLEEVES AND SLEEVE SEALS FOR
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**SECTION 27 15 00
COMMUNICATIONS HORIZONTAL CABLING**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Division 01 Specification Sections, apply to this Section.
- B. Related Requirements:
 - 1. Section 27 05 00 "Supplemental Requirements for Communications."
 - 2. Section 27 05 26 "Grounding and Bonding for Communications Systems."
 - 3. Section 27 05 28 "Pathways for Communication Systems."
 - 4. Section 27 05 29 "Hangers and Supports for Communications Systems."
 - 5. Section 27 05 44 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."
 - 6. Section 27 42 19 "Public Information Display Systems."

1.2 SUMMARY

- A. Section Includes:
 - 1. Horizontal cabling description.
 - 2. Performance requirements.
 - 3. UTP cable.
 - 4. UTP cable hardware
 - 5. 12-Strand single mode fiber cable.
 - 6. Single mode fiber cable hardware.
 - 7. Consolidation points.
 - 8. Telecommunications outlet/connectors.
 - 9. Public Address Microphone Paging System.
 - 10. Grounding.
 - 11. Identification products.
 - 12. Source quality control.

1.3 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. CATV: Community antenna television (or cable television).
- C. Consolidation Point: A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways.
- D. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- E. EMI: Electromagnetic interference.
- F. FTP: Shielded twisted pair.

- G. F/FTP: Overall foil screened cable with foil screened twisted pair.
- H. F/UTP: Overall foil screened cable with unscreened twisted pair.
- I. IDC: Insulation displacement connector.
- J. LAN: Local area network.
- K. Jack: Also commonly called an "outlet," it is the fixed, female connector.
- L. MUTOA: Multiuser telecommunications outlet assembly, a grouping in one location of several telecommunications outlet/connectors.
- M. NRTL: Nationally Recognized Testing Laboratory.
- N. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.
- O. Plug: Also commonly called a "connector," it is the removable, male telecommunications connector.
- P. RCDD: Registered Communications Distribution Designer.
- Q. Shield: A metallic layer, either a foil or braid, placed around a pair or group of conductors.
- R. S/FTP: Overall braid screened cable with foil screened twisted pair.
- S. S/UTP: Overall braid screened cable with unscreened twisted pairs.
- T. STP: Shielded twisted pair.
- U. TDMM: Telecommunications Distribution Methods Manual.
- V. UTP: Unshielded twisted pair.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate layout and installation of telecommunications cabling with Owner's telecommunications and LAN equipment and service suppliers.
- B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- 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:
 - a. Cross-connects.
 - b. Patch panels.
 - c. Patch cords.
5. Cross-connects and patch panels. Detail mounting assemblies and show elevations and physical relationship between the installed components.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.
- B. Certification: Panduit Certified Installer capable of providing coverage under the Panduit Certification Plus System Warranty Program.
- C. Source quality-control reports.
- D. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

- A. Scaled as built drawings identifying system routing, components and labeling.
- B. Maintenance Data: For splices and connectors to include in maintenance manuals.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Patch-Panel Units: One of each type.
 2. Connecting Blocks: One of each type.
 3. Device Plates: One of each type.

1.9 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
 1. Layout Responsibility: Preparation of Shop Drawings, Cabling Administration Drawings and field-testing program development by an RCDD.
 2. Installation Supervision: Installation shall be under the direct supervision of 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.

1.10 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory test UTP cables on reels according to ANSI/TIA-568.1-E.
- C. Factory test UTP cables according to ANSI/TIA-568.2-D.
- D. Cable will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports and submit for approval.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
 - 1. Test each pair of UTP cable for open and short circuits.

1.12 COORDINATION

- A. Contractor to request and obtain information for patch cables, with appropriate length, for connection to following systems:
 - 1. Security Systems Access Control Panels, security video cameras, and equipment.
 - 2. Public Address System microphone station and equipment.

PART 2 - PRODUCTS

2.1 HORIZONTAL CABLING DESCRIPTION

- A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called a "permanent link," a term that is used in the testing protocols.
 - 1. ANSI/TIA-568.1-E requires that a minimum of two telecommunications outlet/connectors be installed for each work area.
 - 2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
 - 3. Bridged taps and splices shall not be installed in the horizontal cabling.
- B. A work area is approximately 100 sq. ft. and includes the components that extend from the telecommunications outlet/connectors to the station equipment.
- C. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment or in the horizontal cross-connect.
- D. Station cabling between communications rooms and outlets shall be 4-pair, plenum rated and conform to ANSI/TIA-568.2-D Category 6 requirements. For each data drop terminated, provide one (1) 6-foot and one (1) 15-foot long Category 6 connector cables.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Horizontal cabling system shall comply with transmission standards in ANSI/TIA-568.1-E when tested according to test procedures of this standard.
- B. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the applicable standard and NFPA 70 for the following types:
 - 1. Communications, Plenum Rated: Type CMP complying with UL 1685.
 - 2. Communications, Plenum Rated: Type CM, Type CMG, Type CMP, Type CMR, or Type CMX in metallic conduit installed according to NFPA 70, Article 300.22, "Wiring in Ducts, Plenums, and Other Air-Handling Spaces."
 - 3. Communications, Non-plenum: Type CMR complying with UL 1666 and ICEA S-103-701.
 - 4. Communications, Non-plenum: Type CMP or Type CMR in listed plenum or riser communications raceway.
 - 5. Communications, Non-plenum: Type CMP or Type CMR in metallic conduit installed according to
- C. NFPA 70, Article 300.22, "Wiring in Ducts, Plenums, and Other Air-Handling Spaces."
- D. Surface-Burning Characteristics: Comply with ASTM E 84; testing 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.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- F. Grounding: Comply with ANSI/TIA-607-E.
- G. RoHS compliant.

2.3 CATEGORY 6 UTP CABLE

- A. Each horizontal link is an individual category 6 cable and not formed into 25-pair binder groups covered with an overall jacket and metallic shield. Refer to County standards for color of outer jacket depending on the purpose of the cable.
- B. Manufacturers: The basis of design for Cat6 UTP cable shall be as follow:
 - 1. Panduit Enhanced Category 6 cable, Plenum rated PUP6004*-W, or as acceptable by the Owner, for the cable by the manufacturers that meet or exceed the performance.
 - 2. Panduit Category 6 OSP Cable PUO6C04BL-U, or as acceptable by the Owner, for the cable by the manufacturers that meet or exceed the performance.
- C. Description: 100-ohm, four-pair UTP, covered with a thermoplastic jacket (jacket color as described in paragraph 2.3.E of this Section).
 - 1. Comply with ICEA S-90-661 for mechanical properties.
 - 2. Comply with ANSI/TIA -568.1-E for performance specifications.
 - 3. Comply with ANSI/TIA-568.2-D, Category 6.

- D. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
 - 1. Communications Plenum Rated: Type CMP, complying with NFPA 262.
- E. Sheath for Cat 6 cables shall be different colors (Cable/Jack/Patch Cable):
 - 1. Airport/Aviation Data (General use and Tenants): Yellow/Yellow/Yellow
 - 2. VoIP Voice: (Blue/Blue/Blue)
 - 3. Access Control System: Red/Red/Red
 - 4. Paging System: White/White/White
 - 5. Video Camera: Green/Green/Green
 - 6. Audio/Video Display System: Gray/Gray/Gray

2.4 TELECOMMUNICATIONS OUTLET/CONNECTORS

- A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with ANSI/TIA-568.2-D.
- B. 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.
- C. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.
 - 1. Category 6/6A: The basis of design shall be Panduit Category 6/6A jacks, TX series Color as per paragraph 2.3.E of this Section.

2.5 TELECOMMUNICATIONS PATCH PANELS

- A. 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.
 - 1. Number of Jacks per Field: One for each four-pair conductor group of indicated cables, plus spares and blank positions adequate to suit specified expansion criteria.
 - 2. The basis of design shall be Panduit Unpopulated Hi-density 48-port patch CPP48HDEWBL, or as acceptable by the Owner, for the product by the manufacturers that meet or exceed the performance.
 - 3. Provide Panduit Strain Relief Bar model SRB19BLY, or as acceptable by the Owner, for the product by the manufacturers that meet or exceed the performance.

2.6 TELECOMMUNICATIONS PATCH CORDS

- A. Patch Cords: Factory-made, four-pair cables in lengths to be coordinated with the final device location. Patch cords shall be terminated with eight-position modular plug at each end.
 - 1. 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.
 - 2. Patch cords shall have color-coded as per paragraph 2.3.E of this Section.

2.7 TELECOMMUNICATION OUTLETS.

- A. Workstation Outlets: Assemblies mounted in single or multi-gang faceplate as indicated on the Drawings.
 - 1. Vertical single gang faceplates designed to mount to single gang wall boxes. The basis of design shall be Panduit Single gang faceplate, flush (White) Mini-Com Executive series 6-port or as described in the Contract Drawings.
 - 2. The Metal Faceplate: Stainless steel as indicated on the Drawings and basis of design shall be Panduit Wall phone jack kit Stainless Wall Plate.
 - 3. Provide bank inserts by Panduit Blank MiniCom inserts Color to match plate, or as acceptable by the Owner, for the product by the manufacturers that meet or exceed the performance.
 - a. Panduit Surface mount box Single- and Two-Port Pan-Way series
 - b. Panduit Extra-Deep Surface Mount Box JB1DIW-A
 - 4. Legend: Snap-in, clear-label covers and machine-printed paper inserts.

2.8 TELECOMMUNICATION SURFACE MOUNT OUTLET

- A. The surface mount box shall be plenum rated for single- and two-port. The basis of design shall be Panduit Surface mount box Single- and Two-Port Pan-Way series, or as acceptable by the Owner, for the product by the manufacturers that meet or exceed the performance.
- B. The extra-deep surface mount box shall be plenum rated for single- and two-port. The basis of design shall be Panduit Extra-Deep Surface Mount Box JB1DIW-A, or as acceptable by the Owner, for the product by the manufacturers that meet or exceed the performance.

2.9 PUBLIC ADDRESS MICROPHONE STATION

- A. Provide microphone station at the new A6 Gate Counter. The basis of design shall be Biamp Vocia DS-10 or as approved by the Owner.

2.10 MISCELLANEOUS CABLES

- A. HDMI Cables: Provide HDMI cable at the location shown in the floor plan. The basis of design shall be Extron Electronics HDMI Pro Series.
- B. HDMI Connector Plate: Female-to-female 10" pigtail. The basis of design shall be Extron Electronics model 70-617-12.

2.11 GROUNDING

- A. Comply with requirements in Section 27 05 26 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.
- B. Comply with ANSI/TIA-607-E.

2.12 IDENTIFICATION PRODUCTS

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

- B. Comply with requirements in Electrical Drawings for 26 05 53 "Electrical Identification."

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

- A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.2 WIRING METHODS

- A. Install cables in pathways and cable trays except within consoles, cabinets, desks, and counters. Conceal pathways and cables except in unfinished spaces.
 - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
 - 2. Comply with requirements in Section 27 05 28 "Pathways for Communications Systems."
- B. Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures:
 - 1. Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
 - 2. Install lacing bars and distribution spools.
 - 3. Install conductors parallel with or at right angles to sides and back of enclosure.

3.3 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
 - 1. Comply with ANSI/TIA-568.1-E.
 - 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 - 3. Install 110-style IDC termination hardware unless otherwise indicated.
 - 4. MUTOA shall not be used as a cross-connect point.
 - 5. Consolidation points may be used only for making a direct connection to telecommunications outlet/connectors:
 - a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
 - b. Locate consolidation points for UTP at least 49 feet from communications equipment room.
 - 6. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
 - 7. 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.
 - 8. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.

9. 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.
 10. 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.
 11. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
 12. In the communications equipment room, install a 10-foot-long service loop on each end of cable.
 13. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
- C. UTP/STP Cable Installation:
1. Comply with ANSI/TIA-568.2-D.
 2. Do not untwist UTP and STP cables more than 1/2 inch from the point of termination to maintain cable geometry.
 3. Category 6 data cables will be terminated on the appropriately colored Category 6 RJ-45 jacks using the T568B or as approved by EUG.
- D. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 2. Suspend UTP and STP cables not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
 3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- E. 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 long not less than 12 inches in diameter below each feed point.
- F. Group connecting hardware for cables into separate logical fields.
- G. Separation from EMI Sources:
1. Comply with BICSI TDMM and ANSI/TIA-569-E 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 Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.4 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies.
- B. Provide materials classified by UL to provide fire stopping equal to time rating of construction being penetrated.
- C. Comply with ANSI/TIA-569-E, Annex A, "Firestopping."
- D. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.5 GROUNDING

- A. Install grounding according to BICSI TDMM, "Bonding and Grounding (Earthing), Chapter 8"..
- B. Comply with ANSI/TIA-607-E.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch 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.

3.6 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with ANSI/TIA-606-D. Comply with requirements for identification specified in Section 26 05 53 for "Identification for Electrical Systems."
 1. Administration Class: 3.
 2. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.

- B. Using cable management system software specified in Part 2, develop Cabling Administration Drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable and label cable, jacks, connectors, and terminals to which it connects with same designation. At completion, cable and asset management software shall reflect as-built conditions.
- C. Comply with requirements in for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- D. Paint and label colors for equipment identification shall comply with ANSI/TIA-606-D for Class 3 level of administration, including optional identification requirements of this standard.
- E. Cable Schedule: Post in 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. Follow convention of ANSI/TIA-606-D. Furnish electronic record of all drawings, in software and format selected by Owner.
- G. Cable and Wire Identification:
 - 1. Label each cable within 4 inches 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. 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 shall be identified with name and number of particular devices 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 ANSI/TIA-606-D.
 - 1. Cables use flexible vinyl or polyester that flex as cables are bent.

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections:
 - 1. Visually inspect UTP and STP cables 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 ANSI/TIA-568.1-E.
 - 2. Visually confirm Category 6, or Category 6A marking of outlets, cover plates, outlet/connectors, and patch panels.
 - 3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 - 4. Test UTP backbone 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 ANSI/TIA-568.2-D. 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.
 - b. Provide Raw cable test data ".flw" file from the Fluke Versiv platform for review by EUG IT Infrastructure prior to acceptance of cable installation.
- 5. UTP and STP Performance Tests:
 - a. Test for each outlet and MUTOA. Perform the following tests according to ANSI/TIA-568.1-E and ANSI/TIA-568.2-D:
 - 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) Alien crosstalk.
 - 9) Return loss.
 - 10) Propagation delay.
 - 11) Delay skew.
 - b. Final Verification Tests: Perform verification tests for UTP systems after the complete communications cabling and workstation outlet/connectors are installed.
 - c. 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.
- d. 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.
- D. 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.
 - E. End-to-end cabling will be considered defective if it does not pass tests and inspections. See Section 01 40 00 "Quality Requirements" for retesting and reinspection requirements and Section 01 70 00 "Execution and Closeout Requirements" for requirements for correcting the Work.
 - F. Prepare test and inspection reports. The report for cables shall be compiled and submitted for review and approval.

END OF SECTION 27 15 00

**EUGENE AIRPORT
CONCOURSE A PASSENGER BOARDING
BRIDGE UPGRADES
EUGENE, OREGON**

**SECTION 27 15 00
COMMUNICATIONS HORIZONTAL
CABLING**

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**SECTION 27 42 19
PUBLIC INFORMATION DISPLAY SYSTEMS**

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.
- B. Related Sections:
 - 1. Section 27 05 00 "Supplemental Requirements for Communications."
 - 2. Section 27 05 26 "Grounding and Bonding for Communications Systems."
 - 3. Section 27 05 28 "Pathways for Communication Systems."
 - 4. Section 27 05 29 "Hangers and Supports for Communications Systems."
 - 5. Section 27 05 44 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."
 - 6. Section 27 15 00 "Communications Horizontal Cabling."

1.2 SUMMARY

- A. This section includes the following Public Information Display Systems:
 - 1. Flight Information Display (FID) System
 - a. Flat panel displays
 - b. Monitor Management System (MMS) software
 - c. Display mounts
 - d. Display data controllers (media players)
 - e. HDBaseT video extender pairs
 - f. Network switches
 - g. Miscellaneous hardware/cables
 - h. License
- B. The Work shall include the installation of new hardware, software, and ancillary equipment to support of the following Public Information Systems:
 - 1. Gate Information Display (GID) System – The Work includes an expansion of the existing GID system that currently provides flight and baggage information to passengers at the EUG Airport. The existing GID system is managed/administered by the EUG and utilizes existing Application Software. The Work shall include all necessary hardware, software, and professional services required to implement a fully functional expansion of this system.
- C. In addition to field devices, the Work shall include the provision and installation of equipment within designated Telecom Rooms and connection of such devices to various existing networks. Refer to the Contract Drawings for demarcations of responsibilities within these rooms.
- D. The supply and installation of 120-volt power circuits and receptacles for the public information systems is described in Division 26 and 27 and is shown on the Electrical and Communications drawings. The Work of this Section shall include the coordination of power requirements, locations, connections, etc., with the Electrical and Communications Work.
- E. New structural supports for the various displays systems shall be closely coordinated with the Architectural Interiors plans and as specified under Division 05. The Work of this Section shall also include the coordination of device mounting and cable management with the new decorative structures.

- F. The supply and installation of data cabling and outlets for the public information systems is described elsewhere in Division 27 and is shown on the T-series drawings. The Work of this Section shall include the coordination of data requirements, locations of outlets, connections, etc., with the Communications Work.
- G. The Work of this Section includes the final termination and connection of data patch cords between the communications outlets and patch panels installed under the Communications Work with the new public information system displays and electronic equipment. Refer to the Contract Drawings for further clarification concerning limits of responsibilities between disciplines.
- H. Purchase and provide configuration support for the monitor management software (MMS). Deliver MMS software provided by monitor supplier(s) to support remote monitoring and control of the various displays installed under this Project. The software shall store information about all remote displays installed under the project and shall support remote diagnostics, controls, and adjustments of individual displays. The MMS software shall be supplied by the contractor and turned over to the Airports Authority for installation on workstations and/or servers provided by the Authority. The Contractor's Work shall include software configuration support and communications infrastructure to collect, consolidate, and access such information from a central location.
- I. Complete installation, connection, configuration, and adjustment of new displays and Display Data Controllers (DDCs) at those locations shown on the Contract Drawings.
- J. Unless specifically noted otherwise, the configuration of the existing system head-ends (GID systems) and associated screen content development is outside the scope of the Work.
- K. The Work of this Section includes the complete testing of the public information system equipment installed under this Project, to ensure a fully functional installation.
- L. The Work of this Section includes the coordination with the various Authority system administrators to ensure a fully functional installation.
- M. The Work shall include the documentation, and warranty of the new components identified on the Contract Documents and as specified herein.

1.3 ACRONYMS/ABBREVIATIONS/DEFINITIONS

- A. Titles of electronic industry standards, trade names, and communications terminology are frequently abbreviated. The following acronyms or abbreviations may be referenced in this section.
 - 1. ANSI - American National Standards Institute
 - 2. CAT 6 - Category 6 communications cable
 - 3. DDC - Display Data Controller
 - 4. FCC - Federal Communications Commission
 - 5. FHD – Full High Definition (1,920 x 1,080 Pixels)
 - 6. HDCP – High-bandwidth Digital Content Protection
 - 7. HDMI – High-Definition Multimedia Interface
 - 8. IP – Internet Protocol
 - 9. LAN - Local Area Network
 - 10. MMS – Monitor Management System
 - 11. MTBF - Mean Time Between Failure
 - 12. NEC - National Electric Code
 - 13. OS - Operating System
 - 14. PoE – Power Over Ethernet
 - 15. SSCP – Security Screening Checkpoint
 - 16. TIA - Telecommunications Industry Association

- 17. UL - Underwriters Laboratories
- 18. VLAN - Virtual Local Area Network

B. The following definitions specifically apply to this Specification Section:

- 1. **As Acceptable to the Authority:** Where this term is used, it is intended to denote any article that the Authority, at its sole discretion, determines to be equal of that specified, considering quality, workmanship, economy of operation, and suitability for the purpose intended, shall be accepted. The burden of proof of product equality lies with the Contractor and not with the Authority.
- 2. **Demonstration:** This term signifies the verification by activation, operation, movement or adjustment of an item or system and the comparison of the item or system performance against a qualitative standard or other standard(s) as set forth in the specific requirements of the cited paragraph.
- 3. **Furnish:** Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- 4. **Head-End:** The core components of the public information systems including servers, core network switches, operating systems, application software, and databases.
- 5. **Install:** Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- 6. **Test:** "Test" implies the systematic exercising of an item or system under all specified conditions with quantitative measurement of specified parameters and comparison of performance against the quantitative standards set forth.

1.4 GENERAL ARRANGEMENT OF CONTRACT DRAWINGS

- A. Contract Drawings are diagrammatic and may not show all components, materials, offsets, bends, elbows, and other specific elements that may be required for a complete installation. The Contractor shall be responsible for providing all materials needed for a complete and functional installation.
- B. If the Contractor believes or determines that any departure from the Contract Documents is warranted, or in the event of conflicts in the Specifications and/or Drawings, details of such departures or conflicts, including schedule and cost impacts, if any, and the justification thereof shall be submitted in writing to the Owner at the Contractor's earliest opportunity. The Contractor shall not proceed with any work associated with these proposed departures or conflicts without the prior written approval of the Owner.

1.5 CONFLICTS

- A. Should there be conflicts between the Contract Documents, between any other project Specifications and Drawings, between Specifications or Drawings and standards and codes, or any other pertinent conflicts related to the Contractor's Work, such conflicts shall be brought to the attention of the Owner at the Contractor's earliest opportunity. The Contractor shall not proceed with any work associated with these conflicts without the prior written approval of the Owner.

1.6 SUBMITTALS

- A. In accordance with the requirements of this Section, the Contractor shall specifically provide those submissions identified below.
- B. **Materials and Equipment List:** Provide a complete listing of all equipment proposed for the Work. Specific items to be included include, but are not limited to, the following:
 - 1. Manufacturer
 - 2. Model number (to include all options)

3. Quantities provided for initial deployment
 4. Quantities provided as spares
- C. Product Data: Contractor shall submit for approval a compilation product data of all materials, equipment and accessories proposed for his Work in accordance with these Specifications and Contract Drawings. The data shall include manufacturers' complete catalog identification numbers and model or system designator, quantities, options, and data sheets. The submittal shall be in sufficient detail whereby the Owner can readily identify the equipment and materials proposed. Catalog data sheets shall be clearly marked to identify the specific models, options, and features being proposed. No consideration will be given to partial lists or lists submitted from time-to-time. Approval of materials and equipment will be "conditional" pending the submission of complete shop drawings. The Authority shall not be obligated in any manner for any materials, equipment or accessories that have not been accepted by the Owner. Collect product data into a single submittal for each element of construction or subsystem and submit at one time. Product data includes printed information such as manufacturer's installation instructions, catalog cuts, standard color charts, rough-in diagrams and templates, standard wiring diagrams, controls and performance curves. Where product data must be specially prepared or modified because standard printed data is not suitable for use, submit as "Shop Drawings".
1. Clearly mark each copy to identify pertinent products, models, features, and accessories. Show performance characteristics and capacities. Show dimensions and clearances required. At a minimum, include the following information:
 - a. Manufacturer's printed specifications.
 - b. Compliance with recognized trade association standards.
 - c. Compliance with recognized testing agency standards.
 - d. Application of testing agency labels and seals.
 - e. Notation of dimensions verified by field measurement.
 - f. Notation of coordination requirements.
 2. Do not submit product data until compliance with requirements of the Contract Documents has been confirmed by the Contractor.
- D. Shop Drawings
1. After receiving conditional approval of the Materials and Equipment List submission and before ordering, purchasing, fabricating or installing any materials or equipment, the Contractor shall submit shop drawings of the system and applicable installation details to demonstrate compliance with the Contract Documents. The shop drawings shall be submitted at one time. No consideration will be given to partial submittals.
 2. The submission must be made sufficiently in advance of the time the drawings must be used during construction to allow time for review by the Owner and their return. No extension of the contract time will be granted for failure to allow sufficient time for review and processing.
 3. Shop drawings shall be in the form of instrument-drawn, accurately scaled drawings, showing methods of fabrication, interconnection and wiring diagrams, schematics, wire and conduit sizes, installation and equipment locations, and details of installation, as well as all field-verified (by the Contractor) conditions and dimensions necessary for satisfactory installation. Freehand sketches will not be accepted.
 4. Where custom components are to be used, fabrication drawings and functional specifications shall be provided to the Owner for inspection and approval prior to fabrication and installation.
 5. Submit newly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents.
 6. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings.

7. The shop drawing submissions shall include detailed, to-scale, instrument-drawn drawings describing the products (systems, equipment, devices and materials) and Contractor's services as to include mounting and installation methods, details and dimensions, point-to-point interconnect diagrams, equipment schedules, conduit sizing and routing, and such other diagrammatic or written descriptions to allow the Owner to thoroughly and accurately understand the systems and equipment that are being furnished, how it is intended to function, how it will be installed, and all other necessary information of similar intent.
8. Shop drawings shall be presented in a clear and thorough manner. Details shall be identified by reference to sheet and detail, schedule, or room/space numbers shown on the Contract Drawings.
9. Shop Drawings shall include:
 - a. Point-to-point wiring diagrams. Include wiring diagrams and roughing-in details for required power and data connections for each sign type.
 - b. Dimensions, identification of products and materials, compliance with specified standards, notations of coordination requirements, and notations of dimensions established by field measurement.
10. Shop drawings will be reviewed for general conformance with the design concepts. Apparent dimensional and quantitative discrepancies observed during the Owner's review will be noted for the Contractor's convenience only and should not be accepted as correct or complete or in any way understood to modify the Contractor's responsibilities as a part of this Contract.
11. Do not use Shop Drawings without Owner's or its designated representative's final stamp indicating action taken in connection with construction.
12. If departures from the shop drawings are subsequently deemed necessary by the Contractor, details of such departures and the reasons for such departures shall be submitted in writing or on drawings to the Owner for approval prior to fabrication or the start of any related Work.

E. System Test Plan

1. At least 30 days prior to testing, submit for approval a complete System Test Plan that shall be used to demonstrate the proper operation of all equipment, accessories, and interconnecting cabling provided under this section. Refer to paragraph 3.10 of this section for details concerning specific testing requirements to be addressed by the System Test Plan.

F. Spare Parts and Components List

1. The Contractor shall submit to the Owner a complete list of recommended spare parts and components to satisfactorily maintain and service the public information system elements required under this Section for a period of one (1) year.
2. The spare parts and components list shall also identify any special tools and testing equipment needed to maintain the new system components as well as the any cleaning supplies.

G. Record Documents Submittal

1. General: Record Drawings and Specifications shall comply with the requirements of this Section.
2. The Contractor shall maintain a clean undamaged set of prints of both Contract Drawings and Shop Drawings. The Contractor shall mark the set to show the actual installation where the installed Work varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing the actual "field" condition fully and accurately. Where Shop Drawings are used for mark-up, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed

work that would be difficult to measure and record at a later date. The shop drawing mark-ups shall be incorporated into the final CAD Record Drawing submission by the Designer.

H. Operation, Maintenance, and Service Manuals

1. General: Operation, Maintenance, and Service Manuals shall comply with the requirements of this Section.
2. Prior to final acceptance, complete sets of operations, maintenance, and service manuals shall be submitted for systems and equipment provided under this Section, including all original software media and licenses. The manuals shall be compiled, assembled and indexed, in an easily identifiable hard-cover form. Manuals shall include the following:
 - a. Complete operating instructions;
 - b. Complete maintenance instructions, wiring diagrams, troubleshooting instructions;
 - c. System service instructions for Work which manufacturers recommend user-provided service;
 - d. Complete parts lists for each major item of equipment and/or system;
 - e. Manufacturers' recommended cleaning methods;
 - f. Complete collection of manufacturers' product and catalog literature for equipment and systems installed under this contract;
 - g. Manufacturers' warranties;
 - h. Operating characteristics, performance data, ratings, and manufacturers' specifications for each item of equipment or system;
 - i. Name, address, and telephone number for service for each item of equipment or system;
 - j. Software User Documentation: Manual shall include copies of software licenses, operating instructions, user instructions, technical documentation and maintenance procedures to support system configuration and operation;

1.7 DELIVERY, STORAGE AND HANDLING

- A. Provisions for direct delivery of system hardware components properly packaged in factory-fabricated containers shall be made for acceptance by the Contractor at the project site. The Contractor shall take such measures as are necessary to ensure that all products are adequately protected from environmental damage during shipment and prior to installation.
- B. Store delivered materials in a clean dry space. Protect materials from dirt, fumes, water, construction debris and traffic.
- C. Handle equipment hardware carefully to prevent damage, breakage, denting, and scoring finishes. Do not install damaged components; replace with new equipment and return damaged units to manufacturer.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. General: Except as otherwise specified, equipment and materials furnished shall be new, standard, current products of the manufacturers, and shall be suitable for the systems being installed and the intent of the design.
- B. Damaged Products: Any material, device, or equipment damaged prior to or during installation and before acceptance by the Authority shall be replaced, unless repairs can be made that are acceptable to the Owner. Any such replacement or repairs, including repairs to the finish, shall be made at no cost to the Authority.

- C. **Protection of Materials.** Equipment and materials shall be properly stored, adequately protected and carefully handled to prevent damage before and during installation. Equipment and materials shall be handled, stored and protected in accordance with the manufacturers' recommendations. Equipment provided with a factory finish shall be maintained free of dust, dirt and foreign matter prior to installation. Dents, marred finishes and other damage shall be repaired to its original condition or shall be replaced, at no additional cost to the Authority. The Contractor shall protect the Authority's equipment and materials, as well as the Contractor's tools and materials, against theft and vandalism.
- D. **Materials Not Listed:** Furnish all necessary hardware, materials, and supporting components required to install devices and make them operational. Depending on the manufacturers selected by the Contractor, some equipment, materials, and hardware may not be contained in either the Contract Drawings or these written Specifications, but are required by for full and complete operation in accordance with the intent of the design and these Specifications. In such cases, the Owner or its designated representative shall be given the opportunity to approve the additional equipment, hardware and materials that shall be fully identified in the equipment list submittal. The Owner or its designated representative shall be consulted if there is any question as to which supporting equipment, materials, or hardware is intended to be included.
- E. **Like Items:** Where two or more items of equipment performing the same function are required, they shall be exact duplicates produced by one manufacturer.

2.2 PRODUCT SELECTION

- A. **Provide products that comply with the Contract Documents and the following requirements:**
 - 1. Provide products complete with all accessories, trim, mounting hardware, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.
 - 2. Like items shall be the same and shall be interchangeable.
 - 3. For products specified by naming one or more manufacturers (if ever), submit a request for substitution for any manufacturer not specifically named.
 - 4. For products specified by naming one or more manufacturers with a "no substitution" statement, substitutions are not allowed.
 - 5. For products specified by performance requirements, provide products that fully comply with these requirements.
 - 6. Where specifications require matching or conforming to an established sample or quality standard or objective, the Owner's decision will be final on whether a proposed product or installation practice matches satisfactorily. Requirements for inconspicuous or concealed installation, as one example, establish such a standard and objective.

2.3 MANUFACTURER

- A. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Sharp NEC Display Solutions.
 - 2. LG Displays.
 - 3. Samsung
 - 4. Or as approved by the Authority.

2.4 AIRPORT AUTHORITY PROVIDED EQUIPMENT

- A. The following items shall be supplied by the Airport Authority in support of the Work. Refer to the Contract Drawings for additional details concerning limits of responsibility. Should any of the below items be inadequate or incompatible with the Contractor's proposed solution, it shall be the

Contractor's responsibility to identify such issues to the Owner prior to commencing any related Work.

1. Flight Information Display System

- a. GID System Head-End: The GID head-end includes servers, application software, databases, network drives, airline interfaces, etc.,
- b. Network Configuration: While the Contract Documents include the provision and installation of new GID System network switches, the Airport Authority will take responsibility for configuration of such switches in support of connections to new field devices and the GID System head-end.
- c. FID System Screen Content: The Airport Authority will take full responsibility for FID System screen designs and the assignment of such designs to specific FID System displays.

2.5 GATE INFORMATION DISPLAY (GID) SYSTEM

1. Flat-Panel Displays

a. General

- 1) Displays shall be specifically designed to meet public information display applications, i.e., displays shall be commercial grade - specifically designed for 24/7 operation.
- 2) Monitors shall be designed to support the orientation (i.e., portrait or landscape) as shown on the Contract Drawings.
- 3) Monitors shall be fully compatible with the DDCs to be provided under this project, to include all required video connectivity.
- 4) Voltage Rating: 100-120VAC, 60Hz
- 5) Mounting: Standard VESA configuration
- 6) Warranty: 3-year on-site parts (including backlighting) and labor

b. 55" LCD Displays: Displays shall meet or exceed the following characteristics:

- 1) Viewable Image Size: 55" measured diagonally
- 2) Native Resolution: 1920 x 1080
- 3) Aspect Ratio: 16:9
- 4) Vertical Scanning Frequency: 60Hz
- 5) Backlight: LED (either edge lit or direct lit)
- 6) Brightness: 700 nit
- 7) Contrast Ratio: 4,000:1
- 8) Viewing Angle: 178 degrees vertical/178 degrees horizontal
- 9) Response Time: 8msec
- 10) Dynamic Backlight Adjustment: Automatically adjusts the backlight and power management depending on the ambient lighting brightness
- 11) Screens should be equipped with anti-glare/anti-reflection coatings appropriate for the installed environments
- 12) Orientation: Landscape
- 13) Inputs:
 - a) Digital: HDMI. DisplayPort is also acceptable.
 - b) Analog: VGA 15-pin D-sub
 - c) External Control: Infrared remote and ambient light sensor
 - d) External Monitoring/Control: RJ-45 (to support MMS functionality)
- 14) Bezel Width (Left and Right): 17mm (max)

- c. Manufacturer. Provide flat screen from the following manufacturers:
 - 1) LG Electronics,
 - 2) Samsung,
 - 3) NEC Sharp,
 - 4) Or as approved by the Owner.
2. Monitor Management System (MMS) Software
 - a. For each display manufacturer, the system shall support centralized monitoring, control, and diagnostics for all displays installed under the Project. Manufacturer-provided software shall be loaded on a remote workstation(s) to be provided by the Airport Authority. This application(s) shall allow remote monitoring and management of all displays supplied under this project and shall be capable of expanding such monitoring/control features to future display installations. The software shall store information about all remote displays and shall provide remote access/control of settings within the displays. The system shall not require remote virtual network computing (VNC) connections to each DDC to obtain needed information. Provide all required software, connections, cabling, and configuration support for the centralized monitoring of all displays provided under this Project.
3. Display Mounts
 - a. Surface Mount
 - 1) Overall size: Compatible with screen size
 - 2) Weight Capacity: 80lb
 - 3) Construction: High-grade cold rolled steel
 - 4) Color: Black Powder Coat Finish
 - 5) Mounting Pattern: Compatible with monitor
 - 6) Mount shall support angled installation as required on the FID system structures. The units shall provide secure top and bottom latching points that can be locked using a security screw. Security screw shall be accessible from top of mount. Once removed, mount shall remain latched until manually lifted off of the support bracket.
4. Display Data Controllers (Media Players) and Software. DDCs shall meet or exceed the following minimum requirements:
 - a. Fully compatible with 55" displays – see specifications above.
 - b. Workstation shall be provided in a small form factor configuration.
 - c. 3.4GHz quad core processor
 - d. 8 GB RAM
 - e. 256 GB SSD
 - f. The video card shall support HDMI video connections for four (4) independent video displays. As acceptable alternatives, the video cards can provide either four (4) DisplayPort (DP) or Mini DisplayPort (mDP) video ports; however, Contractor shall be responsible for providing all conversion equipment to support the required video extender/monitor connections.
 - g. One [1] Ethernet network interface card (100/1000)
 - h. Minimum of two (2) USB 2.0 ports
 - i. Each DDC shall be configured with the following software. All purchased software licenses shall be transferred to the Authority.
 - 1) Microsoft Windows 7/10 Professional Edition
 - 2) Microsoft .NET Framework 4.6.2
 - 3) Adobe Flash Player – latest version

- 4) windows media player – latest version
 - 5) Adobe PDF Reader – latest version
 - 6) SQL Server Client Access License
 - 7) Windows Server Client Access License
 - 8) License (one for each connected display)
- j. Provide mounts and/or other accessories as required to allow DDCs to be mounted within racks in the designated Telecom Rooms (refer to IT/IDF Enlarge Floor Plans and Rack Elevation provided in T40X- Series Plans).
5. Network Switches
 - a. Network switches to support data communication for the FIDS shall be provided and configured under the communications work.
6. Miscellaneous Hardware/Cables
 - a. Provide all ancillary power supplies, shelves mounting brackets, rack-mount kits, cables, connectors, etc., as required for the complete and professional installation of the above items.
7. License: Provide content management software license per media player used for the FIDS.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. The Contractor must examine areas and conditions under which components are to be installed and notify the Owner, in writing, of those conditions which are, in the Contractor's opinion, potentially detrimental to proper completion of the Work. The Contractor shall not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to both the Authority and the Contractor.
- B. The Contractor shall examine the materials identified to be supplied by the Airport Authority and shall notify the Owner, in writing, as early as possible, if the materials are incompatible with the Contractor's proposed systems or are, in the Contractor's opinion, potentially detrimental to proper completion of the Work.
- C. Specific items of examination shall include, but shall not necessarily be limited to, the following:
 1. Authority-supplied network equipment
 2. Locations for all new displays/devices
 3. Communications provisions as required in Division 27 - Communications.
 4. Power provisions as required in Division 26 - Electrical.

3.2 INSTALLATION

- A. General: Install components, including all hardware, software, cabling, connectors, etc., as required to comply with hardware and software manufacturer's written instructions, with recognized ANSI/TIA and other relevant industry practices, and the Contract Drawings and Specifications.
- B. The Work shall include all time, equipment, and materials required for project coordination, troubleshooting, testing, and documentation of the system as required herein.

- C. The Authority shall provide and maintain the Authority's data network up to the points of demarcation identified on the Contract Drawings.
- D. Fully coordinate the means of attaching new display mounts to supporting structures. The installation shall include all ancillary materials/hardware needed to securely attach supports, mounts, and displays to the sign structures in accordance with the approved fabrication/shop drawings.
- E. Hardware components and wiring shall be installed in a neat, workmanlike manner consistent with best industry practices.
- F. Label all cables with the appropriate cable management/identification as approved by the Owner during the submittal process.

3.3 CLEANING AND PROTECTION

- A. Monitors:
 - 1. Verify that each mount is at proper angle of tilt and swivel for optimum viewing. Coordinate such adjustments with the Owner upon completion of each sign.
 - 2. Adjacent monitors must be aligned plumb and level to provide a professional appearance.
 - 3. Clean screens and exposed surfaces with manufacturer-approved cleaning agents upon placing into operation.

3.4 SYSTEM SET-UP/CONFIGURATION

- A. The Contractor shall be responsible for the complete set-up and adjustment of all display devices for optimal viewing.
- B. Contractor shall be responsible for the configuration support for the MMS to include, but not limited to, the following:
 - 1. Configuration of MMS parameters to include monitor addressing, IP assignments (based upon directives issued from the Airport Authority).
 - 2. Coordination with the Airport Authority for the installation and configuration of the MMS software on a workstation to be designated by the Airport Authority.
 - 3. Participation in testing communications between workstation and each display.

3.5 WARRANTY

- A. Written Guarantee: In addition to the warranty provisions of this Section, the Contractor shall, as a condition precedent to final payment, execute a written guarantee (warranty) to the Owner certifying that all the contract requirements have been completed in accordance with the final Specifications and Contract Drawings. The written warranty shall specifically address the following:
 - 1. The Contractor shall warrant all installed hardware and communications infrastructure for a period of one (1) year from the date of Final Acceptance. Where such warranties are provided directly from the equipment manufacturers, the Contractor shall formally transfer all such warranties to the Authority. In the event that any manufacturer customarily provides a warranty period greater than one (1) year, or such extended warranties are required by the Contract Documents (e.g., 3 years for monitors), the warranty shall be for the greater period of time.
 - 2. The Contractor shall warrant for a period of one (1) year from the date of Final Acceptance all defects or damages due to faulty materials or workmanship. Defects related to faulty workmanship, including all damage to surrounding work caused by such defects, shall be, without delay, repaired to the Owner's satisfaction at the Contractor's own expense.

- D. ~~warranty work.~~ When equipment and labor covered by the Contractor's warranty or by a manufacturer's warranty have been replaced or restored because of failure during the period of that warranty, the warranty period for the replaced or repaired equipment or restored Work shall be reinstated for a period of time equal to the original warranty period and commencing with the date of completion of the replacement or restoration work.

3.6 SYSTEM MAINTENANCE

- A. Upon Final Acceptance, the Airport Authority will assume maintenance responsibilities for the accepted displays and shall perform all repairs not covered under the Contractor's warranty.

3.7 TRAINING

- A. The Contractor shall provide training for newly introduced displays. Such training shall include operational and maintenance training and shall be provided to maintenance staff to be designated by the Authority.
- B. As part of the training, the Contractor shall provide orientation training to review the locations of system components and their interconnections.
- C. All training shall take place in person and onsite at the Airport. Training shall be conducted by qualified personnel fully conversant on the equipment, materials, software, and over all operation of the installed elements.

3.8 SPARES

- A. As a condition of Final Acceptance, the Contractor shall deliver to an approved Airport storage facility all materials listed on the approved Spare Parts and Components List (as required in Part 1, Section 1.6.F). This shall include all spare parts and components, including any special tools and testing equipment, as required to maintain the new system elements for a one-year period following Final Acceptance.

3.9 FIELD QUALITY CONTROL

- A. FCC Compliance: Comply with Parts 68 and 76, Subpart J or Part 15, Federal Communications Commission Rules, pertaining to radiation limits and frequency usage and Class A computer registration by manufacturer.

3.10 SYSTEM TESTING

- A. The Contractor shall provide the test procedures and technical acceptance criteria to be used for the Project.
- B. Test procedures shall follow and comply with the approved Test Plan and shall specifically include:
 - 1. Scope and purpose of each test
 - 2. Equipment and/or software to be tested
 - 3. Range of values or output results considered acceptable.
 - 4. Test checklists with entries for test date and initials for personnel conducting tests and witnesses.
 - 5. Remarks field for entering handwritten notes associated with tests.
- C. The Contractor shall be responsible for organizing a structured demonstration of all tests to ensure organized and efficient testing.

- D. ~~General.~~ The Contractor shall utilize formal testing to verify that all requirements of the Contract Documents are met. Upon completion of each phase of the installation, testing shall be performed under the direct supervision of the Owner or his designated representative to verify proper operation of new equipment and devices prior to connection to the existing system head-ends and then verify operation after being placed into service with the overall systems.
- E. Verification by Inspection: Verification by inspection includes examination of an item and the comparison of pertinent characteristics against the qualitative or quantitative standards set forth in the applicable paragraphs from the Specifications. Inspection may require moving or partially disassembling the item to accomplish the verification. Inspection shall be made of all equipment installations to ensure requirements of the Contract Documents are met and that the overall installation is accomplished in a professional and workmanlike manner. The Authority or its designated representative shall have full opportunity to witness the required Contractor inspections or to conduct his own inspections of the installation.
- F. Verification by Test and Demonstration: The Contractor shall verify by formal demonstrations or tests that the requirements of the Contract Documents have been met. The Owner or its designated representative shall be afforded fourteen (14) calendar day advance notice of all demonstrations/tests. The Owner or its designated representative reserves the right to witness any and/or all of the tests described below.
 - 1. Preliminary Tests: Following installation, the Contractor shall individually test each system device/assembly and verify the proper functionality of each system component. Each system device/assembly shall be tested to the demarcation limits established by the Contract Drawings. Preliminary Tests shall be conducted as follows:
 - a. A formal test plan and test procedures for each portion of the test shall be prepared by the Contractor and submitted for Owner's or its designated representative's approval. Approval of the test procedures must be obtained prior to notification of testing to the Owner.
 - b. The test plan and procedures shall address the following:
 - 1) Test of all display mounting hardware
 - 2) Test of all displays in stand-alone operation
 - 3) Test of all contractor-supplied DDCs in stand-alone operation
 - 4) Visual inspection of all wiring and terminations
 - c. The Contractor shall successfully conduct its own Preliminary Tests in advance of notifying Owner that the system is ready to be formally tested. As a condition of completing the Preliminary Tests, the Contractor shall correct any deficiency pertaining to these requirements and successfully retest the failed item. All testing shall be recorded in a clear and concise manner for submission to the Owner.
 - d. After successfully completing all Preliminary Tests, the system shall be re-tested in the presence of Owner or its designated representative. The advance notice shall include certification that the installation is complete and operable, and the Contractor has satisfactorily performed the Preliminary tests specified herein.
 - e. All preliminary tests shall be successfully completed prior to System Operational Testing.
 - 2. System Operational Testing: Following successful completion of the Contractor's Preliminary Tests and the completion of the software configuration work to be performed by the Airports Authority, the Airports Authority and the Contractor shall jointly conduct a formal test, to be known as the "System Operational Test", in which all components and subsystems are demonstrated to operate together as a fully operational system. System Operational Tests shall be conducted as follows:

- a. The Owner shall be notified in writing fourteen (14) days in advance of the proposed System Operational Test dates. The advance notice shall include certification that the Contractor has satisfactorily performed the Preliminary Tests specified above.
 - b. This System Operational Test shall be performed over a continuous period during which the Contractor and the Airports Authority shall participate together to test the system. During testing, the parties shall identify the cause of any test failures and mutually assign responsibility for resolving such failures. Once identified, all failures shall be resolved and successfully re-tested.
 - c. System operational testing/re-testing shall be performed in the presence of Owner or its designated representative.
 - d. The Contractor shall maintain a log of all test activities and results. Typed copies of this log shall be submitted to the Owner or its designated representative within seven (7) days of the testing.
3. Re-Test: In the event that the Owner or its designated representative is required to witness a re-test (either Preliminary or System Operational testing) at a later date because the Contractor is either not adequately prepared to conduct the tests or due to significant test failures resulting from the Contractor's work, which shall be solely determined by the Authority's representatives witnessing the tests, the costs of witnessing additional tests, including time and travel costs for the Authority and its representatives, shall be borne exclusively by the Contractor.

3.11 DOCUMENTATION AND INSPECTION REQUIREMENTS

- A. Test Results: The Contractor shall submit, in writing, to the Owner or its designated representative, the results of all testing.

END OF SECTION 27 42 19

SECTION 28 05 00
SUPPLEMENTAL REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Access Control Systems
 - 2. Video Surveillance Systems
 - 3. Grounding and bonding
 - 4. Cable pathways
 - 5. Cable management

1.2 RELATED WORK SPECIFIED UNDER OTHER DIVISIONS

- A. Foundations and pads required for equipment furnished under this Division.
- B. Field painting, except such painting as is required to maintain shop coat painting and factory finish painting.
- C. Flashing of conduits into roofing and outside walls.
- D. Heating, ventilating and air conditioning equipment.
- E. Electrical service to equipment rooms.
- F. Cutting and patching for security systems work, except for errors and omissions under this Division.
- G. Related Requirements:
 - 1. Section 28 05 13 "Conductors and Cables for Electronic Safety and Security."
 - 2. Section 28 05 26 "Grounding and Bonding for Safety and Security."
 - 3. Section 28 05 28 "Pathways for Electronic Safety and Security."
 - 4. Section 28 05 44 "Sleeves and Sleeve Seals for Electronic Safety and Security Pathways and Cabling."
 - 5. Section 28 13 00 "Access Control."
 - 6. Section 28 23 00 "Video Surveillance."

1.3 QUALITY ASSURANCE

- A. Comply with applicable local, state and federal codes.
- B. Comply with applicable requirements of recognized industry associations which produce standards for the various trades.
- C. Warrant Work under this specification against faulty material or Workmanship in accordance with Division 01. If the project is occupied or the systems placed in operation in several phases at the request of the Owner, then the warranty of each system or piece of equipment used shall begin on the date of substantial completion for each phase. The use of building equipment for temporary service and testing does not constitute the beginning of the warranty.
- D. Equipment and material provided under this Division shall be periodically inspected and serviced by competent installers. This function becomes the responsibility of the Owner once the system is accepted by the Owner. The one-year material and workmanship warranty is not intended to supersede normal inspection or service and shall not be construed to mean the Contractor shall provide free service for normal maintenance items

such as periodic cleaning and adjustment due to normal use, nor to correct without charge, breakage, maladjustment and other trouble caused by improper maintenance.

- E. Upon completion of contract and progressively as work proceeds, clean-up and remove dirt, debris and scrap materials. Maintain the premises in a neat and clean condition at all times during construction. Protect and preserve access to head-end equipment at all times. Clean items with factory finishes. Touch-up minor damage to surfaces; refinish entire piece of equipment when sustained major damage. All electronics must be protected from dust and other airborne debris. Contractor shall identify all types of quality control mechanisms they employ. List all types.

1.4 STANDARDS

- A. The Contractor's performance of the Work shall comply with applicable federal, state and local laws, rules and regulations. The Contractor shall give required notices, shall procure necessary governmental licenses, permits, and inspections and shall pay without burden to The Owner, all fees and charges in connection therewith unless specifically provided otherwise. In the event of violation, the Contractor shall pay all fines and penalties, including attorney's fees and other defense costs and expenses in connection therewith.
- B. Federal Communications Commission
 - 1. Equipment requiring FCC registration or approval shall have received such approval and shall be appropriately identified.
- C. Codes, Standards and Ordinances
 - 1. Design, manufacture, test and install security and communications cabling per manufacturer's requirements and in accordance with state codes, local codes, requirements of authorities having jurisdiction and particularly the following standards:
 - a. NECA 1 – Standard for Good Workmanship in Electrical Construction, 2015
 - b. ANSI/TIA-568.0-E – Generic Telecommunications Cabling for Customer Premises, 2020
 - c. ANSI/TIA-568.1-E – Commercial Building Telecommunications Infrastructure Standard, 2020
 - d. ANSI/TIA-568.2-D – Balanced Twisted Pair Telecommunications Cabling and Components Standard, 2018
 - e. ANSI/TIA-568.3-E – Optical Fiber Cabling and Components Standard, 2022
 - f. ANSI/TIA-606-D – Administration Standard for Telecommunications Infrastructure, 2021
 - g. ANSI/TIA-607-E – Generic Telecommunications Bonding and Grounding Earthing) for Customer Premises, 2024
 - h. NFPA 70 – National Electrical Code
 - i. NFPA 72 – National Fire Alarm Code
 - j. FCC 47 Part 68 Code of Federal Regulations, Title 47, Telecommunications
 - k. IEEE National Electrical Safety Code (NESC)
 - l. American Society for Testing and Materials (ASTM): ASTM E. 814 – Standard Test Method for Fire Tests of Penetration Firestop Systems

- m. Underwriters Laboratories, Inc. (UL): UL 1479 – Tests of Through-Penetration Firestop Systems
 - n. Americans with Disabilities Accessibility Guidelines, 2010.
 - o. Code of Federal Regulations, Title 29, Chapter XVII, Part 1910 (OSHA).
 - p. International Building Code (IBC).
 - q. Applicable codes and directives of authorities having jurisdiction
- 2. References to codes and standards called for in the Specifications refer to the latest edition, amendments, and revisions to the codes and standards in effect on the date of these Specifications.
- D. Federal, state, and local codes, rules, regulations, and ordinances governing the Work, are as fully part of the specifications as if herein repeated or hereto attached. If the Contractor should note items in the drawings or the specifications, construction of which would be code violations, promptly call them to the attention of the Owner's Representative in writing. Where the requirements of other sections of the specifications are more stringent than applicable codes, rules, regulations, and ordinances, the specifications shall apply.

1.5 COMPLETENESS OF WORK

- A. The Contract Documents depict security systems which are intended to be complete and functioning systems. All products, materials, labor, and programming necessary to render a fully functional system to fulfill the design intent shown on the documents shall be provided by the Contractor.
- B. Catalog numbers referenced throughout this Division's drawings and specifications are intended to convey a general understanding of the type of quality of the product required. Where written descriptions differ from information conveyed by a catalog number, the written description shall govern. No extra charge shall be allowed because a catalog number is found to be incomplete or obsolete.

1.6 PRE-INSTALLATION CONFERENCE

- A. Arrange and schedule pre-installation conference prior to beginning any work of this section.
- B. Agenda: Clarify questions in writing related to work to be performed, scheduling, coordination, etc. with Consultant and/or Project Manager/Owner Representative.
- C. All individuals, who will be in an on-site supervisory capacity, shall be required to attend the pre-installation conference. This includes project managers, site supervisor and lead installers. Individuals who do not attend the conference will not be permitted to supervise the personnel that install, terminate or test communications cables on the project. The Contractor's project manager that will oversee the installation is required to attend the pre-installation conference.
- D. The manufacturer that will be providing the extended warranty is required to have a representative attend the pre-installation conference.

1.7 SEQUENCE AND SCHEDULING

- A. The Contractor shall comply with all scheduling requests established by Owner, both prior to commencing Work and during construction. The Contractor shall provide a detailed

schedule of work to be performed. This schedule shall be submitted with the bid and if accepted will be used to track work status.

- B. Work should be scheduled not to interfere with day-to-day operations within the facility. Operations vary by area and should be given careful consideration in relation to the schedule.
- C. The successful Contractor for all or any portion of the work will be responsible for achieving a complete and fully functional installation on or before the contract scheduled completion date.
- D. Submit schedule for installation of equipment and cabling. Indicate delivery, installation and testing for conformance to specific job completion dates. As a minimum, dates are to be provided for bid award, installation start date, completion of cable pathway, cabling, equipment installation, system testing and labeling, cutover, completion of the final punch list, start of demolition, Owner acceptance and demolition completion.

1.8 SUBMITTALS

- A. Comply with provisions of Division 01.
- B. Provide all submittal requirements under this section as a single package.

1.9 ALTERNATES, SUBSTITUTIONS AND CHANGE ORDERS

- A. If a proposed alternate material is equal to or exceeds specified requirements, Contractor shall provide manufacturer's specifications in writing for written approval prior to purchase and installation of proposed materials. The proposed material substitution shall not void or change manufacturer's warranty.
- B. Contractor shall provide a complete security system according to these written specifications and drawings. If the Owner changes the scope of work to be performed by the Contractor, it shall be in writing. Contractor shall respond to these changes with a complete material list, labor, and taxes in writing presented to the Owner for approval. Contractor shall not proceed with additional scope of work without a signed approval by the Owner.
- C. Additional work performed by the Contractor will not be paid by Owner without signed approval of these changes prior to implementing changes. Submit a copy of signed change order upon billing.

1.10 USE OF THE SITE

- A. Use of the site shall be at the Owner's direction in matters in which the Owner deems it necessary to place restriction.
- B. Access to the building wherein the Work is performed shall be as directed by the Owner.
- C. The Owner will occupy the premises during the entire period of construction for conducting his or her normal business operations. Cooperate with the Owner to minimize conflict and to facilitate the Owner's operations.
- D. Schedule necessary shutdowns of plant services with the Owner and obtain written permission from the Owner. Refer to article - CONTINUITY OF SERVICES herein.
- E. Proceed with the Work without interfering with ordinary use of streets, aisles, passages, exits and operations of the Owner.
- F. All Contractor personnel must check in with the facilities engineering department and/or the General Contractor upon arrival and upon departure.

1.11 DELIVERY AND STORAGE

- A. Insofar as possible, deliver items in manufacturers' original unopened packaging. Where this is not practical, cover items with protective materials, to keep them from being damaged. Use care in loading, transporting, unloading and storage to keep items from being damaged.
- B. Store items in a clean dry place and protect from damage.
- C. Storage space on project site may be limited. The Contractor shall coordinate delivery and arrange storage of materials and equipment with the Owner.
- D. Components sensitive to damage in a harsh environment shall be stored off-site and delivered as needed.
- E. Provide protective covering during construction to prevent damage or entrance of foreign matter.
- F. Contractor is responsible for on-site security of tools, test equipment and materials.
- G. Replace at no expense to the Owner, product damaged during transporting, storage, handling or the course of construction.

1.12 CONTRACTOR CLOSE OUT SUBMITTALS

- A. Submit Closeout documentation within 30 days of substantial completion and in accordance with Division 1 of the Project Manual and any applicable supplements. The number of submittal sets required is the greater of either the requirements of Division 1 of the Project Manual, or a minimum of four (4) sets.
 - 1. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues
 - 2. Test reports on all systems (electronic file format and hard copy)
 - 3. As-built door and device schedules
 - 4. As built documentation of all systems installed under this project
 - 5. As built documentation of TR modifications and associated cabinet and wall elevations.
- B. Warranty and Maintenance:
 - 1. Test Report Binder(s)
 - 2. Record Drawings

1.13 RECORD DRAWINGS

- A. Keep a hard copy set of project drawings at the job site exclusively for recording deviations from the Construction Drawings.
- B. Record locations and depths of buried and concealed conduits from fixed, easily identifiable objects, such as building walls. Where conduits are concealed in walls, indicate distances off of building corners or other building features not likely to be disturbed by future alterations.
- C. Mark deviations in a different color so that work of various systems can be easily identified.
- D. At completion of as-built drawings, submit Project Record Documents to Design Consultant for the Owner's records.
 - 1. Upon completion of the as built drawings, the Design Consultant will review the as built work with the Contractor.

2. If the as-built work is not complete, the Contractor will be so advised and shall complete the work as required.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. All materials and equipment used in carrying out these specifications are to be new and have UL listing, or listing by other recognized testing laboratory when such listings are available.
- B. Model numbers and manufacturers included in this specification are listed to establish as standard of product quality.
- C. Other qualified manufacturers may be substituted only with the Owner's written consent. To request a substitution, the Contractor shall submit complete technical data, samples, and if requested, results of independent testing laboratory tests of proposed equipment.
 1. If the proposed System includes equipment other than specified model numbers, submit a list of major items and their quantities, with a one-line schematic diagram for review.
 2. Material not specifically identified within this document, but which is required for the successful implementation of the intended system(s), shall be of the same class and quality as the specified material and equipment.
 3. Include a list of previously installed projects using proposed equipment that are similar in nature to specified system.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Insofar as it is possible to determine in advance, advise the General Contractor to leave proper chases and openings. Place all outlets, anchors, sleeves, and supports prior to pouring concrete or installation of masonry work. Should the Contractor neglect doing this, any cutting and/or patching required is to be done at this Contractor's expense.
- B. Visit site and be informed of conditions under which work must be performed. No subsequent allowance will be made because of error or failure to obtain necessary information to completely estimate and perform the work involved.
- C. Carefully coordinate with other divisions to ensure proper power requirements, grounding, fireproofing and interlocking controls between the fire alarm system, security system, and other Owner-furnished systems.
- D. Notify other tradesmen of any deviations or special conditions necessary for the installation of work. Interferences between the work of various Contractors to be resolved prior to installation. Work installed not in compliance with specifications and drawings and without properly checking and coordinating as specified above shall, if necessary, be removed and properly reinstalled without additional cost to the Owner.
- E. The Owner or the Owner's Representative shall be the mediating authority in all deviation and disputes arising on project.
- F. Intent:
 1. These sections of specifications and drawings form a complete set of documents for communications systems for this project. Neither is complete without the other. Any item mentioned in one shall be as binding as though mentioned in both.

2. The intent of these specifications and drawings is to form a guide for a complete systems installation. Where an item is reasonably necessary for a complete system but not specifically mentioned, such as pull boxes, fittings, expansion fittings, support hangers, etc., provide same without additional cost to Owner.
3. Communication equipment room layouts indicated on drawings are diagrammatical only. The exact location of outlets and equipment to be coordinated and governed by project conditions. The Designer reserves the right to make any reasonable changes (approximately 6 feet) in location of junction boxes or equipment prior to roughing in of such without additional cost to Owner.

G. Deviations:

1. No deviations from specifications and drawings to be made without full knowledge and consent of the Designer. Should the Contractor find during progress of work that existing conditions make desirable a modification of the requirements of any particular item, report such item promptly to the Designer for their decision and instructions.

H. Main Horizontal Pathway/Raceway:

1. Unless otherwise noted in the drawings, all security systems cabling shall be routed above accessible corridor ceilings parallel to room walls and corridors via dedicated conduit. Cabling shall be segregated by function as follows:
 - a. Access control
 - b. Video surveillance

3.2 CONTINUITY OF SERVICES

- A. The Contractor shall not take any action that will interfere with, or interrupt, existing building services unless previous arrangements have been made with the Owner's Representative. Arrange the Work to minimize shutdown time.
- B. Owner's personnel will perform shutdown of operating systems. The Contractor shall give three (3) days' advance notice for systems shutdown.
- C. Should services be inadvertently interrupted, immediately furnish labor, including overtime, material, and equipment necessary for prompt restoration of interrupted service.

3.3 PLYWOOD BACKBOARD AND WALL BACKING

- A. Contractor shall provide 4-foot wide, by 8-foot high, by 3/4-inch-thick fire-retardant plywood backboard as indicated in all TRs. Plywood is to be painted with two coats of flat white fire-retardant paint on all six sides and installed as indicated on the drawings. The fire rating on the plywood shall be masked prior to painting and the mask removed after installation such that the fire rating is always visible for inspection.
- B. General Contractor is to provide appropriate backing in walls as required for mounting brackets and other wall mounted equipment per manufacturer requirements.

3.4 FIRESTOPPING

- A. Select appropriate type or types of through penetration firestop devices or systems appropriate for each type of communications penetration and base each selection on criteria specified herein.
- B. Selected systems shall not be less than the hourly time delay ratings indicated in the Contract Documents for each respective fire-rated floor, wall or other partition of building construction. Firestop for each type of communications penetration shall conform to requirements of an independent testing laboratory design drawing or manufacturer's approved modification when used in conjunction with details shown on the Drawings.
- C. Perform all necessary coordination with trades constructing floors, walls or other partitions of building construction with respect to size and shape of each opening to be constructed and device or system approved for use in each instance.
- D. Coordinate each firestop selection with adjacent Work for dimensional or other interference and for feasibility. In areas accessible to public and other finished areas, firestop systems Work shall be selected, installed and finished to the quality of adjacent surfaces of building construction being penetrated.
- E. Use materials that have no irritating or objectionable odors when firestopping is required in existing buildings and areas that are occupied.
- F. Provide damming materials, plates, wires, restricting collars and devices necessary for proper installation of firestopping. Remove combustible installation aids after firestopping material has cured.
- G. All firestops shall be installed in accordance with the manufacturer's instructions in order to maintain the specific rating assigned by the independent testing laboratory.
- H. Existing raceways, cable trays and cabling that penetrate existing building construction shall be firestopped to the extent necessary to fill cavities that may exist between existing building construction and existing communications penetrations or existing conduit sleeve, and between existing conduits and existing conduit sleeve.
- I. If required by inspecting authorities:
 - 1. Expose and remove firestopping to the extent directed by inspecting authority to permit his or her inspection
 - 2. Reinstall new firestopping and restore Work where removed for inspection.

3.5 TESTS

- A. On completion of Work, installation shall be entirely free of damaged conductors, software errors, incomplete jack termination including labeling and faceplates and dust. Perform a thorough operation test in the presence of the Owner or their representative. Provide documentation of all test results as outlined in each system's specifications. Include labor, materials, and instruments for the above tests.
- B. Furnish to the Owner, as a part of closing documents, a copy of such tests including identification of each cable.
- C. Prior to final observation and acceptance, test and leave in satisfactory operating condition, all systems and equipment including but not limited to the following:
 - 1. Grounding.
 - 2. Firestopping of all sleeves and conduits.
 - 3. Security systems.
 - 4. Turn in test results on cabling.

3.6 CLEANING

- A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, dust, and construction debris and repair damaged finish, including chips, scratches, and abrasions. This includes touching up paint removed for grounding.
- B. Contractor shall provide a clean work environment, free from trash/rubbish accumulated during and after cabling installation.
- C. Maintain construction materials and refuse within the area of work. Clean the work area at the end of each day.
- D. Contractor shall keep all liquids (drinks, sodas, etc.) off finished floors, carpets, tiles, racks and equipment. If any liquid damage to above finishes or equipment occurs, Contractor shall provide professional services to clean or repair scratched/soiled finishes or damaged equipment at own expense.

3.7 INSPECTION FEES AND PERMITS

- A. Obtain and pay for all necessary permits and inspection fees required for communication systems installation. Work shall not start until all permit applications are approved.

3.8 OBSERVATIONS

- A. When field observation services are a part of the project scope, the Designer's office will provide periodic observation of the progress of Work specified herein. The purpose of the observation service is to ensure compliance of Contractor's Work with specifications and drawings. The Designer's office may also observe tests required of this Contractor as called for in other sections of the specifications.
- B. Specifications and drawings represent Work to be done in view of total project requirements. To eliminate possible conflict with other trades, final location of conduits, jacks, outlets, components, etc., is the responsibility of this Contractor. Contractor to provide all supervision required for his personnel to ensure that installation is made in accordance with specifications and drawings and all safety rules and regulations are observed. In the event of conflicts of Work on project with other trades, Contractor is to make every reasonable effort to resolve conflict through meetings and discussions with other parties involved, by preparation of drawings or other appropriate action. Only after this has been done shall the Designer's assistance be requested through the RFI process.
- C. When the Designer is requested to visit the project to aid in resolution of conflicts, or for witnessing tests, he shall be given a minimum of 48 hours' notice prior to time their presence is requested at job site.

3.9 DEMONSTRATION AND TRAINING

- A. In addition to items specified in Section 01 79 00 "Demonstration and Training", include the following:
 - 1. Submit instruction program outline complete with modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module.
 - 2. Define the different types of training sessions (i.e., administrative, operational, maintenance, etc.)

3. Instructors must be factory-authorized service representative on the system and equipment.
4. Provide training in person (virtual training sessions are not acceptable).
5. Record training sessions for refresher later or propose manufacturer-produced demonstration and training video recordings for systems, equipment, and products.
6. Convey training manual and all educational materials to Owner for future refresher training.

3.10 WARRANTY-GUARANTEE

- A. The Designer reserves the right to accept or reject any part of the installation which does not successfully meet requirements as set out in these specifications.
- B. Contractor shall, and hereby does, guarantee all Work installed under this division shall be free from defects in workmanship and materials for a period of one year from date of final acceptance. This Contractor further agrees to repair or replace any defective material or workmanship which is or becomes defective within the terms of this warranty guarantee.
- C. All surplus parts and pieces for the installation shall be maintained as a spare parts inventory at the building site. Parts replaced during the warranty period shall have a warranty matching that of the original part from the date of replacement.

END OF SECTION 28 05 00

**SECTION 28 05 13
CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Division 01 Specification Sections, apply to this Section.
- B. Related Requirements:
 - 1. Section 28 05 00 "Supplemental Requirements for Electronic Safety and Security."
 - 2. Section 28 05 26 "Grounding and Bonding for Safety and Security."
 - 3. Section 28 05 28 "Pathways for Electronic Safety and Security."
 - 4. Section 28 05 44 "Sleeves and Sleeve Seals for Electronic Safety and Security Pathways and Cabling."
 - 5. Section 28 13 00 "Access Control."
 - 6. Section 28 23 00 "Video Surveillance."

1.2 SUMMARY

- A. Section Includes:
 - 1. UTP cable.
 - 2. RS-232 cable.
 - 3. RS-485 cable.
 - 4. Low-voltage control cable.
 - 5. Control-circuit conductors.
 - 6. Identification products.

1.3 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. EMI: Electromagnetic interference.
- C. IDC: Insulation displacement connector.
- D. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.
- E. NRTL: Nationally Recognized Testing Laboratory.
- F. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).
- G. RCDD: Registered Communications Distribution Designer.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.
- B. Source quality-control reports.
- C. Field quality-control reports.

1.6 QUALITY ASSURANCE

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

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
 - 1. Test each pair of UTP cable for open and short circuits.

1.8 FIELD CONDITIONS

- A. Do not install conductors and cables that are wet, moisture damaged, or mold damaged.
 - 1. Indications that wire and cables are wet, or moisture damaged include, but are not limited to, discoloration and sagging of factory packing materials.
- B. 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.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified NRTL. Identify products with appropriate markings of applicable NRTL.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 50 or less.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified NRTL, and marked for intended location and application.

2.2 UTP CABLE

- A. Refer to Section 27 15 00 "Communications Horizontal Cabling" for requirement and for sheath, jack and patch cord color requirements.

2.3 RS-232 CABLE

- A. General: If required, RS-232 (ANSI/TIA-232-F) communications require three conductors with an overall shield. Circuit is limited to a distance of not more than 50 feet.
- B. Standard Cable: NFPA 70, Type CM.
 - 1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
 - 2. Polypropylene insulation.
 - 3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
 - 4. PVC jacket.
 - 5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
 - 6. Flame Resistance: Comply with UL 1581.
- C. Plenum-Rated Cable: NFPA 70, Type CMP.
 - 1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
 - 2. Plastic insulation.
 - 3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
 - 4. Plastic jacket.
 - 5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
 - 6. Flame Resistance: Comply with NFPA 262.

2.4 RS-485 CABLE

- A. General: Where required, RS-485 communications require two twisted pairs. Circuit is limited to a distance of not more than 4000 feet.
- B. 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.
- C. 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.
 - 6.

2.5 LOW-VOLTAGE CONTROL CABLE

- A. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.
 - 1. One pair, twisted, No. 16 AWG, stranded (19x29) and No. 18 AWG, stranded (19x30) tinned copper conductors.
 - 2. PVC insulation.
 - 3. Unshielded.

- 4. PVC jacket.
- 5. Flame Resistance: Comply with NFPA 262.

2.6 CONTROL-CIRCUIT CONDUCTORS

- A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, complying with UL 83, in raceway or Type XHHN, complying with UL 44, in raceway.
- B. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, complying with UL 83, in raceway, power-limited cable, complying with UL 83, concealed in building finishes, power-limited tray cable, complying with UL 83, in cable tray or Type XHHN, complying with UL 44, in raceway.
- C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or TF, complying with UL 83.

2.7 IDENTIFICATION PRODUCTS

- A. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- B. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."
- C. Comply with ANSI/TIA-606-D.

2.8 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory test UTP and optical fiber cables on reels according to ANSI/TIA-568.1-E.
- C. Factory test UTP cables according to ANSI/TIA-568.2-D.
- D. Factory sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.
- E. Cable will be considered defective if it does not pass tests and inspections. Comply with Section 01 40 00 "Quality Control" for retesting and re-inspecting requirements.
- F. Prepare test and inspection reports and submit for approval.

PART 3 - EXECUTION

3.1 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements in Electrical Drawings for 27 05 29 "Hangers and Supports for Communications Systems" for installation of supports for cables.

3.2 WIRING METHOD

- A. Install wiring in metal pathways and wireways.

1. Minimum conduit size shall be 3/4 inch. Control and data transmission wiring shall not share conduit with other building wiring systems.
- B. Comply with requirements in Section 27 05 28 "Pathways for Communications Systems."
- C. Install cable, concealed in accessible ceilings, walls, and floors when possible.
- D. Wiring within Enclosures:
 1. Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
 2. Install lacing bars and distribution spools.
 3. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer.
 4. Install conductors parallel with or at right angles to sides and back of enclosure.
 5. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with intrusion system to terminal blocks.
 6. Mark each terminal according to system's wiring diagrams.
 7. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

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 ANSI/TIA-568.1-E.
 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. UTP Cable Installation: Install using techniques, practices, and methods that are consistent with Category 6 rating of components and that ensure Category 6 performance of completed and linked signal paths, end to end.
 1. Comply with ANSI/TIA-568.2-D.

- E. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry
- F. Separation from EMI Sources:
 - 1. Comply with BICSI TDMM and ANSI/TIA-569-E 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 Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
 - 6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.4 POWER AND CONTROL-CIRCUIT CONDUCTORS

- A. 120-V Power Wiring: Install according to Electrical Drawings for "Low-Voltage Electrical Power Conductors and Cables" unless otherwise indicated.
- B. Minimum Conductor Sizes:
 - 1. Class 1 remote-control and signal circuits, No. 14 AWG.
 - 2. Class 2 low-energy, remote-control and signal circuits, No. 16 AWG.
 - 3. Class 3 low-energy, remote-control, alarm and signal circuits, No. 12 AWG.

3.5 CONNECTIONS

- A. Comply with requirements in Section 28 13 00 "Access Control" for connecting, terminating, and identifying wires and cables.
- B. Comply with requirements in Section 28 23 00 "Video Surveillance" for connecting, terminating, and identifying wires and cables.

3.6 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies.
- B. Provide materials classified by UL to provide fire stopping equal to time rating of construction being penetrated. Provide asbestos free materials that comply with applicable codes and have been tested under positive pressure in accordance with UL 1479 or ASTM E814.
- C. Comply with ANSI/TIA-569-E, Annex A, "Firestopping."
- D. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.7 GROUNDING

- A. For communications wiring, comply with ANSI/TIA-607-E and with BICSI TDMM, "Bonding and Grounding (Earthing), Chapter 8".
- B. For low-voltage wiring and cabling, comply with requirements in Section 27 05 26 for "Grounding and Bonding for Communications Systems."

3.8 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with ANSI/TIA-606-D. Comply with requirements for identification specified in Electrical Drawings for "Identification for Electrical Systems."

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections:
 - 1. Visually inspect UTP and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with ANSI/TIA-568.1-E.
 - 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 - 3. Test UTP 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 ANSI/TIA-568.2-D. 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 ANSI/TIA-568.1-E. 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) Single mode Link Measurements: Test at 1310 or 1550 nm in one direction according to ANSI/TIA-526.7-A, Method B, One Reference Jumper.
 - 2) Attenuation test results for links shall be less than 2.3 dB. Attenuation test results shall be less than that calculated according to equation in ANSI/TIA-568.3-E.
- D. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide or transfer the data from the instrument to the computer, save as text files, print, and submit.
- E. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports and submit for approval.

END OF SECTION 28 05 13

**SECTION 28 05 26
GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY**

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. Grounding conductors.
 - 2. Grounding connectors.
 - 3. Grounding busbars.
- B. Related Requirements:
 - 1. Section 280500 "Supplemental Requirements for Electronic Safety and Security."
 - 2. Section 28 05 13 "Conductors and Cables for Electronic Safety and Security."
 - 3. Section 28 05 28 "Pathways for Electronic Safety and Security."
 - 4. Section 28 05 44 "Sleeves and Sleeve Seals for Electronic Safety and Security Pathways and Cabling."
 - 5. Section 28 13 00 "Access Control."
 - 6. Section 28 23 00 "Video Surveillance."

1.3 DEFINITIONS

- A. Signal Ground: The ground reference point designated by manufacturer of the system that is considered to have zero voltage.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SYSTEM COMPONENTS

- A. Comply with ANSI/TIA-607-E.

2.2 CONDUCTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following (or approved equal):
 - 1. Harger Lightning and Grounding.
 - 2. Panduit Corp.
 - 3. TE Connectivity Ltd.
- B. Comply with UL 486A-486B.
- C. Insulated Conductors: Stranded copper wire, green or green with yellow stripe insulation, insulated for 600 V, and complying with UL 83.
 - 1. Ground wire for custom-length equipment ground jumpers shall be No. 6 AWG, 19-strand, UL-listed, Type THHN wire.
- D. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Cable: 28 kmils (14.2 sq. mm), 14 strands of No. 17 AWG conductor, and 1/4 inch (6.3 mm) in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Tinned-copper tape, braided conductors terminated with two-hole copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.3 CONNECTORS

- A. Comply with Section 27 05 26 "Grounding and Bonding for Communications Systems."

2.4 GROUNDING BUSBARS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following (or approved equal):
 - 1. Chatsworth Products, Inc.
 - 2. Erico.
 - 3. Harger Lightning and Grounding.
 - 4. Panduit Corp.
- B. Grounding Busbars: Connect to Secondary Busbar (SBB). Predrilled rectangular bars of hard-drawn solid copper, 1/4 by 2 inches (6.3 by 50 mm) in cross section, length as indicated on Drawings. The busbar shall be for wall mounting, shall be Nationally Recognized Testing Laboratory (NRTL) listed as complying with UL 467, and shall comply with ANSI/TIA-607-E.
 - 1. Predrilling shall be with holes for use with lugs specified in this Section.
 - 2. Mounting Hardware: Stand-off brackets that provide at least a 2-inch (50-mm) clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.
 - 3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600 V switchboards, impulse tested at 5000 V.

- C. Rack and Cabinet Grounding Busbars: Rectangular bars of hard-drawn solid copper, accepting conductors ranging from No. 14 to No. 2/0 AWG, NRTL listed as complying with UL 467, and complying with ANSI/TIA -607-E. Predrilling shall be with holes for use with lugs specified in this Section.
 - 1. Cabinet-Mounted Busbar: Terminal block, with stainless-steel or copper-plated hardware for attachment to the cabinet.
 - 2. Rack-Mounted Horizontal Busbar: Designed for mounting in 19- or 23-inch (483- or 584-mm) equipment racks. Include a copper splice bar for transitioning to an adjoining rack, and stainless-steel or copper-plated hardware for attachment to the rack.
 - 3. Rack-Mounted Vertical Busbar: 72 or 36 inches (1827 or 914 mm) long, with stainless-steel or copper-plated hardware for attachment to the rack.

2.5 LABELING

- A. Comply with Section 27 05 26 "Grounding and Bonding for Communications Systems."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with IEEE 1100, "Recommended Practice for Power and Grounding Electronic Equipment."
 - 1. 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.
 - 2. Bond shields and drain conductors to ground at only one point in each circuit.
- B. Signal Ground:
 - 1. For each system, establish the signal ground and label that location as such.
 - 2. Bond the signal ground to the alternating-current (ac) power system service by connecting to one of the following listed locations, using insulated No. 6 AWG, stranded, Type THHN wire:
 - a. Grounding bar in an electrical power panelboard if located in the same room or space as the signal ground.
 - b. Telecommunications grounding busbar.
- C. Comply with NECA 1.

3.2 APPLICATION

- A. Conductors: Install solid conductor for No. 8 AWG and smaller and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Grounding and Bonding Conductors:

1. Install in the straightest and shortest route between the origination and termination point, and no longer than required. The bend radius shall not be smaller than eight times the diameter of the conductor. No one bend may exceed 90 degrees.
2. Install without splices.
3. Support at not more than 36-inch (900-mm) intervals.

3.3 CONNECTIONS

- A. Stacking of conductors under a single bolt is not permitted when connecting to busbars.
- B. Assemble the wire connector to the conductor, complying with manufacturer's written instructions and as follows:
 1. Use crimping tool and the die specific to the connector.
 2. Pre-twist the conductor.
 3. Apply an antioxidant compound to all compression connections.
- C. Shielded Cable: Bond the shield of shielded cable to the signal ground. Comply with ANSI/TIA - 568.1-E and ANSI/TIA -568.2-D when grounding screened, balanced, twisted-pair cables.
- D. Rack- and Cabinet-Mounted Equipment: Bond powered equipment chassis to the cabinet or rack grounding bar. Power connection shall comply with NFPA 70; the equipment grounding conductor in the power cord of cord- and plug-connected equipment shall be considered as a supplement to bonding requirements in this Section.

3.4 IDENTIFICATION

- A. Comply with Section 27 05 26 "Grounding and Bonding for Communications Systems."

3.5 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

END OF SECTION 28 05 26

**SECTION 28 05 28
PATHWAYS FOR ELECTRONIC SAFETY AND SECURITY**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Requirements:
 - 1. Section 28 05 00 "Supplemental Requirements for Electronic Safety and Security."
 - 2. Section 28 05 13 "Conductors and Cables for Electronic Safety and Security."
 - 3. Section 28 05 26 "Grounding and Bonding for Safety and Security."
 - 4. Section 28 05 44 "Sleeves and Sleeve Seals for Electronic Safety and Security Pathways and Cabling."
 - 5. Section 28 13 00 "Access Control."
 - 6. Section 28 23 00 "Video Surveillance."

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal conduits, tubing, and fittings.
 - 2. Nonmetallic conduits, tubing, and fittings.
 - 3. Metal wireways and auxiliary gutters.
 - 4. Nonmetallic wireways and auxiliary gutters.
 - 5. Surface pathways.
 - 6. Boxes, enclosures, and cabinets.

1.3 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid steel conduit.
- C. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

- A. Product Data: For surface pathways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Sustainable Design Submittals:
- C. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

- D. Samples: For wireways and surface pathways and for each color and texture specified, 12 inches (300 mm) long.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Pathway routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
 - 1. Structural members in paths of pathway groups with common supports.
 - 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
- B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. General Requirements for Metal Conduits and Fittings:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Comply with ANSI/TIA-569-E.
- B. GRC: Comply with ANSI C80.1 and UL 6.
- C. ARC: Comply with ANSI C80.5 and UL 6A.
- D. IMC: Comply with ANSI C80.6 and UL 1242.
- E. PVC-Coated Steel Conduit:
 - 1. Comply with NEMA RN 1.
 - 2. Coating Thickness: 0.040 inch (1 mm), minimum.
- F. EMT: Comply with ANSI C80.3 and UL 797.
- G. FMC: Comply with UL 1; aluminum.
- H. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- I. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
 - 2. Fittings for EMT:
 - a. Material: die cast.
 - b. Type: Setscrew or compression.
 - 3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 467, rated for environmental conditions where installed, and including flexible external bonding jumper.

- 4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.
- J. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Allied Tube & Conduit; a part of Atkore International.
 - 2. CANTEX INC.
 - 3. RACO; Hubbell.
- B. General Requirements for Nonmetallic Conduits and Fittings:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Comply with ANSI/TIA-569-E.
- C. ENT: Comply with NEMA TC 13 and UL 1653.
- D. RNC: Type EPC-40-PVC complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- E. LFNC: Comply with UL 1660.
- F. Rigid HDPE: Comply with UL 651A.
- G. Continuous HDPE: Comply with UL 651B.
- H. RTRC: Comply with UL 2420 for below ground, UL 2525 for above ground, and NEMA TC 14.
- I. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
- J. Fittings for LFNC: Comply with UL 514B.
- K. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 OPTICAL-FIBER-CABLE PATHWAYS AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Arnco Corporation.
 - 2. IPEX USA LLC.
- B. Description: Comply with UL 2024; flexible-type pathway, approved for plenum riser or general-use installation unless otherwise indicated.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with ANSI/TIA-569-E.

2.4 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 1. Hoffman; a brand of Pentair Equipment Protection.
 2. Square D.
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 and/or Type 3R unless otherwise indicated, and sized according to NFPA 70.
 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Comply with ANSI/TIA-569-E.
- C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Hinged type unless otherwise indicated.
- E. Finish: Manufacturer's standard enamel finish.

2.5 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 1. Allied Moulded Products, Inc.
 2. Niedax Inc.
- B. General Requirements for Nonmetallic Wireways and Auxiliary Gutters:
 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Comply with ANSI/TIA-569-E.
- C. Description: Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets.
- D. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.
- E. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.

- F. Solvents and Adhesives: As recommended by conduit manufacturer.

2.6 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Crouse-Hinds, an Eaton business.
 - 2. Hoffman; a brand of Pentair Equipment Protection.
 - 3. Wiremold / Legrand.
- B. General Requirements for Boxes, Enclosures, and Cabinets:
 - 1. Comply with ANSI/TIA-569-E.
 - 2. Boxes, enclosures and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet-Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.
- E. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- F. Metal Floor Boxes:
 - 1. Material: Cast metal.
 - 2. Type: Fully adjustable
 - 3. Shape: Rectangular.
 - 4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- G. Nonmetallic Floor Boxes: Nonadjustable, rectangular.
 - 1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- I. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- J. Device Box Dimensions: 4-11/16 inches square by 2-1/2 inches deep.
- K. Gangable boxes are allowed.
- L. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- M. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures:
 - a. Material: Plastic.
 - b. Finished inside with radio-frequency-resistant paint.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

N. Pull Boxes:

1. NEMA Type 4 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 - EXECUTION

3.1 PATHWAY APPLICATION

A. Outdoors: Apply pathway products as specified below unless otherwise indicated:

1. Exposed Conduit: Type EPC-40-PVC
2. Concealed Conduit, Aboveground: EMT.
3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply pathway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT
3. Exposed and Subject to Severe Physical Damage: GRC
4. Pathway locations include the following:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 - d. Gymnasiums
5. Concealed in Ceilings and Interior Walls and Partitions: EMT
6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric-Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
7. Damp or Wet Locations: GRC

8. Pathways for Concealed General-Purpose Distribution of Optical-Fiber or Communications Cable: General-use, optical-fiber-cable pathway
 9. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 nonmetallic in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Pathway Size: 3/4-inch trade size. Minimum size for optical-fiber cables is 1 inch.
- D. Pathway Fittings: Compatible with pathways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 3. EMT: Use compression, cast-metal fittings. Comply with NEMA FB 2.10.
 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- F. Install surface pathways only where indicated on Drawings.
- G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

- A. Comply with NECA 1, NECA 101, and ANSI/TIA-569-E for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum pathways. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.
- B. Keep pathways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.
- C. Complete pathway installation before starting conductor installation.
- D. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- E. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications wiring conduits for which only two 90-degree bends are allowed. Support within 12 inches (300 mm) of changes in direction.
- F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- G. Support conduit within 12 inches (300 mm) of enclosures to which attached.
- H. Pathways Embedded in Slabs:
1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot (3-m) intervals.

2. Arrange pathways to cross building expansion joints at right angles with expansion fittings.
 3. Arrange pathways to keep a minimum of 2 inches of concrete cover in all directions.
 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
 5. Change from ENT to EMT before rising above floor.
 6. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.
- J. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.
- K. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.
- L. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- M. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to conduit assembly to assure a continuous ground path.
- N. Cut conduit perpendicular to the length. For conduits of 2-inch trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.
- O. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground pathways designated as spare above grade alongside pathways in use.
- P. Surface Pathways:
1. Install surface pathway for surface electrical outlet boxes only where indicated on Drawings.
 2. Install surface pathway with a minimum 2-inch radius control at bend points.
 3. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight pathway section. Support surface pathway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- Q. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:
1. 3/4-Inch Trade Size and Smaller: Install pathways in maximum lengths of 50 feet (15 m).
 2. 1-Inch Trade Size and Larger: Install pathways in maximum lengths of 75 feet (23 m).
 3. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

- R. Install pathway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway sealing fittings according to NFPA 70.
- S. Install devices to seal pathway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service pathway enters a building or structure.
 - 3. Where otherwise required by NFPA 70.
- T. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.
- U. Expansion-Joint Fittings:
 - 1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C), and that has straight-run length that exceeds 25 feet (7.6 m). Install in each run of aboveground EMT conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).
 - 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C)
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
 - 3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
 - 4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 - 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- V. Flexible Conduit Connections: Comply with NEMA RV 3. Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semi recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 1. Use LFMC in damp or wet locations subject to severe physical damage.
 - 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- W. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

- X. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
 - Y. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
 - Z. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
 - AA. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
 - BB. Set metal floor boxes level and flush with finished floor surface.
 - CC. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
- 3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRONIC SAFETY AND SECURITY PENETRATIONS
- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 27 05 44 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."
- 3.4 FIRESTOPPING
- A. Install firestopping at penetrations of fire-rated floor and wall assemblies.
 - B. Provide materials classified by UL to provide fire stopping equal to time rating of construction being penetrated. Provide asbestos free materials that comply with applicable codes and have been tested under positive pressure in accordance with UL 1479 or ASTM E814.
 - C. Comply with ANSI/TIA-569-E, Annex A, "Firestopping."
 - D. Comply with BICSI TDMM, "Firestopping Systems"
- 3.5 PROTECTION
- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 28 05 28

**SECTION 28 05 44
SLEEVES AND SLEEVE SEALS FOR ELECTRONIC SAFETY AND SECURITY PATHWAYS AND
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.
- B. Related Requirements:
 - 1. Section 280500 "Supplemental Requirements for Electronic Safety and Security."
 - 2. Section 28 05 13 "Conductors and Cables for Electronic Safety and Security."
 - 3. Section 28 05 26 "Grounding and Bonding for Electronic Safety and Security."
 - 4. Section 28 05 28 "Pathways for Electronic Safety and Security."
 - 5. Section 28 13 00 "Access Control."
 - 6. Section 28 23 00 "Video Surveillance."

1.2 SUMMARY

- A. Section Includes:
 - 1. Sleeves for pathway and cable penetration of non-fire-rated construction walls and floors.
 - 2. Sleeve-seal systems.
 - 3. Sleeve-seal fittings.
 - 4. Grout.
 - 5. Silicone sealants.

1.3 ACTION SUBMITTALS

- A. Refer to the requirements of Section 27 05 44 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

PART 2 - PRODUCTS

2.1 SYSTEM COMPONENTS

- A. Comply with Section 01 40 00 "Quality Requirements."

2.2 SLEEVES

- A. Refer to the requirements of Section 27 05 44 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

2.3 SLEEVE-SEAL SYSTEMS

- A. Refer to the requirements of Section 27 05 44 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

2.4 SLEEVE-SEAL FITTINGS

- A. Refer to the requirements of Section 27 05 44 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

2.5 GROUT

- A. Refer to the requirements of Section 27 05 44 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

2.6 SILICONE SEALANTS

- A. Refer to the requirements of Section 27 05 44 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Refer to the requirements of Section 27 05 44 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Refer to the requirements of Section 27 05 44 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Refer to the requirements of Section 27 05 44 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

END OF SECTION 28 05 44

**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.
- B. Related Requirements:
 - 1. Section 28 05 00 "Supplemental Requirements for Electronic Safety and Security."
 - 2. Section 28 05 13 "Conductors and Cables for Electronic Safety and Security."
 - 3. Section 28 05 26 "Grounding and Bonding for Safety and Security."
 - 4. Section 28 05 28 "Pathways for Electronic Safety and Security."
 - 5. Section 28 05 44 "Sleeves and Sleeve Seals for Electronic Safety and Security Pathways and Cabling."
 - 6. Section 28 23 00 "Video Surveillance."

1.2 SUMMARY

- A. Section Includes:
 - 1. Security system operation.
 - 2. Application software (existing).
 - 3. Surge and tamper protection
 - 4. Network switch (existing).
 - 5. Security access controllers.
 - 6. Card readers.
 - 7. Door switches.
 - 8. Passive infrared sensors.
 - 9. Lock power supplies.
 - 10. Duress Push Button.
 - 11. ACS Server (existing).
 - 12. Interfaces.
 - 13. Cables.
 - 14. Transformers.

1.3 REFERENCES

- A. Section 28 05 13 – "Conductors and Cables for Electronic Safety and Security"
 - 1. Federal Communications Commission (FCC):
 - a. FCC Part 15 – Radio Frequency Device
 - b. FCC Part 68 – Connection of Terminal Equipment to the Telephone Network
 - 2. Underwriters Laboratories (UL):
 - a. UL294 – Access Control System Units
 - b. UL1076 – Proprietary Burglar Alarm Units and Systems
 - 3. National Fire Protection Association (NFPA):

- a. ~~NEC/ATC~~ – National Electrical Code
- 4. Telecommunications Industry Association (TIA):
 - a. RS232F – Interface between Data Terminal Equipment and Data Communications Equipment
- 5. Employing Serial Binary Data Interchange
 - a. RS485 – Electrical Characteristics of Generators and Receivers for use in Balanced Digital Multi-Point Systems
- 6. Federal Information Processing Standards (FIPS):
 - a. Advanced Encryption Standard (AES) (FIPS 197)
 - b. FIPS 201: Personal Identity Verification (PIV) of Federal Employees and Contractors
- 7. Homeland Security Presidential Directive 12 (HSPD-12)

1.4 DEFINITIONS

- A. ACS: Access Control System
- B. CPU: Central processing unit.
- C. Credential: Data assigned to an entity and used to identify that entity.
- D. I/O: Input/Output.
- E. LAN: Local area network.
- F. 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 a ANSI/TIA 485-A communications loop. Where this term is presented with an initial capital letter, this definition applies.
- G. NRTL: Nationally Recognized Testing Laboratory.
- H. PC: Personal computer. Applies to the central station, workstations, and file servers.
- I. PCI Bus: Peripheral Component Interconnect. A peripheral bus providing a high-speed data path between the CPU and the peripheral devices such as a monitor, disk drive, or network.
- J. PDF: Portable Document Format. The file format used by the Acrobat document-exchange-system software from Adobe.
- K. PIR: Passive infrared. Applies to PIR REX sensors used to unlock an access-controlled door and/or shunt a door position switch.
- L. REX: Request-to-exit.
- M. TCP/IP: Transport control protocol/Internet protocol incorporated into Microsoft Windows.
- N. UPS: Uninterruptible power supply.

U. VMS: video management system.

P. Workstation: A PC with software that is configured for specific, limited security-system functions.

1.5 ACTION SUBMITTALS

A. Coordination: Submittals of each type listed below for this Section; Section 28 23 00 "Video Surveillance" shall be submitted at one time. Refer to Section 28 23 00 for additional action submittal requirements.

B. Materials and Equipment List: Complete list of all materials, equipment and accessories proposed for the Work in accordance with these Specifications and Contract Drawings, including manufacturers, complete catalog identification numbers and model or system designator, quantities, and software packages (where applicable), shall be submitted with the Product Data defined below. The submittal shall be in sufficient detail whereby the equipment and materials proposed can be readily identified. No consideration will be given to partial lists or lists submitted from time-to-time. Approval of materials and equipment will be tentative to the submission of complete shop drawings. The Owner shall not be obligated in any manner for any materials, equipment or accessories that have not been accepted.

C. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, standard wiring diagrams, dimensions, standard colors and finishes, furnished specialties and accessories, and compliances. Clearly indicate all models, features, options and accessories to be provided. Include system block diagrams showing interconnectivity of equipment. Reference each product to a location on Drawings.

D. Shop Drawings: After receiving written acceptance of the product data submittals, and tentative acceptance of the materials and equipment lists, and before ordering, purchasing, fabricating or installing any materials or equipment, the Contractor shall submit accurately scaled, computer-generated shop drawings of the systems to demonstrate compliance with the Contract Documents. Clearly indicate any deviations from the Contract Drawings. Shop drawings will be reviewed for general conformance with the design concepts and noted for the Contractor's convenience only and should not be accepted as correct or complete or in any way relieve the Security Contractor's responsibilities as a part of this Contract. Shop drawings shall include the following:

1. Fabrication and installation details.
2. System architecture, block diagrams, schematics, and point-to-point wiring diagrams.
3. Schedules.
4. Conduit types, sizes and routing.
5. Equipment loads and standby power sizing calculations used by the system equipment supporting compliance with minimum UPS power standby requirements specified herein.
6. Graphic maps of all areas including room and device designations with dynamic icons for remote monitoring and control of the systems.

1.6 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Test Plan and Schedule: Test plan defining all tests required to ensure that system meets technical, operational, and performance specifications within 60 days of date of Contract award.

C. The phased test plan shall include specific requirements for an operational facility to be commissioned in phases to coincide with the construction phasing, including all required temporary signage as coordinated with Airport Security. Submit plan for approval.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For security system to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 00 "Closeout Submittals" include the following:
 - 1. For each type of product, hard copies of manufacturer's specification sheets, operating specifications, design guides, user's guides for software and hardware, and features and operating sequences (both automatic and manual).
 - 2. PDF files on thumb drive of the hard-copy submittal.
 - 3. System installation and setup guides with data forms to plan and record options and setup decisions.
 - 4. Lists of spare parts and replacement components recommended to be stored at the site for ready access.
- B. Record Drawings: Provide, and keep up to date, a complete record set of drawings which shall be corrected and shall show every change from the original Contract Drawings and shop drawings through final acceptance. The record set of drawings shall be protected against soiling, tears and similar damage and defacement. This set of prints shall be kept on the job site and shall be used only as a record set. This shall not be construed as authorization for the Contractor to make changes in the Work without proper approvals. Upon completion of the Work and before final payment, the Contractor shall submit the complete record set to the Owner/Owner's Representative for review. Upon acceptance, the record set shall be converted to computer generated as-built drawings to be retained by the Owner, or by their representative. Hand-drawn sketches or red-lined markups will not be accepted.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
 - 1. Comply with Section 28 05 13 "Conductors and Cables for Electronic Safety and Security."
 - 2. Cable installers must have on staff a registered communication distribution designer certified by Building Industry Consulting Service International.
- B. Manufacturer Qualifications:
 - 1. The manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, the equipment and material specified for this project, and shall have manufactured the item for at least five years.
- C. Product Qualifications:
 - 1. The manufacturer's product shall have been in satisfactory operation, on three installations of comparable size and type as this project, for approximately three years.
 - 2. The Owner reserves the right to require the Contractor to submit a list of installations where the products have been in operation before approval.
- D. Source Limitations: Obtain controllers and all software through one source from a single manufacturer.
 - 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Comply with NFPA 70, "National Electrical Code."

3. Comply with SIA CF-01-2019, DC-03-2003.10, AND DC-07-2001.009.

E. Contractor Qualifications:

1. The Contractor or security sub-contractor shall be a licensed security Contractor with a minimum of five (5) years of experience installing and servicing systems of similar scope and complexity. The Contractor shall be an authorized regional representative of the Access Control System manufacturer.
2. The Contractor shall provide four (4) current references from clients with systems of similar scope and complexity which became operational in the past three (3) years. At least three (3) of the references shall be utilizing the same system components, in a similar configuration as the proposed system. The references must include a current point of contact, company or agency name, address, telephone number, complete system description, date of completion, and approximate cost of the project. The owner reserves the option to visit the reference sites, with the site owner's permission and representative, to verify the quality of installation and the references' level of satisfaction with the system.
3. The Contractor shall provide copies of the system manufacturer certification for all technicians. The Contractor shall only utilize factory-trained technicians to install, program, and service the Access Control System. The Contractor shall only utilize factory-trained technicians to install, terminate and service controller/field panels and reader modules. The technicians shall have a minimum of five (5) continuous years of technical experience in electronic security systems.
4. The Contractor shall have a local service facility. The facility shall be located within 60 miles of the project site. The local facility shall include sufficient spare parts inventory to support the service requirements associated with this contract. The facility shall also include appropriate diagnostic equipment to perform diagnostic procedures. The Resident Engineer reserves the option of surveying the company's facility to verify the service inventory and presence of a local service organization.
5. The Contractor shall provide proof project superintendent with BICSI Certified Commercial Installer Level 1, Level 2, or Technician to provide oversight of the project.
6. Cable installer must have on staff a Registered Communication Distribution Designer (RCDD) certified by Building Industry Consulting Service International. The staff member shall provide consistent oversight of the project cabling throughout design, layout, installation, termination, and testing.

F. Service Qualifications:

1. There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within eight (8) hours of receipt of notification that service is needed. Submit name and address of service organizations.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Controllers:

1. Store in temperature- and humidity-controlled environment in original manufacturer's sealed containers. Maintain ambient temperature between 50- and 85-degrees F (10- and 30-degrees C), 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. Save original manufacturer's containers and packing materials and deliver as directed under provisions covering extra materials.

1.10 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-degrees F (16- to 30-degrees C) and a relative humidity of 20 to 80 percent, noncondensing.
 2. Indoor, Controlled Environment: NEMA 250, Type 1 enclosure. System components, except the central-station control unit, installed in air-conditioned indoor environments shall be rated for continuous operation in ambient conditions of [36- to 122-degrees F (2- to 50-degrees C) dry bulb and 20 to 90 percent relative humidity, noncondensing.
 3. Indoor, Uncontrolled Environment: NEMA 250, Type 3R enclosures. System components installed in non-temperature-controlled indoor environments shall be rated for continuous operation in ambient conditions of [0 to 122-degrees F (-18 to +50-degrees C) dry bulb and 20 to 90 percent relative humidity, noncondensing.
 4. Outdoor Environment: NEMA 250, Type 4X enclosures as required. System components installed in locations exposed to weather shall be rated for continuous operation in ambient conditions of -30 to +122-degrees F (-34 to +50-degrees C) 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 (137 km/h).
 5. 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.
 6. Corrosive Environment: For system components subjected to corrosive fumes, vapors, and wind-driven salt spray in coastal zones, provide NEMA 250, Type 4X or Type 6P enclosures.

1.11 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer and Installer agree to repair or replace components of access control devices and equipment that fail in materials or workmanship within specified warranty period.
1. Warranty Period: One year from date of Final Acceptance.

1.12 COORDINATION

- A. Coordination: The Work of this Section shall include the review of the Contract Documents, both written and illustrated, for the entire Project. The Contractor shall examine all plans and specifications for related work that may impact the installation of the security system. Contractor shall coordinate such Work as, but not limited to, the following:
1. Data network connections;
 2. Precise locations of field devices;
 3. Labeling and identification requirements for new cabling;
 4. Coordinate with the Communications Work for the provision of 120VAC UPS-backed power circuits required for security systems;
 5. Connections points for electronic door hardware;
 6. Connections points for door release relays;
 7. Activation of all new security devices; and
 8. Testing activities involving other disciplines.

2.1 SYSTEM COMPONENTS

- A. Certain equipment shall match or be compatible with existing as defined herein.

2.2 DESCRIPTION

- A. Access Control System: The ACS shall be an extension of the existing security management systems:
 - 1. EUG Access Control System – Existing Software House (Tyco).
 - 2. Video Management System (VMS) – Existing Ocularis by Qognify.
- B. Card readers:
 - 1. HID Global or as directed by the Owners (EUG).

2.3 OPERATION

- A. General: The existing security access system is configured to use a database for access-control and credential-creation functions. Standard features and specific capabilities shall be reviewed with the Owner for selection of configuration criteria.
- B. System Network Requirements:
 - 1. System components shall be interconnected and shall 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. The system shall automatically annunciate communication failures to the operator and shall identify the communications link that has experienced a partial or total failure.
- C. 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.
- D. Field equipment shall include controllers, sensors, and controls.
 - 1. Controllers shall serve as an interface between the central station and sensors and controls.
 - 2. Data exchange between the central station and the controllers shall include down-line transmission of commands, software, and databases to controllers.
 - 3. 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.
 - 4. Controllers are classified as alarm-annunciation or entry-control type.
- E. System Response to Alarms:
 - 1. Field device network shall provide a system end-to-end response time of less than one second for every device connected to the system.
 - 2. Alarms shall be annunciated at the central station within one second of the alarm occurring at a controller or at a device controlled by a local controller, and within 100 ms if the alarm occurs at the central station.

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3. Alarm and status changes shall be displayed within 100 ms after receipt of data by the central station.
 4. All graphics shall be displayed, including graphics-generated map displays, on the console monitor within five seconds of alarm receipt at the security console.
- F. Data Line Supervision: System shall initiate an alarm in response to opening, closing, shorting, or grounding of data transmission lines.
- G. Door Hardware Interface:
1. Comply with requirements in Section 08 71 00 "Door Hardware" for door hardware required to be monitored or controlled by the security access system.
 2. The electrical characteristics of controllers shall match the signal and power requirements of door hardware.
- H. Graphic Maps:
1. Graphic map displays shall show the layout of the protected facilities. Portals and zones corresponding to those monitored and controlled by the system shall be identified by dynamic icons on the maps that change state to indicate status of each portal or zone.
- 2.4 CONTROLLERS
- A. Manufacturer: Subject to compliance with requirements, provide products by the following to match existing:
1. The controller shall be existing iSTAR Ultra panel in IT/Comm room 2007.
- B. The existing Controller Software shall have following features:
1. Controllers shall operate as autonomous, intelligent processing units.
 - a. Controllers shall make decisions about access control, alarm monitoring, linking functions, and door-locking schedules for their operation, independent of other system components.
 - b. Controllers shall be part of a fully distributed processing-control network.
 - c. 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. 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 the 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.
 3. Controller Operations at a Location:

- a. Up to 64 controllers connected to TCP/IP. Globally operating I/O linking and anti-passback functions between controllers within the same Location without central-station or workstation intervention. Linking and anti-passback shall remain fully functional within the same Location even when the central station or workstations are off-line.
 - b. In the event of communication failure between the central station and a Location, there shall be no degradation in operations at the controllers at that Location. Controllers at each Location shall be connected to a memory buffer with a capacity to store up to 10,000 events; there shall be no loss of transactions in system history files until the buffer overflows.
 - c. Buffered events shall be handled in a first-in-first-out mode of operation.
4. Individual Controller Operation:
- a. Controllers shall transmit alarms, status changes, and other data to the central station when communications circuits are operable. If communications are not available, controllers shall function in a stand-alone mode; operational data, including the status and alarm data normally transmitted to the central station, shall be stored for later transmission to the central station. Storage capacity for the latest 1024 events shall be provided at each controller.
 - b. Card-reader ports of a controller shall be custom configurable for at least 120 different card-reader or keypad formats. Multiple reader or keypad formats may be used simultaneously at different controllers or within the same controller.
 - c. Controllers shall provide a response to card readers or keypad entries in less than 0.25 seconds, regardless of system size.
 - d. Controllers that are reset, or powered up from a nonpowered state, shall automatically request a parameter download and reboot to their proper working state. This shall happen without any operator intervention.
 - e. Initial Startup: When controllers are brought on-line, database parameters shall be automatically downloaded to them. After initial download is completed, only database changes shall be downloaded to each controller.
 - f. On failure for any reason, controllers shall perform an orderly shutdown and force controller outputs to a predetermined failure-mode state, consistent with the failure modes shown and the associated control device.
 - g. After power is restored, following a power failure, startup software shall initiate self-test diagnostic routines, after which controllers shall resume normal operation.
 - h. After controller failure, if the database and application software are no longer resident, controllers shall not restart but shall remain in failure mode until repaired. If database and application programs are resident, controllers shall immediately resume operation. If not, the software shall be restored automatically from the central station.
5. Communications Monitoring:
- a. The system shall monitor and report the status of TCP/IP of each Location.
 - b. Communication status window shall display which controllers are currently communicating, a total count of missed polls since midnight, and which controller last missed a poll.
 - c. The communication status window shall show the type of CPU, the type of I/O board and the amount of RAM for each controller.
6. Time Clock Synchronization:
- a. Operating systems shall include a real-time clock function that maintains seconds, minutes, hours, day, date, and month. The real-time clock shall be automatically synchronized with the central station at least once a day to plus or minus 10

seconds. The time synchronization shall be automatic, without operator action and without requiring system shutdown.

C. PC-to-Controller Communications:

1. Central-station or workstation communications shall use TCP/IP LAN interface cards.
2. Each serial port used for communications shall be individually configurable for direct communications or as an ASCII output port. Serial ports shall have adjustable data transmission rates and shall be selectable under program control.
3. Use a multiport communications board if more than two serial ports are needed.
 - a. Use a 4-, 8-, or 16-serial port configuration that is expandable to 32- or 64-serial ports.
 - b. Connect the first board to an internal PCI bus adapter card.
4. Direct serial, TCP/IP, and dial-up, cable, or satellite communications shall be alike in the monitoring or control of the system except for the connection that must first be made to a dial-up or voice-over IP Location.
5. TCP/IP network interface card (NIC) shall have an option to set the poll-frequency and message-response time-out settings.
6. PC-to-controller and controller-to-controller communications (direct, dial-up, or TCP/IP) shall use a polled-communication protocol that checks sum and acknowledges each message. All communications in this subparagraph shall be verified and buffered and retransmitted if not acknowledged.

D. Direct Serial or TCP/IP PC-to-Controller Communications:

1. Communication software on the PC shall supervise the PC-to-controller communications link.
2. Loss of communication to any controller shall result in an alarm at all PCs running the communication 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.

E. Controller-to-Controller Communications:

1. ANSI/TIA 485-A, four-wire, point-to-point, regenerative (repeater) communications network methodology (also known as RS-485 communications protocol).
2. ANSI/TIA 485-A communications signal shall be regenerated at each controller.

F. 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.

G. ACS Alarm Monitoring: Monitor ACS sensors, controllers, and DTS circuits and notify operators of an alarm condition. Display higher-priority alarms first and, within alarm priorities, display the oldest unacknowledged alarm first. Operator acknowledgment of one alarm shall not be considered acknowledgment of other alarms nor shall it inhibit reporting of subsequent alarms. Configure system to monitor alarms same as existing operation or as directed by the Owner.

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- ## 2.5 TAMPER PROTECTION

- ## 2.6 NETWORK SWITCH

- ## 2.7 ACS SERVER

- ## 2.8 CARD READERS

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- e. A valid card is presented to the reader and a valid generic code is entered into the keypad.
 - 2. The reader shall require that a card, once read, must be removed from the RF field for approximately one second before reading again to prevent multiple reads from the same card and anti-passback errors.
 - 3. The reader shall have a high-intensity red/green/blue (RGB) light bar integrated into the device to provide clear visual status. The light bar shall provide uniform distribution of light eliminating individual bright spots. The light bar shall illuminate steady red in normal state. Valid reads shall cause the light bar to illuminate steady green during the unlock (or validation) period. Invalid reads shall cause the light bar to flash red five (5) times. Light bar illumination operation shall be programmable as determined by the Owner.
 - 4. The reader shall have an audio transducer capable of providing unique tone sequences for various status conditions, including access granted, access denied, power up, diagnostics, and PIN prompt. Presenting the card to the reader shall cause a beep to sound once received. Beeper operation shall be programmable as determined by the Owner.
 - 5. The reader shall allow the reader firmware to be upgraded in the field without the need to remove the reader from the back box through the use of factory-provided programming cards.
 - 6. The reader shall be connected via multi-pair, stranded, 22AWG with overall shield. The contractor shall provide quantity of conductors necessary for the functionality described above.
- F. Mounting: Back plates shall be mounted to flush wall single-gang back boxes (with the exception of mullion mounted readers mounted directly to doorframes if required). Readers shall be sufficiently insulated so as not to allow false positive reads by an adjacent reader or cause the signal to be attenuated.
- G. Enclosure: Suitable for surface, semi-flush, pedestal, or weatherproof mounting. Mounting types shall additionally be suitable for installation in the following locations:
- 1. Indoors, controlled environment.
 - 2. Indoors, uncontrolled environment.
 - 3. Outdoors.

2.9 ANNUNCIATION DEVICES

- A. Audible/Visual Annunciators: The combination audible/visual alarm annunciation device shall consist of a horn and strobe to be reset locally by key or remotely by the ACS operator. Annunciators shall be wired so that the horn and strobe can be reset simultaneously by key or individually by the ACS. Characteristics include the following:
- 1. UL-listed.
 - 2. At least two (2) selectable and distinct audible signals.
 - 3. Two (2) power taps for field selectable sound levels of normal dBA output and high dBA output. The unit shall operate on 24VDC input power with low current draw.
 - 4. The strobe shall be rated for at least 38 candelas and flash at least once per second.
 - 5. Flush mounted to a standard electrical box within 24-inches of the doorframe at a height of 84-inches AFF.
 - 6. High-impact plastic cover.
 - 7. Colors and finishes of devices must be approved by the Owner, including blue strobe lens cover.

D. Manufacturer. Provide products by the following:

1. Fire Safety and Protection,
2. Edwards Fire Safety.
3. Or as proved the Owner.

2.10 DURESS AND BREACH PUSHBUTTON

A. Under Counter (Covert) Duress Alarm Switches: Provide hard-wired duress/panic alarm pushbuttons, where indicated on the Drawings. Honeywell 269R for gate counter.

1. Under counter switch assembly with recessed button to prevent accidental depression that allows an individual to send a duress signal to the controller.
 - a. Minimum Switch Rating: 50,000 operations.
 - b. Push Button: Finger activated, suitable for mounting on horizontal or vertical surface. Exact location under counter.
 - c. Double-pole double-throw contacts for multi-notifications
 - d. Construction: High impact plastic.

2.11 DOOR SWITCHES

A. Basis-of Design Product: GE Interlogix or approved equal.

B. Unless otherwise indicated, the door contacts shall be GE Interlogix #1076C-W. Provide built-in, end-of-line resistors as required. Units that shall meet or exceed the following:

1. Recessed 3/4-inch door contract
2. SPDT Single pole – doble-throw
3. Voltage: 30V DC maximum
4. Current: 0.25 A maximum

2.12 END-OF-LINE RESISTOR PACKS

A. Basis-of-Design Product: George Risk Industries, model 6644 resistor pack.

B. Provide units that shall meet or exceed the following:

1. 2 – 1K 1/8-watt 5% carbon film resistor in overall casing
2. Two (2) blue and Two (2) black 12-inch leads.

2.13 PASSIVE INFRARED SENSORS

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

1. Bosch Security Systems, Inc
2. SDC, Security Door Controls.
3. Or as acceptable manufacturers by the Owner.

B. The UL-listed sensors used exclusively for REX functions shall be installed above doors and shall be used to temporarily shunt door alarms, and in some cases unlock doors, after detecting individuals approaching the secure side of the door. The sensor shall be activated by infrared energy emitted from a human body and shall require no specific action on the part of the

individual approaching the door. Activation of the PIR REX shall give a positive indication through the use of LEDs.

- C. The sensor shall be designed for continuous operation and shall be resistant to potential false alarm sources such as radio frequency interference, fluorescent lighting, drafts, and electrical noise.
- D. When mounted at a height of 8 feet, the sensor shall have a minimal detection zone of 4 feet wide x 1.5 feet deep for single door applications, and 8 feet wide x 1.5 feet deep for double door applications. The detection pattern shall have a sensitivity adjustment and a minimum vertical adjustment of +/-10 degrees.
- E. Sensors shall provide dry contacts to be monitored by the ACS. As a minimum, the contact closure shall support the power requirements for the given application.
- F. REX device inputs shall be wired individually and not in series with other devices or sensors.
- G. The sensors shall be equipped with walk test/activation LED that illuminates upon activation to assist service personnel.
- H. Sensors shall be specifically designed for above-door applications.
- I. Sensors shall be enclosed in slim, attractive housing.

2.14 LOCK POWER SUPPLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Altronix, Part Number AX-1024ACMCB.
 - 2. Or as acceptable manufacturers by the Owner.
- B. Provide 12VDC/24VDC lock power supplies as required in types, sizes and quantities as recommended by the approved manufacturer of each type of electric/electronic locking device. Provide all necessary wiring as recommended by the manufacturer as required to meet intended operation required by the design. Power supplies shall be installed where indicated on the Drawings and connected 120VAC, 20A fed from emergency circuits. Provide all necessary relays and connections to the fire alarm system for release of electromagnetic locks to meet NFPA 101 life safety requirements. Refer to Section 08 71 00 "Door Hardware" for electric/electronic locking specifications.
 - 1. IDS Motion Sensor.
 - 2. IDS Keypad.
 - 3. Intercom Master Station.
 - 4. Intercom Remote Station.

2.15 DOOR HARDWARE INTERFACE

- A. Preparation: Contractor shall coordinate with the door hardware installer for placement of following door hardware and preparation of all doors and doorframes. Contractor shall provide all cabling, terminations and interfaces.
 - 1. Electric Strike.
 - 2. Time-delayed Electromagnetic Lock.
 - 3. Magnetic Lock.

4. Door Position Switch (DPS).
5. Power Transfer.
6. Panic Hardware.

2.16 CABLES

- A. General Cable Requirements: Comply with requirements in Section 28 05 13 "Conductors and Cables for Electronic Safety and Security" and as recommended by system manufacturer for integration requirement. All wire types and gauges to be confirmed according to field conditions and distances to mitigate electromotive interference, communications protocol distance limitations, voltage drop, etc.

2.17 TRANSFORMERS

- A. General: NFPA 70, Class II control transformers, NRTL listed. Transformers for security access-control system shall not be shared with any other system.
- B. UPS: Connect all critical ACS equipment to circuits connected to UPS with battery backup, including security access controllers and transformers.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Pathways: Examine pathway elements intended for cables. Check raceways and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.
- B. Rough-in: Examine roughing-in for LAN and control cable conduit systems to controllers, card readers, and other cable-connected devices to verify actual locations of conduit and back boxes before device installation.
- C. Unsatisfactory Conditions: Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Compliance: Comply with recommendations in SIA CP-01. Comply with ANSI/TIA-606-D.
- B. Project Planning: 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. For each Location, record setup of controller features and access requirements.
 2. Propose start and stop times for time zones and holidays and match up access levels for doors.
 3. Set up groups, facility codes, linking, and list inputs and outputs for each controller.
 4. Assign action message names and compose messages.
 5. Set up alarms. Establish interlocks between alarms, intruder detection, and video surveillance features.
 6. Prepare and install alarm graphic maps.
 7. Develop user-defined fields.
 8. Develop screen layout formats.
 9. Propose setups for guard tours and key control, if required.

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10. Complete system diagnostics and operation verification.
11. Prepare a specific plan for system testing, startup, and demonstration.
12. Develop acceptance test concept and, on approval, develop specifics of the test.

- C. Meetings: In meetings with Owner/Owner's Representative, present Project planning documents and review, adjust, and prepare final setup documents. Use final documents to set up system software.

3.3 CABLING

- A. Compliance: Comply with NECA 1, "Good Workmanship in Electrical Construction."
- B. Reference: Install cables and wiring according to requirements in Section 28 05 13 "Conductors and Cables for Electronic Safety and Security."
- C. Wiring Method: Install wiring in raceway except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Use NRTL-listed plenum cable in environmental airspaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.
- D. LAN: Install LAN cables using techniques, practices, and methods that are consistent with Category 6A rating of components, and ensure performance of completed and linked signal paths, end-to-end.
- E. Boxes and Enclosures: 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 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.
- F. End-of-Line Resistors: at the field device location and not at the controller or panel location.

3.4 CABLE APPLICATION

- A. Compliance: Comply with ANSI/TIA-569-E for installation of cables in pathways and spaces.
- B. Minimum Requirements: Cable application requirements are minimum requirements and shall be exceeded if recommended or required by manufacturer of system hardware. Refer to Section 28 05 13 "Conductors and Cables for Electronic Safety and Security" for other methods (if required).
- C. ANSI/TIA 232-F Cabling: Install at a maximum distance of 50 ft. (15 m).
- D. ANSI/TIA 485-A Cabling: Install at a maximum distance of 4000 ft. (1220 m).
- E. Card Readers and Keypads:
1. Install number of conductor pairs recommended by manufacturer for the functions specified.
 2. Unless the manufacturer recommends larger conductors, install No. 24 AWG wire if maximum distance from controller to the reader is 450 ft. (135 m), and install No. 20 AWG wire if maximum distance is 500 ft. (150 m).
 3. For greater distances, install "extender" or "repeater" modules recommended by the manufacturer of the controller.

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4. Install minimum No. 10-24 AWG shielded cable to readers and keypads that draw 50 mA or more.

- F. Locks: Install minimum No. 12 AWG cable from controller to electrically powered locks. Do not exceed manufacturer's recommended distances. Refer to Section 08 71 00 "Door Hardware" for hardware sets and list of locking manufacturers.
- G. Transformers: Install minimum No. 18 AWG ac power wire from transformer to controller, with a maximum distance of 25 ft. (8 m).

3.5 GROUNDING

- A. Reference: Comply with Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- B. Compliance: Comply with IEEE 1100, "Recommended Practice for Power and Grounding Electronic Equipment."
- C. General: 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. Bonding: 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. Card Reader: Mount card reader to back box as recommended by the manufacturer at heights and locations detailed on the Drawings. For back-to-back installation, provide sufficient insulation (and distance if required) so that the signal has minimal attenuation.

3.7 IDENTIFICATION

- A. Compliance: In addition to the requirements in this article, comply with applicable requirements in ANSI/TIA-606-D.
- B. General: Use unique, alphanumeric designation for each cable, and label cable and jacks, connectors, and terminals to which it connects with the same designation. Use logical and systematic designations for facility's architectural arrangement.
- C. Labels: 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.

- D. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."

3.8 SYSTEM SOFTWARE AND HARDWARE

- A. Test software and hardware and perform tests for the complete and proper operation of new systems involved. Assign any additional software license to Owner.

3.9 FIELD QUALITY CONTROL

A. TESTS AND VERIFICATIONS

1. General: The Contractor shall verify that all requirements of the Contract Documents are met. Upon completion of each phase of the installation, procedures shall be performed under the direct supervision of the Owner or his designated representative to:
 - a. Calibrate and test all equipment
 - b. Verify proper operation of devices prior to connection to existing equipment or systems,
 - c. Place the integrated system in service, and
 - d. Test the integrated system.
2. LAN Cable Procedures: Inspect for physical damage and test each conductor signal path for continuity and shorts. Use Class 2, bidirectional, Category 6A tester. Test for faulty connectors, splices, and terminations. Test according to ANSI/TIA-568.1-E, "Commercial Building Telecommunications Cabling Standards - Part 1: General Requirements." Link performance for UTP cables must comply with the minimum criteria in ANSI/TIA-568.2-D.
3. Test each circuit and component of each system. Tests shall include, but are not limited to, measurements of power-supply output under maximum load, signal loop resistance, and leakage to ground where applicable. System components with battery backup shall be operated on battery power for a period of not less than 10 percent of the calculated battery operating time. Provide special equipment and software if testing requires special or dedicated equipment.
4. A report shall be submitted describing results of functional tests, diagnostics, and calibrations, including written certification that the installed complete system has been calibrated and tested, and is ready to begin performance verification testing. The report shall also include a copy of the approved performance verification test procedure. Verification shall be through a combination of inspections and demonstrations, as described below.
 - a. Verification by Inspection: Verification by inspection includes examination of an item and the comparison of pertinent characteristics against the qualitative or quantitative standards set forth in the applicable paragraphs from the Specifications. Inspection may require moving or partially disassembling the item to accomplish the verification. Inspection shall be made of all equipment installations to ensure requirements of the Contract Documents are met and that the overall installation is accomplished in a professional and workmanlike manner. The Owner or its designated representative shall have the full opportunity to witness the required Contractor inspections or to conduct his own inspections of the installation.
 - b. Verification by Test and Demonstration: The Contractor shall verify by formal demonstrations or tests that the requirements of the Contract Documents have been met.

B. FORMAL TEST VERIFICATION REQUIREMENTS:

1. General. The Owner or its designated representative shall be afforded fourteen (14) day advance notice of all demonstrations/tests. The OWNER or its designated representative reserves the right to witness any and/or all tests described below.
2. Preliminary Tests: Following installation, the Contractor shall individually test each system device/assembly and verify the proper functioning of each system component. Each system device/assembly shall be tested to the demarcation limits established by the Contract Drawings. Preliminary Tests shall be conducted as follows:
 - a. A formal test plan and test procedures for each portion of the test shall be prepared by the Contractor and submitted for Owner's or its designated representative's approval in accordance with paragraph SUBMITTALS of this section. Approval of the test procedures must be obtained prior to notification of testing to the Authority and Owner.
 - b. The test plan and procedures shall address the following:
 - 1) Copy of the test sheet for each test to be performed.
 - 2) Scope and purpose of the test
 - 3) Equipment and/or software to be tested
 - 4) Range of values or output results considered acceptable.
 - 5) Test forms with entries for test date and initials for test personnel and witnesses.
 - 6) Visual inspection of all wiring and terminations.
 - c. The Contractor shall successfully conduct its own Preliminary Tests in advance of notifying Owner that the system is ready to be formally tested. As a condition of completing the Preliminary Tests, the Contractor shall correct any deficiency pertaining to these requirements and successfully retest the failed item. All testing shall be recorded in a clear and concise manner for submission to the Owner.
 - d. After successfully completing all Preliminary Tests, the system shall be re-tested in the presence of Owner or its designated representative. The advance notice shall include certification that the installation is complete and operable, and the Contractor has satisfactorily performed the Preliminary tests specified herein.
 - e. All preliminary tests shall be successfully completed prior to the system operational testing.
3. System Operational Testing: Following successful completion of the Contractor's Preliminary Tests and the completion of the system configuration to be performed by the Owner (based upon information provided by the Contractor), the Contractor and the Owner shall jointly conduct a formal test, to be known as the "System Operational Test", in which all components and subsystems are demonstrated to operate together as a fully operational system. System Operational Tests shall be conducted as follows:
 - a. The Owner shall be notified in writing fourteen (14) days in advance of the proposed System Operational Test dates. The advance notice shall include certification that the Contractor has satisfactorily performed the Preliminary Tests specified above.
 - b. This System Operational Test shall be performed over a continuous period based upon the Authority's standard testing procedures. The Contractor and the Airport Owner shall participate together to test the system. During testing, the parties shall identify the cause of any test failures and mutually assign responsibility for resolving such failures. Once identified, all failures shall be resolved and successfully re-tested.
 - c. System operational testing/re-testing shall be performed in the presence of Owner or its designated representative.

- u. The Contractor shall maintain a log of all test activities and results. Typed copies of this log shall be submitted to the Owner or its designated representative within seven (7) days of the testing.
 - 4. Re-Test: In the event that the Owner or its designated representative is required to witness a re-test (either Preliminary or System Operational testing) at a later date because the Contractor is either not adequately prepared to conduct the tests or due to significant test failures, which shall be solely determined by the Authority's representatives witnessing the tests, the costs of witnessing additional tests, including time and travel costs for the Authority and its representatives, shall be borne exclusively by the Contractor.
 - C. Unfit Materials: Devices and circuits will be considered defective if they do not pass tests and inspections.
 - D. Reports: Prepare test and inspection reports and submit them for approval.
 - E. See Section 01 40 00 "Quality Control" for retesting and re-inspecting requirements and Section 01 70 00 "Execution and Closeout Requirements" for directions for correcting the Work.
- 3.10 STARTUP SERVICE
- A. Engage a factory-authorized service representative to supervise and assist with startup service.
 - 1. Complete installation and startup check according to approved procedures that were developed in "Preparation" Article and with manufacturer's written instructions.
 - 2. Owner to prepare badges and access cards for use by EUG operators, management, and security personnel.
 - 3. Reset passwords and factory settings as reviewed and approved by the Owner.
- 3.11 PROTECTION
- A. Maintain strict security during the installation of equipment and software. Rooms housing equipment shall be locked and secured during periods when a qualified operator in the employ of Contractor is not present.
- 3.12 DEMONSTRATION
- A. Training: Train Owner's maintenance personnel to adjust, operate, and maintain security access system. See Section 01 78 00 "Closeout Submittals."
 - B. Training Modules: Develop separate training modules for the following:
 - 1. Security personnel and console operators.
 - 2. Hardware maintenance personnel.
 - 3. Agency management.

END OF SECTION 28 13 00

**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.
- B. Related Requirements:
 - 1. Section 28 05 00 "Supplemental Requirements for Electronic Safety and Security."
 - 2. Section 28 05 13 "Conductors and Cables for Electronic Safety and Security."
 - 3. Section 28 05 26 "Grounding and Bonding for Safety and Security."
 - 4. Section 28 05 28 "Pathways for Electronic Safety and Security."
 - 5. Section 28 05 44 "Sleeves and Sleeve Seals for Electronic Safety and Security Pathways and Cabling."
 - 6. Section 28 13 00 "Access Control."

1.2 SUMMARY

- A. Section includes:
 - 1. Video surveillance system requirements.
 - 2. Standard cameras.
 - 3. Signal transmission components.
 - 4. Network Video Recorder (existing)
 - 5. Video server (existing)

1.3 DEFINITIONS

- A. ACS: Access control system.
- B. LAN: Local area network.
- C. NRTL: Nationally recognized testing laboratories.
- D. UPS: Uninterruptible power supply.
- E. VMS: Video management system.

1.4 ACTION SUBMITTALS

- A. General: Comply with Section 28 13 00 "Access Control" action submittal requirements.
- B. Shop Drawings: Indicate exact camera positions on shop drawings and in coordination with other trades and with no obstructions. Graphic maps shall include dynamic icons for each camera to allow cue-up of the camera from the graphic map onto the alarm monitor without use of a camera controller. Camera icons shall be either fixed or multi-sensors in appearance and

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include camera designation established prior to shop drawing submission as reviewed and approved by the Owner.

1.5 INFORMATIONAL SUBMITTALS

- A. Comply with Section 28 13 00 "Access Control" action submittal requirements.

1.6 CLOSEOUT SUBMITTALS

- A. Comply with Section 28 13 00 "Access Control" action submittal requirements.

1.7 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 and access control system shall comply with SIA TVAC.

1.8 PROJECT CONDITIONS

- A. Environmental Conditions: Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
 - 1. Interior, Controlled Environment: System components installed in air-conditioned interior environments shall be rated for continuous operation in ambient temperatures of 36 to 122 degrees F (2 to 50 degrees C) dry bulb and 20 to 90 percent relative humidity, noncondensing. Use NEMA 250, Type 1 enclosures.
 - 2. Interior, Uncontrolled Environment: System components installed in non-air-conditioned interior environments shall be rated for continuous operation in ambient temperatures of 0 to 122 degrees F (-18 to +50 degrees C) dry bulb and 20 to 90 percent relative humidity, noncondensing. Use NEMA 250, Type 4X enclosures.
 - 3. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambient temperatures of -30 to +122 degrees F (-34 to +50 degrees C) 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 (137 km/h). 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 detention areas where surveillance equipment may be subject to physical violence.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of video surveillance devices and equipment that fail in materials or workmanship within specified warranty period.

- 1. Warranty Period: One year from date of Final Acceptance.

PART 2 - PRODUCTS

2.1 SYSTEM COMPONENTS

- A. Certain equipment shall match or be compatible with existing as defined herein.

2.2 DESCRIPTION

- A. Video Surveillance System: The Video Management System (VMS) shall be an extension of the existing Ocularis by Qognify system compatible with the specified cameras and video recording system with standard access control. Field-installed IP-addressable cameras shall be connected by a high-speed electronic-data transmission network back to the headend. The Work shall include configuration of cameras and video recording of all new and existing cameras shown on the Drawings.
- B. System Software: Refer to Section 28 13 00 "Access Control" for additional information about ACS/VMS shared workstations.

2.3 SYSTEM REQUIREMENTS

- 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's entry connection to components.
- B. Tamper Protection: Tamper switches on enclosures, cabinets and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled. Central-station and operator workstation alarm display shall identify tamper alarms and indicate locations.

2.4 NETWORK VIDEO RECORDING

- A. Description: New video surveillance cameras shall be recorded on an existing networked video recording system for a minimum duration of 30 days as shown in the Drawings. Configure all required software and licenses to meet operational requirements for a fully functional system compatible with the new cameras, whether specifically described herein or not.
- B. Video Recording Parameters and Rate: Cameras shall be recorded at 7.5 images per second (ips) for normal conditions and 30 ips for alarm conditions.
- C. Software: Coordinate with EUG IT to configure existing storage management software for a fully functional video recording system and configure to meet operational requirements, whether specifically described herein or not.

2.5 VIDEO MANAGEMENT SERVER

- A. Video Server: Existing video management server to be used for operating the video storage device. Contractor to ensure all required software and ancillary parts for a fully functional system.
- B. Software: Contractor shall coordinate with EUG IT to configure the video management server to add new camera for a fully functional video camera and configure to meet operational requirements, whether specifically described herein or not.

2.6 STANDARD CAMERAS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following to match existing:
 - 1. Axis Communications or as approved by the Owner (EUG).
 - 2. Pelco Inc., (A Motorola Solution).
- B. Interior Ceiling mounted Fixed Color Dome Camera: 4 Mpixel day/night minidome IP-addressable camera assembled and tested as a manufactured unit, containing dome assembly, color camera, 2.9mm focal lens, and receiver. Powered by PoE IEEE 802.3af and using H.264 video signal compression. Provide mounting hardware meeting requirements on the Drawings, including ceiling mount bracket and smoke dome cover.
- C. License: Provide the license for each camera added to the existing VMS.

2.7 SIGNAL TRANSMISSION COMPONENTS

- A. Cable: Comply with requirements in Section 28 05 13 "Conductors and Cables for Electronic Safety and Security" for video and control signals transmitted over category 6A cabling.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. General: 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. Unfit Material: Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 WIRING

- A. Reference: Comply with requirements in Section 26 05 31 "Raceways and Boxes for Electrical Systems."
- B. Wiring Method: Install cables in raceways unless otherwise indicated.

- C. 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.
- D. 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.
- E. Grounding: Provide independent-signal circuit grounding recommended in writing by manufacturer.

3.3 VIDEO SURVEILLANCE SYSTEM INSTALLATION

- A. Install cameras level and plumb.
- B. Adjust final camera position to obtain the field of view required for camera. Connect all controls and alarms and adjust.
- C. Install power supplies and other auxiliary components at control stations unless otherwise indicated.
- D. 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.
- E. Avoid ground loops by making ground connections only at the control station.
- F. Identify system components, wiring, cabling, and terminals.

3.4 SYSTEM SOFTWARE AND HARDWARE

- A. Test software and hardware and perform tests for the complete and proper operation of new systems involved. Assign any additional software license to Owner. Reset passwords and factory settings as reviewed and approved by the Owner.

3.5 FIELD QUALITY CONTROL

- A. General: The Contractor shall verify that all requirements of the Contract Documents are met. Upon completion of each phase of the installation, procedures shall be performed under the direct supervision of the Owner or his designated representative to:
 - 1. Calibrate and test all equipment
 - 2. Verify proper functioning of new equipment and devices prior to connection to existing equipment or systems,
 - 3. Place the integrated system in service, and
 - 4. Test the integrated system.
- B. Inspection: Verify that units and controls are properly installed, connected, and labeled, and that interconnecting wires and terminals are identified.

1. Pretesting: Align and adjust system and pretest components, wiring, and functions to verify that they comply with specified requirements. Conduct tests at varying lighting levels, including day and night scenes as applicable. Prepare video-surveillance equipment for acceptance and operational testing as follows:
 - a. Prepare Test Plan and Schedule described in "Informational Submittals" Article and submit for approval.
 - b. Verify operation of auto-iris lenses.
 - c. Set back-focus of fixed focal length lenses. At focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Adjust until image is in focus with and without the filter.
 - d. Set back-focus of zoom lenses. At focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Additionally, set zoom to full wide angle and aim camera at an object 50 to 75 feet (17 to 23 m) away. Adjust until image is in focus from full wide angle to full telephoto, with the filter in place.
 - e. Set and name all preset positions; consult Owner's personnel.
 - f. Set sensitivity of motion detection.
 - g. Connect and verify responses to alarms.
 - h. Verify operation of control-station equipment.
 - i. Verify video recording functionality.
 - j. Adjust sound levels of microphones.
- C. Test Schedule: Schedule tests after pretesting has been successfully completed and system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days' notice of test schedule.
- D. A report shall be submitted describing results of functional tests, diagnostics, and calibrations, including written certification that the installed complete system has been calibrated, and tested, and is ready to begin performance verification testing. The report shall also include a copy of the approved performance verification test procedure. Verification shall be through a combination of inspections and demonstrations, as described below.
 1. Verification by Inspection: Verification by inspection includes examination of an item and the comparison of pertinent characteristics against the qualitative or quantitative standards set forth in the applicable paragraphs from the Specifications. Inspection may require moving or partially disassembling the item to accomplish the verification. Inspection shall be made of all equipment installations to ensure requirements of the Contract Documents are met and that the overall installation is accomplished in a professional and workmanlike manner. The Authority or its designated representative shall have full opportunity to witness the required Contractor inspections or to conduct his own inspections of the installation.
 2. Verification by Test and Demonstration: The Contractor shall verify by formal demonstrations or tests that the requirements of the Contract Documents have been met.
- E. Formal Test Verification Requirements: The Owner or its designated representative shall be afforded fourteen (14) day advance notice of all demonstrations/tests. The Owner or its designated representative reserves the right to witness any and/or all tests described below.
 1. Preliminary Tests: Following installation, the Contractor shall individually test each system device/assembly and verify the proper functioning of each system component. Each system device/assembly shall be tested to the demarcation limits established by the Contract Drawings. Preliminary Tests shall be conducted as follows:
 - a. A formal test plan and test procedures for each portion of the test shall be prepared by the Contractor and submitted for Owner's or its designated

- representative's approval in accordance with paragraph SUBMITTALS of this section. Approval of the test procedures must be obtained prior to notification of testing to the Authority and Owner.
- b. The test plan and procedures shall address the following:
 - 1) Copy of the test sheet for each test to be performed.
 - 2) Scope and purpose of the test
 - 3) Equipment and/or software to be tested
 - 4) Range of values or output results considered acceptable.
 - 5) Test forms with entries for test date and initials for test personnel and witnesses.
 - 6) Test and verification of intended camera coverage area.
 - 7) Visual inspection of all wiring and terminations;
 - c. The Contractor shall successfully conduct its own Preliminary Tests in advance of notifying Owner that the system is ready to be formally tested. As a condition of completing the Preliminary Tests, the Contractor shall correct any deficiency pertaining to these requirements and successfully retest the failed item. All testing shall be recorded in a clear and concise manner for submission to the Owner.
 - d. After successfully completing all Preliminary Tests, the system shall be re-tested in the presence of Owner or its designated representative. The advance notice shall include certification that the installation is complete and operable, and the Contractor has satisfactorily performed the Preliminary tests specified herein.
 - e. All preliminary tests shall be successfully completed prior to the system operational testing to be jointly performed by the Contractor and the Airport Authority's Security Maintenance Contractor.
2. System Operational Testing: Following successful completion of the Contractor's Preliminary Tests and the completion of the system configuration to be performed by the Owner (based upon information provided by the Contractor), the Contractor and the Owner shall jointly conduct a formal test, to be known as the "System Operational Test", in which all components and subsystems are demonstrated to operate together as a fully operational system. System Operational Tests shall be conducted as follows:
- a. The Owner shall be notified in writing fourteen (14) days in advance of the proposed System Operational Test dates. The advance notice shall include certification that the Contractor has satisfactorily performed the Preliminary Tests specified above.
 - b. This System Operational Test shall be performed over a continuous period based upon the Authority's standard testing procedures. The Contractor and the Owner shall participate together to test the system. During testing, the parties shall identify the cause of any test failures and mutually assign responsibility for resolving such failures. Once identified, all failures shall be resolved and successfully re-tested.
 - c. System operational testing/re-testing shall be performed in the presence of Owner or its designated representative.
 - d. The Contractor shall maintain a log of all test activities and results. Typed copies of this log shall be submitted to the Owner or its designated representative within seven (7) days of the testing.
- F. Re-Test: In the event that the Owner or its designated representative is required to witness a re-test (either Preliminary or System Operational testing) at a later date because the Contractor is either not adequately prepared to conduct the tests or due to significant test failures, which shall be solely determined by the Authority's representatives witnessing the tests, the costs of witnessing additional tests, including time and travel costs for the Authority and its representatives, shall be borne exclusively by the Contractor.

- G. Prepare test and inspection reports and submit for approval.
- H. Video surveillance system will be considered defective if it does not pass tests and inspections. Refer to the requirements of Section 01 70 00 "Execution and Closeout Requirements" for correcting the Work.

3.6 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 (2) visits to Project site during other-than-normal occupancy hours for this purpose, as coordinated with the Owner (EUG). 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.

3.7 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.

3.8 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain video-surveillance equipment.

END OF SECTION 28 23 00