

**PENNSYLVANIA CONVENTION CENTER AUTHORITY  
COMMONWEALTH OF PENNSYLVANIA**

**STANDARD FORM OF AGREEMENT  
FOR FACILITIES PROJECTS**

**GENERAL CONDITIONS**

**ARTICLE 1**

**GENERAL PROVISIONS**

**1.1 CONTRACT DOCUMENTS**

- 1.1.100 The Contract Documents consist of the agreement, notice to contractors, the bid proposal, the contract bonds (if specified), all riders, drawings and specifications, Special Requirements, General Requirements, and addenda issued to the contract. A modification is (1) a written amendment to the contract signed by both parties or (2) a change order. A modification may be made only after execution of the contract. The work specified in the contract includes all labor, equipment, and materials required and incorporated to complete the work specified in and according to all the Contract Documents.
- 1.1.101 The Contract Documents are complementary, and what is required by any one of the Contract Documents shall be binding as if required by all. The intention of the documents is to include all labor, materials, equipment, and other items necessary for the proper execution and completion of the work. Work not covered under any heading, section, branch, class, or trade of the specifications need not be supplied unless it is required elsewhere in the Contract Documents or is reasonably inferable therefrom as being necessary to produce the intended results. If there is a conflict between the drawings and the specifications, the more stringent specification shall prevail. Words which have well-known technical or trade meaning are used herein in accordance with such recognized meanings.
- 1.1.102 Where the work is shown in complete detail on only half or a portion of a drawing or there is an indication of continuation, the remainder being shown in outline, the work drawn out in detail shall be understood to apply to other like portions of the structure. On all work of a remodeling nature or installation within present buildings, the actual situation at the site controls any information given which may affect the quantity, size, and quality of materials required for a satisfactorily completed contract, whether or not such information is indicated on the drawings or within the specifications.
- 1.1.103 Unless otherwise noted in the Contract Documents, the Authority will provide the Contractor three (3) complete sets of stamped drawings and specifications for permitting, free of charge. The Contractor shall reimburse the Authority if additional sets are required beyond the three provided.

All drawings, specifications, and copies thereof furnished by the Professional are and shall remain the property of the Authority. They are not to be used on any other project, without permission of the Authority, and, with the exception of one contract set for each party to the contract, are to be returned to the Authority on request at the completion of the work.

**1.2 GOVERNING LAW**

This Agreement shall be governed by and construed in accordance with laws of the Commonwealth of Pennsylvania, notwithstanding any conflict-of-laws doctrines of said jurisdiction to the contrary and without the aid of any canon, custom or rule of law requiring construction against the draftsman. With respect to any suit, action or proceeding relating to this Agreement, Consultant hereby submits to the exclusive jurisdiction of the courts of the

Commonwealth of Pennsylvania.

**1.3 NOTICES**

Wherever the term "notice" is used, such notices to be effective shall be in writing and if to the Authority shall be mailed certified mail, postage and fees prepaid, or delivered to the Authority, and if to the Professional shall be similarly mailed or delivered to him at this address set forth in the caption of this Agreement, unless and until notice of another address shall be given hereunder, in which case notices shall be so delivered or mailed to the address last so given.

**1.4 INTEGRATION**

This Agreement contains all the terms and conditions agreed to by the parties hereto, and no other agreements, oral or otherwise, regarding the subject matter of this Agreement exist.

**1.5 NO THIRD PARTY RIGHTS**

The Contractor agrees to indemnify and hold harmless the Authority and the Commonwealth of Pennsylvania against any costs incurred by the Authority or the Commonwealth of Pennsylvania (including without limitation amounts paid pursuant to judgments or settlements and as counsel fees) in consequence of any claim by a third party against the Authority or the Commonwealth of Pennsylvania, including without limitation any claim by an employee of the Authority or the Commonwealth of Pennsylvania, the Contractor or a subcontractor and any claim by a subcontractor or another contractor, whether filed before or after final payment, based on actual or alleged damage to or destruction of property or injury to persons allegedly caused by the Contractor, or any subcontractor, or by their respective employees, in connection with the work.

The Authority shall promptly notify the other party of the assertion of any claim against which the Authority or the Commonwealth is held harmless pursuant to this condition, shall give such other party the opportunity to defend any such claim, and shall not settle any such claim without the approval of the indemnifying party.

**1.6 HOLD HARMLESS**

The Contractor shall indemnify and hold harmless the Authority, the Construction Manager, the Professional, their agents and employees from and against all claims, damages, losses and expenses including attorneys' fees arising out of or resulting from the performance of the work, including any and all design work performed by or for the Contractor, provided that any such claim, damage, loss or expense: (1) is attributable to bodily injury, sickness, disease or death or to injury to or destruction of tangible property including the loss of use resulting therefrom, and (2) is caused in whole or in part by any negligent act or omission of the Contractor, any subcontractor, any one directly or indirectly employed by any of them, or any one for whose acts any of them may be liable, regardless of whether or not it is caused in part by a party indemnified hereunder.

In any and all claims against the Authority, Construction Manager or the Professional or any of their agents or employees by any employee or the Contractor, any subcontractor, any one directly or indirectly employed by any of them or any one for whose acts any of them may be liable, the indemnification obligations shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the Contractor or any subcontractor under workmen's compensation acts, disability benefit acts or other employee benefit acts.

The obligations of the Contractor under this Section shall not extend to the liability of the Construction Manager, Professional, their agents or employees arising out of (1) the preparation or approval of maps, drawings, opinions, reports, surveys, change orders, designs or specifications, or (2) the giving of, or the failure to give, directions or instructions by the Construction Manager, Professional, their agents or employees provided such giving, or failure to give, is the primary cause of the injury or damages.

**1.7 OFFSET PROVISIONS**

The Contractor, by execution of the agreement, certifies that it has no outstanding tax liability to Pennsylvania; authorizes the Department of Revenue to release information related to its tax liability to the Authority; and, authorizes the Commonwealth to set off any State and local tax liabilities of the Contractor or any of its subsidiaries, as well as any other amount due to the Commonwealth from the Contractor, not being contested on appeal by the Contractor, against any payment due to the Contractor under an agreement with the Commonwealth.

The certification of no outstanding tax liability is a material representation of fact, upon which reliance is placed by the Authority in entering the agreement. If it is later determined that the Contractor knowingly rendered an erroneous certification, the Authority may find the Contractor in default and terminate the agreement. Such erroneous certification may also be grounds for initiation of civil or criminal proceedings.

**1.8 not used**

**1.9 CONTRACTOR RESPONSIBILITY PROVISIONS**

- A. Contractor certifies that it is not currently under suspension or debarment by the Commonwealth, any other state, or the federal government, and if the contractor cannot so certify, then it agrees to submit along with the bid proposal a written explanation of why such certification cannot be made.
- B. If contractor enters into any subcontracts or employs under this contract any subcontractors/individuals who are currently suspended or debarred by the Commonwealth or the federal government or who become suspended or debarred by the Commonwealth or the federal government during the term of this contract or any extensions or renewals thereof, the Commonwealth shall have the right to require the contractor to terminate such subcontracts or employment.
- C. The contractor agrees to reimburse the Commonwealth for the reasonable costs of investigation incurred by the Office of Inspector General for investigations of the contractor's compliance with the terms of this or any other agreement between the contractor and the Commonwealth which results in the suspension or debarment of the contractor. Such costs shall include, but not be limited to, salaries of investigators, including overtime; travel and lodging expenses; and expert witness and documentary fees. The contractor shall not be responsible for investigative costs for investigations that do not result in the contractor's suspension or debarment.

**1.10 not used**

**1.11 not used**

**1.12 AMERICAN WITH DISABILITIES ACT**

Pursuant to federal regulations promulgated under the authority of The Americans with Disabilities Act, 28 C.F.R. 35.101 et seq., the Contractor understands and agrees that no individual with a disability shall, on the basis of the disability, be excluded from participation in this contract or from activities provided for under this contract. As a condition of accepting and executing this contract, the Contractor agrees to comply with the "General Prohibitions Against Discrimination", 28 C.F.R. 35.130, and all other regulations promulgated under Title II of the Americans with Disabilities Act which are applicable to the benefits, services, programs, and activities provided by the Pennsylvania Convention Center Authority through contracts with outside contractors.

The contractor shall be responsible for and agrees to indemnify and hold harmless the Commonwealth of Pennsylvania, the Pennsylvania Convention Center Authority and their

respective officers and employees from all losses, damages, expenses, claims, demands, suits, and actions brought by any party against any of the foregoing as a result of the contractor's failure to comply with the provisions of the paragraph above.

**1.13 ASSIGNMENT**

This agreement shall be binding on the parties hereto, their heirs, executors, administrators, successors and assigns, but it may not be assigned by the Contractor without the prior written consent of the Authority.

**1.14 ASSIGNMENT OF ANTITRUST CLAIMS**

The contractor and the Authority recognize that in actual economic practice, overcharges by the contractor's suppliers, resulting from the violations of State or Federal anti-trust laws are, in fact, borne by the Authority. As part of the consideration for the award of this contract, and intending to be legally bound, contractor assigns to the Commonwealth all rights, title and interest in and to any claims contractor now has, or may hereafter acquire, under State or Federal anti-trust laws relating to the goods or services which are the subject of this contract.

**1.15 LIENS**

In accordance with applicable Commonwealth Law 49 P.S. 1303, the parties hereto hereby specifically waive the right to file any mechanics or other lien or claim for work done or material furnished in or about the performance of this Agreement, and it is hereby expressly agreed that no such claim or claims shall be filed by anyone and that the Contractor shall not file nor permit any subcontractor, material man, mechanics or other person under him to file, nor shall any such contractor, subcontractor, material man or other person file any mechanics or other lien or claim for work done or material furnished in or about the performance of this Contract against the Authority, the Commonwealth of Pennsylvania, and/or the ground upon which the structure or work herein provided for is erected or done, or against any structure thereon erected or to be erected, or against any structure or property whatsoever covered by the Contract.

**1.16 NONDISCRIMINATION**

The Commonwealth's nondiscrimination / sexual harassment clause, as found in the Bid Proposal Form, is hereby incorporated by reference.

**1.17 THE PROFESSIONAL**

If retained and so designated by the Authority, a Professional architect or engineer may act as the agent for the Authority in the administration of the contract and may perform any or all of the functions stated herein. The Professional will, as determined by agreement with the Authority, visit the site to review progress in accordance with the contract drawings and specifications, attend job conferences, approve applications for payments, make progress reports to the Authority and review and accept/reject the Contractor's Schedule of Values.

The Professional has the authority to interpret the Contract Documents, reject work which does not conform to the Contract Documents, review and approve shop drawings, prepare drawings and specifications for change orders or modifications, participate in completion inspections, prepare as-built drawings, and review and approve all catalog data, manufacturers operating and maintenance instructions, certificates, warranties, written guarantees, and related documents required by the contract. The Professional may perform additional functions as determined by the Authority necessary to protect the Authority's interest.

**1.18 THE CONSTRUCTION MANAGER**

If retained and so designated by the Authority, a Construction Manager (CM) may also act as the agent for the Authority in the administration of the contract and may perform any or all of the functions stated herein, as determined by agreement with the Authority. The Construction Manager may visit the site to review progress according to the contract drawings and

specifications, independent of or in conjunction with the Professional. The Construction Manager may, with concurrence of the Professional, reject work that does not conform to the Contract Documents and safe working practices.

As and on behalf of the owner, the CM shall have authority to review with the Professional materials, workmanship, and equipment incorporated, or submitted for incorporation in the work. They shall review and provide an evaluation of the Contractor's testing, inspection, quality assurance, and certification program to the Professional, and they shall review and prepare an independent evaluation of the amount of the request for payment for acceptability of the quantity and quality of work performed or materials and equipment provided, and prepare and/or evaluate prepared schedules for the work.

The Construction Manager shall review the Contractor's construction practices and advise on unsafe working conditions during execution of the work. The Construction Manager shall work with the Professional as the Authority's representative in the administration of the Authority's interest in the project.

## **ARTICLE 2**

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### **2.1 THE AUTHORITY REPRESENTATIVES**

Representatives designated by the Authority will have the authority to inspect the work and to reject all work not performed in accordance with the contract provisions. In addition, only those representatives so designated have authority to change, modify, or alter the work or incur or cause to be incurred additional obligations beyond the contract provisions.

### **2.2 THE AUTHORITY'S RIGHT TO CARRY OUT THE WORK**

If the Contractor fails to carry out the work in accordance with the Contract Documents or fails to perform any provision of the agreement, the Authority may, after three (3) working days written notice to the Contractor, and without prejudice to any other remedy the Authority may have, make good such failures. In such case, an appropriate change order shall be issued deducting from the payments then or thereafter due the Contractor the cost of correcting such failures, including the cost for the Professional's additional services made necessary by such failure. If the payments then or thereafter due the Contractor are not sufficient to cover such amount, the Contractor and/or the Contractor's Surety shall pay the difference to the Authority.

### **2.3 RIGHT TO AWARD CONTRACTS**

The Authority reserves the right to award other contracts in connection with other portions of the project under these similar conditions of this agreement.

## **ARTICLE 3**

### **THE CONTRACTOR'S RIGHTS AND RESPONSIBILITIES**

#### **3.1 COVENANT AGAINST CONTINGENT FEES**

The Contractor warrants that no person or selling agency has been employed or retained to solicit or secure this contract upon an agreement or understanding for a commission, percentage, brokerage or contingent fee (excepting bona fide employees or bona fide established commercial or selling agencies maintained by the Contractor for the purpose of securing business). For breach or violation of this warranty, the Authority shall have the right to annul this contract without liability or, in its discretion, to deduct from the contract price or consideration, or otherwise recover, the full amount of such commission, percentage, or

contingent fee.

### **3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS**

- 3.2.100 The Contractor shall perform the work according to good quality industry standards, practices, and procedures, and in accordance with the Contract Documents and submittals approved.
- 3.2.101 The Contractor shall accept all conditions as found upon examination of the site, and take field measurements and verify field conditions and compare carefully such measurements and conditions with the Contract Documents before commencing activities. If the Contractor, in the course of construction finds any conflict, error or discrepancy on or among the Contract Documents, such conflict, error or discrepancy shall be immediately referred to the Professional in writing.

### **3.3 SUPERVISION AND CONSTRUCTION PROCEDURES**

- 3.3.100 The Contractor shall supervise and direct the work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for the work performed and have control over construction means, methods, techniques, sequences and procedures, and for coordinating all portions of the work, unless the Contract Documents give other instructions.
- 3.3.101 The Contractor shall provide all labor, materials, and equipment necessary for the proper prosecution of the work in an acceptable manner and at a satisfactory rate of progress.
- 3.3.102 The Contractor shall be responsible for the acts and omissions of all their employees, all subcontractors and their agents and employees, and all other persons performing portions of the work under a contract with the Contractor.
- 3.3.103 Inclement weather, including but not limited to cold or freezing weather, shall not be considered an excuse for non-performance of work under this contract. The Contractor shall use such methods of protecting as may be necessary to continue to work throughout the period of inclement weather.

### **3.4 LABOR AND MATERIALS**

- 3.4.100 The Contractor shall enforce strict discipline and good order and conduct among their employees and other persons carrying out the contract. Every employee shall be fit and skilled in the performance of tasks assigned to them.
- 3.4.101 Wages: Prior to submitting a Proposal, each Proposer must familiarize itself with all current working conditions, including but not limited to the labor environment and all applicable laws, codes, ordinances, contracts, agreements, rules and regulations that will affect the delivery of the services to be provided by the Proposer.
- 3.4.102 Products incorporated into the Work: The Authority anticipates the Contractor will provide products (i.e., products, materials, and equipment as defined in Section 016000 - Product Requirements) to be incorporated into the work of the project that are new, undamaged, and unused at the time of the installation, unless otherwise indicated in the Contract Documents. The Contractor shall produce, upon request, evidence supporting the source of materials used in the work.

The products provided under the contract shall meet or exceed the quality specified in the Contract Documents. The burden of proof of quality for all products provided rests with the Contractor. The costs incurred for substantiating quality shall be borne by the Contractor. If the Authority accepts substituted materials of a lesser quality than specified, the Authority shall be entitled to a credit equal to the difference in cost of the products specified and the

products provided.

The Contractor shall comply with the requirements of the Reciprocal Limitations 1998-Act 57 Commonwealth Procurement Code; Act 146 of 1986, the Trade Practices Act of July 23, 1968 P.L. 686 (71 P.S. 773.101 et seq.); and Act 3 of March 3, 1978, P.L. 6, commonly referred to as the "Steel Products Procurement Act", as outlined in the Special Requirements.

### **3.5 TAXES**

Refer to Bid Document.

### **3.6 PERMITS, FEES, AND NOTICES**

3.6.100 The Contractor shall obtain and pay for all permits, licenses and certificates required by Law and/or any public authority for the proper execution and completion of its work. The Contractor shall furnish proof of payment for all such permits, licenses and certificates, or proof that no permits, licenses or certificates are required. This proof must be furnished before the second request for payment.

3.6.101 The Contractor shall give all notices and comply with all applicable Laws, ordinances, regulations, rules and orders of any public authority bearing on the performance of the work. If the Contractor observes that any of the Contract Documents is at variance therewith in any respect, it shall promptly notify the Professional in writing. The Professional will make any necessary modifications. If the Contractor performs any work knowing it to be contrary to such applicable laws, ordinances, regulations, rules or orders, and without such written notice to the Professional, it assumes full responsibility therefor and shall bear all costs attributable thereto.

3.6.102 The Contractor shall pay all royalties and license fees. It shall defend all suits or claims for infringement of any patent rights and shall save the Authority harmless from loss on account thereof. The Authority shall be responsible for all such loss when a particular design, process or the product of a particular manufacturer or manufacturers is specified. However, if the Contractor has reason to believe that the designing process or product specified is an infringement on a patent, it shall be responsible for such loss unless it promptly gives such information to the Authority.

### **3.7 SUPERINTENDENT**

3.7.100 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor. The superintendent is responsible for continuous field supervision, coordination and completion of the work, and for the prevention of accidents.

3.7.101 Job conferences shall be scheduled by the Authority and shall be attended by the superintendent or a representative of the Contractor authorized to make all decisions and representations affecting the contract and its progress in the project.

### **3.8 PROGRESS SCHEDULE**

3.8.100 Immediately upon receipt of Notice to Proceed, the Contractor for general construction on the project shall furnish to each separate prime Contractor within fourteen (14) days a schedule of the proposed prosecution of the work under their contract. Each separate prime Contractor shall submit to the Contractor for general construction within twenty-one (21) days after issuance of the Notice to Proceed, a schedule of the proposed prosecution of their work. The

Contractor for general construction shall then submit to the Professional, CM, and the Authority within twenty-eight (28) days after issuance of the Notice to Proceed, a complete project schedule signed by all prime contractors indicating their approval, and showing in detail to the satisfaction of the Professional, CM and the Authority, the proposed dates for the performance of each phase of the work under each contract for the entire project.

- 3.8.101 In the event that the Authority, after the commencing of on-site work, grants an extension of time for sixty (60) days or more to a Contractor, the Contractor receiving the extension of time shall prepare a revised progress schedule for their prime contract. The Contractor involved in the extension shall forward their revised progress schedule to the Authority representatives within thirty (30) days from the approval of their extension. In no event will the granting of an extension of time to a one prime Contractor automatically entitle any other prime Contractor to an extension of time.
- 3.8.102 The Contractor shall complete portions of the work in such order of time as may be stated in the specifications or as required in the progress charts as approved by all prime Contractors and the Authority. The Authority may require the Contractor to apply additional resources to maintain the project schedule, if the Contractor negligently fails to process the work according to the approved project schedule, at no additional cost to the Authority. If the Contractor shall refuse or fails to proceed as directed by the Authority, the Authority may find the Contractor in breach of their contract and/or declare the Contractor in default.
- 3.8.103 In lieu of the project schedule requirements specified in this section, the Authority may specify alternate scheduling procedures in the General Requirements. In that case, the Contractor shall comply with those provisions and a project schedule need not be submitted as specified herein.

### **3.9 SHOP DRAWINGS**

- 3.9.100 The Contractor shall prepare and submit, in accordance with Section 013300-Submittal Procedures, the necessary shop drawings, diagrams, illustrations, schedules, performance charts, brochures, catalog information and other data required to support the proposed installation methods and establish standards by which the work will be judged, according to and within the time schedule submitted by the Contractor and approved by the Professional and the Authority. The times for submission of shop drawings shall be mutually established so as not to delay the project or require a time extension to the contract completion date, without agreement by the Authority.
- 3.9.101 The Professional's approval of shop drawings or samples shall not relieve the Contractor of responsibility for any deviation from the requirements of the Contract Documents, unless the Contractor has informed the Professional in writing of such deviation at the time of submission, has noted the deviation on the shop drawings, and the Professional has given written approval of the specific deviation. The Professional's approval also does not relieve the Contractor from responsibility for errors or omissions in the shop drawings or samples.
- 3.9.102 No portion of the work requiring a shop drawing or sample submission shall be commenced until the submission has been approved by the Professional. Any work commenced by the Contractor prior to final approval of the shop drawings and/or samples by the Professional is performed by the Contractor at its own risk.

### **3.10 JOB CONDITIONS**

- 3.10.100 The Contractor shall confine operations at the site to areas permitted by law, ordinances, permit and the Contract Documents and shall not unreasonably encumber the site with any materials or equipment, unless otherwise permitted by the Authority. The Contractor shall at all



times keep the work site free from accumulation of waste materials or rubbish carried by their operations.

The site of the work is defined by limit of contract line shown on the drawings. Contractors may only extend their work beyond this line as may be necessary to satisfy requirements of all permits and to make utility and service connections. Before starting any work beyond the limit of contract, the Contractor will submit to the Professional and the Authority a description of the proposed work for their review and approval.

The Contractor shall cooperate in the arrangements of their work as necessary to least affect the administration or operation of any present building, and shall protect their materials. Existing utility services roads and access ways will not be interrupted without prior approval by the Authority. The Contractor will comply with the Authority's prescribed times for acceptable outage periods.

- 3.10.101 The Contractor shall at all times afford other contractors reasonable access to the site, material storage areas, and shall perform their work so as not to interfere with the work of other contractors.
- 3.10.102 The Contractor shall be responsible for providing temporary heat, light and water as necessary to execute and protect their work, and shall maintain adequate ventilation of the work site to ensure proper air quality for human breathing, material protection, and safety equipment operations.
- 3.10.103 The Contractor shall be responsible to obtain all approvals and certificates of occupancies from local and state authorities having jurisdiction over the project, and submit the completed documents to the Authority.

## **ARTICLE 4**

### **CLAIMS AND DISPUTES**

#### **4.1 CLAIMS FOR CONCEALED OR UNKNOWN CONDITIONS**

- 4.1.100 If conditions are encountered at the site which are (1) subsurface or otherwise concealed physical conditions which differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, then notice by the Contractor shall be given to the Authority promptly before conditions are disturbed and in no event later than 21 days after first observance of the conditions.
- 4.1.101 The Authority will promptly investigate such conditions and, if they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the work, will recommend an equitable adjustment in the contract sum or contract time, or both. If the conditions at the site are not materially different from those indicated in the Contract Documents, no change in the terms of the Contract is justified. No adjustment shall be made to the contract sum, however, for concealed conditions encountered during cutting and patching of work.

#### **4.2 CLAIMS FOR ADDITIONAL TIME OR COST**

- 4.2.100 If the Contractor wishes to make a claim for an increase in the Contract Sum, written notice shall be given to the Authority before proceeding to execute the work.

- 4.2.101 If the Contractor wishes to make a claim for an increase in Contract Time, written notice shall be given, including an estimate of cost and of probable effect of delay on the progress of the work. If adverse weather conditions are the basis for a claim for additional time, such claim shall be documented by data from a recognized weather authority substantiating that weather conditions were abnormal for the period and could not have been reasonably anticipated. The Contractor shall also substantiate that weather conditions had an adverse effect on the scheduled construction.
- 4.2.102 No claims for increased costs, charges, expenses, or damages of any kind, except as provided in the General Conditions, shall be made by the Contractor against the Authority for any delays or hindrances from any cause whatsoever, including but not limited to strikes, walkouts or work stoppages during the progress of any portion of the work. The Authority may, however, compensate the Contractor for any such delays by extending the time for completion of the work, as provided in the Contract, which extensions shall constitute the exclusive remedy between the parties.

### **4.3 DISPUTES WITH THE AUTHORITY**

- 4.3.100 The Contractor shall carry on the work and maintain the progress schedule during any claims, disputes questions, other related matters or proceedings unless otherwise agreed to in writing by the Contractor and the Authority.
- 4.3.101 In the event of any dispute, claim, question or other matter (hereinafter called disputed item) the Contractor shall immediately refer the disputed item in writing to the Authority Project Manager for a Determination, which said Determination shall be rendered in writing within a reasonable time.
- 4.3.102 Disputed items by the Contractor must be made known by written notice within 21 days after occurrence of the event giving rise to such disputed item, or within 21 days after the Contractor first recognizes the condition giving rise to the disputed item, whichever is later.
- 4.3.103 Claims Procedure: Determinations made by the Authority Project Manager shall be subject to the claims procedure as described herein. Any disputed item which the Contractor may have against the Authority under this contract, except those settled under these provisions, shall be subject to the following procedure for the resolution of same:
- A. Dispute Conference. Any disputed item which the Contractor may have against the Authority under this contract or any breach thereof that has been referred to the Authority Project Manager, except as has been waived by the failure of the Contractor to present a timely claim in accordance with this section, shall be subject to negotiation at a Dispute Conference. A Dispute Conference shall be scheduled by the Authority upon the written demand of the Contractor if submitted no later than thirty (30) days after the date of the Determination by the Authority Project Manager.
  - B. Pre-Claim Hearing. Upon written demand by the Contractor, all disputed items which the Contractor may have against the Authority which have not been resolved at a Dispute Conference shall be heard at a Pre-Claim Hearing chaired by the Authority Director for Engineering & Capital Projects.

No demand for a Pre-Claim Hearing shall be made later than thirty (30) days after the date on which the Contractor has received a decision rendered by the Authority Project Manager as a result of a Dispute Conference, or from the fortieth (40th) day after the Dispute Conference was held, if the Contractor has not received a decision. Failure to demand a Pre-Claim Hearing within the required time period shall result in the decision of the Dispute Conference becoming final and binding upon the Contractor.

#### **4.4 DISPUTES WITH OTHER CONTRACTORS**

- 4.4.100 The Authority shall have no obligation to any third parties for any claim, nor be a party to any claims, disputes or actions between prime contractors or subcontractors concerning such additional expense or damage. Nor shall such claims or disputes be subject to Board of Claims proceedings.
- 4.4.101 Should the Contractor, either directly or by the Contractor's subcontractors, or their respective agents, servants, or employees, cause damage or injury to the property or work of any other prime contractor or contractors, or by failing to perform the Contractor's work (including the work of the Contractor's subcontractors) hereunder with due diligence, delay any other prime contractors who shall suffer additional expense or damage thereby, the parties involved in such dispute shall settle by agreement or arbitrate said claim, dispute or disputes by referring same to the American Arbitration Association. Said dispute or disputes shall be determined pursuant to the construction industry arbitration rules of the American Arbitration Association then in effect. Notice of the demand for arbitration shall be filed in writing with the other prime Contractors and with either the Philadelphia or Pittsburgh Regional Office of the American Arbitration Association, and a copy shall be filed with the professional and the Authority. The demand for arbitration shall be made within a reasonable time after the claim, dispute or other matter in question has arisen.
- 4.4.102 It is agreed by all parties that disputes or actions between Contractors concerning the additional expense or damage herein before mentioned shall not delay completion of the work which shall be continued by the parties, subject to the rights herein before provided. It is agreed by the parties to the contract (the Authority as promisee and the Contractor as promisor) that the intent of this clause is to benefit the other prime Contractors on the project or related projects and to serve as an indication of the mutual intent of the Authority and the Contractor that this clause raise such other prime Contractors to the status of third party beneficiaries only as to the terms and conditions of sections entitled Subcontractors and Disputes with the Authority. The Contractor agrees that these sections are provided as a benefit to the Contractor and that they specifically exclude claims against the Authority for delay or other damages.
- 4.4.103 The Contractor agrees that all claims, disputes and other matters in question between prime Contractors, which arise out of, or are related to this contract or the breach thereof shall be settled by agreement or resolved by arbitration in accordance with the construction industry arbitration rules of the American Arbitration Association then in effect, unless the parties mutually agree otherwise. This agreement to arbitrate shall be in consideration of the fact that all prime Contractors agree to this same arbitration provision as provided in each separate prime contract and that arbitration of all claims disputes and other matters in question shall be held within a reasonable time after the claim, dispute or other matter in question has arisen.

### **ARTICLE 5**

#### **SUBCONTRACTORS**

- 5.1** A Contractor may not, except with the consent of the Authority, have a financial interest in any other contractor, subcontractor, or supplier providing services, labor, or material on this project. Failure to disclose the names of such subcontractors and/or suppliers shall be sufficient grounds for termination of this contract. Such failure may also be grounds for the initiation of civil or criminal proceedings.

- 5.2** Subcontractors employed by the prime contractors are solely responsible to the prime Contractor, and shall have no contractual relationship with the Authority.
- 5.3** All work performed for the Contractor by a subcontractor shall be pursuant to an appropriate agreement between the Contractor and the subcontractor. All agreements between Contractors and subcontractors shall contain provisions that:
- A. Preserve and protect the rights of the Authority and the Professional under the Agreement with respect to the work to be performed under the subcontract, so that the subcontracting thereof will not prejudice such rights.
  - B. Require that such work be performed in accordance with the terms, conditions and requirements of the Contract Documents.
  - C. Require that all claims for additional costs, extensions of time or otherwise with respect to subcontracted portions of the work, shall be submitted to the Contractor in the manner provided in the Contract Documents for like claims by the Contractor upon the Authority.
  - D. Require that each subcontractor and/or supplier fully warrants and guarantees for the benefit of the Authority as purchaser the effectiveness, fitness for the purpose intended, quality and merchantability of any item provided and/or installed by such subcontractor.
  - E. Require that the subcontractor is without privity of Contract to the Authority and that it agrees by signing the subcontract that it neither acquires nor intends to acquire any rights against the Authority on a third party beneficiary theory or any others.
- 5.4** The Contractor shall not sublet any part of this contract without written approval of the Authority. Within 30 days of a Notice to Proceed, the Contractor shall submit a list of all subcontractors they propose to use for written approval by the Authority. In all cases, this shall be prior to the first application for payment being submitted.
- 5.5** The Authority has the right to direct the Contractor to replace any subcontractor that the Authority objects to, for reasons that:
- A. The subcontractor has failed to work in accordance with the contract provisions, rules and regulations regarding Contractor performance, contract compliance, good order and conduct of their employees.
  - B. The subcontractor has defaulted or failed to perform on previous Authority projects.
  - C. The subcontractor has been suspended or debarred from doing business with the Commonwealth. The Contractor shall then submit another subcontractor for approval.
- Should there be a cost differential to the Contractor, the Contractor shall submit evidence to that fact, and the Contract Sum shall be increased or decreased by the cost difference by an appropriate Change Order.

## **ARTICLE 6**

### **CHANGES IN THE WORK**

#### **6.1 RIGHT TO ORDER CHANGES**

- 6.1.100 The Authority, without invalidating the agreement, may order changes in the work within the general scope of the agreement consisting of additions, deletions, or other revisions. The contract sum and time shall be adjusted accordingly, as they relate to the cost of the work, and

impact on completion of the work. The Contractor agrees that payment under any method shall be the exclusive compensation for such addition, deletion, or other revision to the original agreement.

- 6.1.101 Minor changes in the work not affecting the contract sum or extension of time, consistent with the intent of the Contract Documents, may be directed by the Authority without additional compensation or time extension.
- 6.1.102 Work that can reasonably be done concurrently with other contract work, without significant addition of labor or equipment or increasing the contract completion date, will not be subject to time extension.

## **6.2 CHANGE ORDERS**

- 6.2.100 The cost or credit of changed work will be determined by one of the methods described herein:
  - A. By a detailed cost breakdown properly itemized. The breakdown shall include size, quantity, type, etc., and may include a maximum of fifteen percent (15%) markup to labor costs and a maximum of ten percent (10%) markup to material and equipment costs for overhead and profit.

The Contractor may include a maximum of ten-percent (10%) total markup to any subcontractor costs for overhead and profit. Subcontractors cannot exceed the markups stated herein for labor, material, or equipment costs.

- B. By unit prices stated in the bid proposal.
  - C. From prices as agreed upon in the Schedule of Values.
- 6.2.101 The Contractor shall not be entitled to profit which is lost as a result of deleted work, but shall be entitled to the overhead attributed to the items of work deleted from the Schedule of Values only when the contract completion date is not reduced.

## **6.3 UNILATERAL CHANGE ORDER**

- 6.3.100 In the event that agreement cannot be reached as to the cost or credit of the changed work, the Authority shall prepare a cost estimate, and the Contractor will be issued a unilateral change order to proceed with the changed work at a cost not-to-exceed the Authority's estimate. The Contractor shall proceed with the work and maintain accurate records of the actual cost of labor and material to perform the work.
- 6.3.101 Upon completion of the work, if the Contractor's actual cost including profit and overhead for the work does not exceed the Authority's not-to-exceed cost estimate, a new change order will be issued in the amount of the Contractor's actual cost.
- 6.3.102 If the work is not completed, and if the Contractor's actual cost has equaled or exceeded the not-to-exceed limit of the unilateral change order, the Authority will audit the Contractor's actual cost and subsequently attempt to negotiate a cost for the remaining work. If agreement cannot be reached for the remaining work, another unilateral change order will be issued at the Authority's revised cost estimate to complete the work. In this case, the Contractor retains the right to claim for equitable adjustment under the disputes clause of this agreement.

## **ARTICLE 7**

### **TIME**

- 7.1 The time specified for the contract completion is the number of calendar days from the date of

the Notice to Proceed. The date for commencement of the work is the date of the Notice to Proceed. On site work shall commence no later than ten (10) days after the date of the Notice to Proceed.

- 7.2** Time extensions may be granted for events impacting the work beyond the control of the Contractor if the changed condition impacts a work item on the critical path of the project schedule, and the scheduled substantial completion date is extended.

## **ARTICLE 8**

### **PAYMENTS AND COMPLETION**

- 8.1** The Contractor warrants and guarantees that title to all work, materials, and equipment covered by an application for payment, whether incorporated in the project or not, will pass to the Authority upon the receipt of such payment, free and clear of all terms, claims, security interests, or encumbrances.

#### **8.2 PAYMENTS**

- 8.2.100 Performance by the contractor in accordance with the provisions of the contract shall entitle the contractor to payment by the Authority. The Authority shall pay the contractor according to the provisions of this section for all items that appear on the application for payment and have been satisfactorily completed. Applications for payment will not be considered to be acceptable unless they meet all the requirements specified in Section 012900 - Payment Procedures and as outlined elsewhere in the contract documents.

8.2.101 Schedule of Values:

The contract sum is stated in the agreement and is the total amount payable for the performance of the work in compliance with the Contract Documents. Before any application for payment can be submitted, the Contractor shall submit to the Authority for its approval a detailed breakdown of the costs indicating a schedule of quantities and values for the items of work included in the contract, as required in Section 012900-Payment Procedures. Each item in the Schedule of Values shall include its proper share of overhead and profit.

The Schedule of Values, when approved by the Authority shall be used as a basis for the Contractor's application for payments. This Schedule of Values may also be used to determine the cost or credit to the Authority resulting from the changes in the work.

- 8.2.102 The Authority may decline to approve any Application for Payment, or portion thereof, because of subsequently discovered evidence or subsequent inspections, which may nullify the whole or part of any Application for Payment previously issued, to such extent as may be necessary to protect the Authority from loss because of:

- A. Defective work not remedied.
- B. Failure of the Contractor to make payments properly to subcontractors or for labor, materials, and equipment.
- C. Reasonable evidences that the work cannot be completed for the unpaid balance of the Contract Sum.
- D. Reasonable evidence that the work will not be completed within the Contract Time and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay.

E. Unsatisfactory prosecution of the work by the Contractor.

8.2.103 Retainage:

Normally, payment of the total amount will be made upon substantial completion, final inspection, and acceptance of the work. However, when a contract exceeds \$10,000 and upon written request, partial payments may be made after completion of portions of the work. To ensure proper performance of the contract, the Authority shall retain from all partial payments an amount not to exceed ten percent (10%) of the amount due the contractor until fifty percent (50%) of the contract is completed. The sum to be withheld from the contractor after the contract is fifty percent (50%) completed shall not exceed five percent (5%) of the value of the completed work based on monthly progress payment requests.

When the contract is fifty percent (50%) completed, one half of the amount retained by the Authority shall be returned to the contractor. However, the architect, engineer, or Authority project representative must approve the application for payment for reduction in retainage. The contractor must be making satisfactory progress, and there must be no specific cause for greater withholding.

All money retained by the Authority may be withheld from the contractor until substantial completion of the contractor. However, in the event a dispute arises between the Authority and any prime contractor, which dispute is based upon increased costs claimed by one prime contractor occasioned by delays or other actions of another prime contractor, additional retainage in the sum of one and one-half times the amount of any possible liability may be withheld until such time as a final resolution is agreed to by all parties directly or indirectly involved, unless the contractor causing the additional claim furnishes a bond satisfactory to the Authority to indemnify the Authority against the claim.

In absence of sufficient reason, within 20 days of receipt of payment of retainage, the contractor shall pay all subcontractors with which it has contracted their earned share of the retainage payment the contractor received.

8.2.104 Withholding of Payments for Good Faith Claims

The Authority may withhold payment for deficiency items according to the terms of the contract. If the Authority withholds payment from a contractor for a deficiency item, the Authority shall notify the contractor of the deficiency item within the timeframe specified in the contract or 15 calendar days of the date that the application for payment is received.

The Contractor may withhold payment from any subcontractor who is responsible for any deficiency item for good faith claims. If a contractor withholds payment from a subcontractor for a deficiency item, it must notify the subcontractor or supplier and the Authority of the reason within 15 calendar days of the date after receipt of the notice of the deficiency item from the Authority.

8.2.105 Payments to Subcontractors

For the purposes of this section, the contract between the contractor and the subcontractor is presumed to incorporate the terms of the contract between the contractor and the Authority. When a subcontractor has performed in accordance with the provisions of the contract, a contractor shall pay to the subcontractor, and each subcontractor shall in turn pay to its subcontractors, the full or proportioned amount received for each such subcontractor's work and material, 14 days after receipt of a progress payment. Neither the Authority nor any Professional shall have any obligation to pay or see to the payment of any monies to any subcontractor except as may be otherwise required by law.

8.2.106 Substantial Completion and Final Payment:

For all contracts containing a provision for retainage, the design professional shall make a final inspection within 30 days receipt of a request by the contractor for final inspection and

application for final payment. If the work is substantially complete, the design professional shall issue a certificate of substantial completion and a final certificate for payment.

The Authority shall make payment in full within 45 days except as provided for in Article 8.2.103 Retainage, less only one and one-half times the amount required to complete any then-remaining uncompleted minor items, which amount shall be certified by the design professional and, upon receipt by the Authority of any guarantee bonds which may be required, in accordance with the contract, to ensure proper workmanship for a designated period of time. The certificate of substantial completion given by the design professional shall list in detail each uncompleted item and a reasonable cost of completion. Final payment of any amount withheld for the completion of the minor items shall be paid upon completion of the uncompleted items listed in the certificate of substantial completion of the design professional.

Payment under this section will be made upon satisfactory completion of the work specified in the Contract Documents and completion of all requirements listed in Section 012900 - Payment Procedures.

### **8.3 ACCEPTANCE OF WORK**

8.3.100 An application for progress payment, a progress payment, or any partial or entire use or occupancy of the project by the Authority shall not constitute an acceptance of any work not in accordance with the Contract Documents.

8.3.101 Partial Occupancy or Use:

The Authority may occupy or use any completed or partially completed portion of the work at any stage when such portion is so designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer, and authorized by public authorities having jurisdiction over the work. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Authority and the Contractor have accepted in writing the responsibilities assigned to each of them for payments, security, maintenance, heat, insurance, etc.

Immediately prior to such partial occupancy or use, the Authority, Contractor, and Design Professional shall jointly inspect the area in order to determine and record the condition of the work, and agree to the period for correction of this work and as to the commencement of warranties.

**8.4** Any person, co-partnership, association, or corporation furnishing labor, material, equipment or renting equipment or rendering public utility services in connection with performance of this contract shall have a right of action to recover the cost thereof from the Contractor and the Surety on the bond given to secure the payment for such labor, material, equipment or equipment rental and services rendered by public utility as though such person or corporation had been named as obligee in such bond; subject to the provisions of the act 1998 Act 57 Commonwealth Procurement Code.

### **8.5 NO ESTOPPEL OR WAIVER OF LEGAL RIGHTS**

8.5.100 Neither the Authority nor the Professional shall be precluded or estopped by the measurements or approved applications for payment made or given by any of them or by any of their agents or employees, at any time, either before or after the completion and acceptance of the work and payment thereof, from showing the true and correct amount and character of the work performed and materials and equipment furnished by the Contractor. The Authority and/or the Professional may show at any time, that any such measurements or approved applications for payment are untrue or incorrectly made in any particular; or that the work or materials, equipment or any parts thereof do not conform to the Contract Documents.

8.5.101 The Authority shall have the right to reject the whole or any part of the aforesaid work or



materials and equipment should the said measurements or approved applications for payment be found or be known to be inconsistent with the terms of the contract, or otherwise improperly given. The Authority shall not be precluded or estopped, notwithstanding any such measurements or approved applications for payment in accordance therewith, from demanding and recovering from the Contractor or their Surety, or both, such damages as it may sustain by reason of the Contractor's failure to comply with the terms of the Contract Documents, or on account of any over-payments made on any approved applications for payment.

- 8.5.102 Neither the acceptance by the Authority or the Professional or any of their agents or employees, nor any certificate approved for payment of money; nor any payments for, nor acceptance of the whole or any part of the work by the Authority, nor any extension of time, nor any position taken by the Authority or its employees, shall operate as a waiver of any portion of the contract or any power herein reserved by the Authority or any right to damages. A waiver of any breach of the contract will not be held to be a waiver of any other or subsequent breach.

## **ARTICLE 9**

### **PROTECTION OF PERSONS AND PROPERTY**

#### **9.1 SAFETY PRECAUTIONS AND PROGRAMS**

The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs required under their portion of the work and maintained during the term of the contract.

#### **9.2 SAFETY OF PERSONS AND PROPERTY**

- 9.2.100 The Contractor shall take all reasonable precautions for the safety of, and shall provide all reasonable protection to prevent damage, injury or loss to:

- A. All employees on the work, and all other persons who may be affected thereby.
- B. All the work materials and equipment to be incorporated therein, whether in storage on or off the site, under the care, custody or control of the Contractor or any of their subcontractors.
- C. Other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

- 9.2.101 The Contractor shall comply with all applicable, laws, ordinances, rules, regulations and orders of any public authority having jurisdiction of the safety of persons or property or to protect them from damage, injury or loss. The Contractor shall erect and maintain as required by existing conditions and progress of the work, until the acceptance of the completion of their portion of the project, all reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent utilities.

- 9.2.102 The Contractor shall designate a responsible member of their organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated in writing by the Contractor to the Authority and the Professional.

- 9.2.103 Explosives shall not be used in the work without specific written approval by the Authority of the Contractor's plan for storage and use of them for accomplishing the work, and the Contractor providing the local Blasting Permit if required, the license for the person doing the blasting, and the Certificate for Insurance indicating blasting is included in the coverage.

### 9.3 EMERGENCIES

In any emergency affecting the safety of persons or property, the Contractor shall act, at their discretion, to prevent threatened damage, injury or loss. Any additional compensation or extension of time claimed by the Contractor because emergency work shall be determined as provided in Changes in the Work.

## ARTICLE 10

### INSURANCE

#### 10.1 GENERAL

10.1.100 All policies shall be issued by insurance companies known to be financially sound and authorized to conduct such business under the laws of the Commonwealth of Pennsylvania.

10.1.101 Coverage shall be maintained without interruption from the date of commencement of the work until the date of final payment and termination of any coverage required to be maintained after final payment.

10.1.102 Insurance required herein shall also name the Authority of the Commonwealth of Pennsylvania as an additional insured, as its interest may appear, and Additional Insured Endorsements shall be provided along with the Certificates of Insurance.

10.1.103 Certificates of Insurance: A Certificate of Insurance acceptable to the Authority shall be filed with the Authority prior to the Authority issuing a Notice to Proceed. In no case shall any commencement of work on site be permitted until the required Certificates of Insurance have been provided and accepted by the Authority.

A. The Certificates of Insurance shall contain a provision that "coverage afforded under the policies will not be canceled, allowed to expire, or in any way changed, including alterations to the conditions of the policy, until at least thirty (30) days written notice has been given, by registered mail, to the Authority".

The Contractor will be responsible to ensure these notifications occur. Furthermore, should there be no notifications of policy expirations, terminations, or alterations of the insurance coverage, it will be the understanding of the Authority that the insurance coverage will be as required in the Contract, or as has been indicated in the latest issued Certificate of Insurance accepted by the Authority.

B. All exclusions to the insurance policies shall be either provided on the Certificate of Insurance, or attached to it as a List of Exclusions. Such exclusions must be acceptable to and agreed to by the Authority. If no such listing is provided, it will be understood by the Authority that there are no exclusions to the policies.

C. The deductible amounts for the coverage provided shall be indicated by the insurance company or companies providing the policies. This information shall be sent along with the Certificates of Insurance.

10.1.104 Copies of all insurance policies shall be made available upon request of the Authority.

10.1.105 At any time the insurance provisions of the agreement, as described herein, are not being maintained, the work of the Contractor may be terminated or suspended, according to the provisions of Article 12-Suspension of the Work and Article 13-Termination of the Work

Agreement.

## 10.2 CONTRACTOR'S LIABILITY INSURANCE

10.2.100 The Contractor shall purchase and maintain such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations under the Contract, whether such operations be by the Contractor or by a subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

- A. Claims under Workers Compensation Disability Benefit and other similar employee benefit Acts. Employees Liability Insurance, with a minimum of \$1,000,000 aggregate coverage, is to be provided on the same operations.
- B. Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees.
- C. Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees.
- D. Claims for damages because of injury to or destruction of tangible property including loss of use resulting therefrom.

10.2.101 The Contractor's commercial general liability insurance and automobile liability insurance shall be written for not less than \$500,000 for injuries including accidental death to any one person, and subject to the same limit for each person, in an amount not less than \$3,000,000 for each occurrence. The Contractor's property damage liability insurance shall be in an amount not less than \$3,000,000 for each occurrence.

10.2.102 The commercial general liability insurance shall:

- A. Include completed operations and products liability coverage.
- B. Shall include contractual liability coverage as necessary to meet the Contractor's obligations under Third Party Indemnification and Authority Indemnification and Hold Harmless.
- C. Shall include the special property damage liability coverage commonly referred to as XCU (explosion, collapse, and underground damage), unless the Authority approves a Contractor's request to exclude this coverage.
- D. Shall include adequate protection against special hazards when required, i.e.: blasting, etc.

10.2.103 Subcontractors Insurance:

- A. The Contractor shall either require each of its subcontractors to procure and to maintain during the life of its subcontract subcontractor's commercial general liability, automobile liability, and property damage liability insurance of the type and in the same amounts as specified in this Article, or insure the activity of its subcontractors in its own insurance policies.
- B. The Contractor shall require each subcontractor to provide Worker's Compensation and Employer's Liability insurance covering all persons employed by such subcontractors on work to be performed on this contract.

- C. The Contractor must submit to the Authority, prior to any subcontractors or sub-subcontractors commencing of any on site work, evidence that the subcontractors or sub-subcontractors are covered by insurance as required herein.

### **10.3 PROPERTY INSURANCE**

- 10.3.100 The Contractor shall purchase and maintain property insurance for all insurable work included in the Contract, in the amount of the original Contract Sum as well as subsequent modifications thereto, in the names of the Authority and the Contractor as their respective interests may appear, in full 100% of the insurable value thereof, including:
  - A. Items of labor and materials connected therewith whether in or adjacent to the structure insured.
  - B. Materials in place or to be used as part of the permanent construction, including surplus materials, protective fences, bridges, temporary structures, miscellaneous materials and supplies incident to the work.
- 10.3.101 The property insurance will include and fully protect the interest of the Authority, the Commonwealth of Pennsylvania, the Contractor, subcontractors, and sub-subcontractors. The Contractor shall submit to the Authority for its approval all items deemed to be uninsurable.
- 10.3.102 Property insurance shall be on an all-risk policy form and shall insure against the perils of fire and extended coverage and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse due to ice and snow, temporary structures, and debris removal as associated hereto.
- 10.3.103 The risk of damage to the construction work due to the perils covered by the said property insurance with extended coverage, is that of the Contractor, and no claims for such loss or damage will be recognized by the Authority, nor will such loss or damage excuse the complete and satisfactory performance of the Contract by the Contractor.
- 10.3.104 Partial occupancy or use in accordance with Article 8.3.101 Partial Occupancy or Use shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or otherwise.

## **ARTICLE 11**

### **UNCOVERING AND CORRECTION OF WORK**

#### **11.1 UNCOVERING OF WORK**

- 11.1.100 Work performed under the contract is subject to inspection by the Authority. If a portion of the work is covered contrary to the request of the Authority or Professional, it must, if required by the Authority or Professional, be uncovered for its observation, and replaced at the Contractor's expense without change in Contract Time.
- 11.1.101 If a portion of the work has been covered which the Authority or Professional has not specifically requested to observe prior to being covered, the Authority or Professional may request to see such work, and it shall be uncovered by the Contractor. If such work is found to be in accordance with the Contract Documents, the cost of uncovering and replacement shall be charged to the Authority.

If the work is not in accordance with the Contract Documents, the work will be removed and

replaced by the Contractor, within the period specified by the Authority by written notice, at no additional cost to the Authority. The Authority may, upon failure by the Contractor to replace the nonconforming work, have the work removed and replaced at the Contractor's expense.

## **11.2 CORRECTION OF DEFECTIVE OR NON-CONFORMING WORK**

11.2.100 The Contractor shall promptly correct all work rejected by the Authority or Professional as defective or as failing to conform to the Contract Documents, whether observed before or after substantial completion and whether or not fabricated, installed or completed. All defective or non-conforming work shall be promptly removed from the site. The Contractor shall bear all costs of correcting such rejected work, including the cost of the Professional's additional services and any additional cost incurred by the Authority. Should the Contractor fail to respond in an expedient manner, the Authority may correct the work under Article 2.2-the Authority's Right to Carry Out the Work.

11.2.101 If, within one year after the date of substantial completion and acceptance of all work performed under the Contract or within such longer period of time as may be prescribed by Law or by the terms of any applicable special guarantee required by the Contract Documents, any of the work is found to be defective or not in accordance with the Contract Documents, the Contractor shall correct it promptly after receipt of a written notice from the Authority to do so, unless the Authority has previously given the Contractor a written acceptance of such specific condition. The Authority shall give such notice promptly after discovery of the condition.

If required, the Maintenance Bond hereto attached and made a part hereof shall provide a guarantee in the sum of ten percent (10%) of the total Contract sum of the work done for the correction and remedy of such defect. If the corrective work is not completed within thirty (30) days after notification by the Authority to the Contractor, the Authority may do the work and submit those costs to the Contractor's Surety for reimbursement.

11.2.102 The Contractor shall bear the cost of making good all work of other Prime Contractors destroyed or damaged by such removal or correction.

11.2.103 If the Contractor does not remove such defective or non-conforming work within the time fixed by written notice from the Authority, the Authority may remove it and may store the materials or equipment at the expense of the Contractor. If the Contractor does not pay the cost of such removal and storage within ten (10) days thereafter, the Authority may, upon ten (10) additional days written notice, sell such work at auction or at private sale and, after deducting all the costs that should have been borne by the Contractor pursuant to the provisions of this paragraph, shall account for the net proceeds of the sale. If such proceeds of sale do not cover all costs that the Contractor should have borne, the difference shall be charged to the Contractor and an appropriate change order shall be issued. If the payments then or thereafter due to Contractor are not sufficient to cover such amount, the Contractor and/or the Contractor's Surety shall pay the difference to the Authority.

11.2.104 The obligations of the Contractor under this section are in addition to and not in limitation of any obligations imposed upon the Contractor by special guarantees required by the Contract Documents or otherwise prescribed by law. Correction of defective work in no way reduces or eliminates the Contractor's responsibilities under the warranty provisions of the contract.

### **11.3 ACCEPTANCE OF NON-CONFORMING WORK**

If the Authority elects to accept non-conforming work, it may do so instead of requiring its correction or removal and replacement. If nonconforming work is accepted, a change order shall be issued to reflect an appropriate reduction in the Contract Sum to reflect the actual cost reduction of the change in the work, or, if the amount is determined after final payment, it shall be paid by the Contractor and/or its Surety. In this case, all the costs of uncovering and recovering the work shall be at the expense of the Contractor, and which costs shall not be included as part of any deduct change order.

## **ARTICLE 12**

### **SUSPENSION OF THE WORK**

#### **12.1 SUSPENSION OF WORK FOR CONVENIENCE**

12.1.100 The Authority may order the Contractor in writing to suspend all or any part of the work for such period of time as it may determine to be appropriate for the convenience of the Authority. This paragraph does not apply under conditions enumerated in Paragraph 12.2--Suspension of Work due to Unfavorable Conditions.

12.1.101 If the performance of all or any part of the work is, for an unreasonable period of time, suspended by the Authority, an adjustment shall be made for any increase in the cost of performance of this Contract (excluding profit) necessarily caused by such unreasonable suspension. The Contract shall be modified in writing accordingly. No adjustment shall be made under this clause for any suspension to the extent that performance would have been so suspended by any other cause, including the fault or negligence of the Contractor; or for which an equitable adjustment is provided for or excluded under any other provision of this Contract.

12.1.102 No claim under this clause shall be allowed unless the claim, in an amount stated, is asserted in writing as soon as practicable after the termination of such suspension. The claim may not be asserted later than the date of Final Completion under the Agreement.

#### **12.2 SUSPENSION OF WORK DUE TO UNFAVORABLE CONDITIONS**

12.2.100 If, in the judgment of the Authority, the Contractor is taking undue risk of damage to any part of a structure or installation by proceeding with the work during unfavorable weather or other conditions, then the Authority may suspend the work temporarily, either wholly or in part for such periods as are necessary. In case of such suspension, a proper extension of time will be allowed as provided herein, but no allowance will be made to the Contractor for any expense or damages resulting from the suspension. The failure of the Authority to suspend the work does not relieve the Contractor of its responsibility to perform the work in accordance with the Contract Documents.

12.2.101 The Authority may require a suspension of the work if, in its opinion, unforeseen conditions warrant such stoppage. When the Authority directs resumption of the work, the Contractor shall resume full operations within a period of ten (10) days after the date of written notice to do so. The Authority is not liable for any damage or anticipated profits on account of the work being suspended.

12.2.102 Any work done by the Contractor during the period of suspension is its responsibility. The contractor shall receive no payment for the work unless the construction is subsequently resume and the work done during the intervals of suspension can be utilized in the resumed work.

12.2.103 Suspensions of work as outlined above shall not in themselves operate to extend the Contract date of completion. Requests for extensions of time shall be submitted in writing by the Contractor, setting forth its reasons for the extension.

### **12.3 SUSPENSION OF WORK FOR FAULT OF THE CONTRACTOR**

Should the Contractor fail to comply with the orders of the Authority relative to any particular parts of the work, the Authority may suspend the work on any or all parts until its orders respecting the particular parts are complied with. In case of such suspension, which shall be considered due to the fault of the Contractor, no extension of time shall be given and no allowance will be made for the expenses incurred by the Contractor during the suspension period.

## **ARTICLE 13**

### **TERMINATION OF THE AGREEMENT**

#### **13.1 TERMINATION FOR CONVENIENCE**

13.1.100 The Authority may, at any time and for any reason, terminate this Agreement for the convenience of the Authority. In such case, the Contractor shall be paid (and shall accept payment) for that portion of the entire Contract actually performed to the date of termination, excluding, however, any loss of anticipated profits. Disputes as to the sum payable to the Contractor shall be settled in accordance with the Disputes Article of the Agreement.

13.1.101 Such termination shall be effective in the manner and at the time specified in such notice and shall be without prejudice to any claims that the Authority may have against the Contractor. Upon receipt of such notice from the Authority, the Contractor shall immediately discontinue all work and the placing of all orders for materials and equipment, facilities and supplies in connection with the performance of this Contract. The Contractor shall cancel promptly all existing orders and terminate work under all subcontracts so far as such orders and work are chargeable to this Contract. The Contractor shall take such measures for the protection of the property of the Authority as may be directed by the Authority.

13.1.102 Upon termination of this Agreement, as provided by this paragraph, full and complete adjustment and payment of all amounts due the Contractor arising out of this Agreement as determined by an audit conducted by or for the Authority, as soon as practicable after such termination, shall be made as follows:

- A. The Authority shall reimburse the Contractor for all costs incurred to date of termination, including reasonable overhead and expense made in the performance of this Contract, less amounts previously paid.
- B. The Authority shall also reimburse the Contractor for all costs to which the Contractor has been subjected or is legally liable for by reason of the termination of this Contract, including reasonable costs related to cancellation of orders, termination of subcontracts, etc.
- C. The Authority shall also reimburse the Contractor for the reasonable cost of providing protection of the property of the Authority as directed by the notice of termination.
- D. The sum total of the payments made under this paragraph shall not exceed the total amount of the Agreement, less payments previously made.
- E. Title to all property accruing to the Authority by reason of the termination of this Contract shall immediately vest in the Authority, and the Contractor will execute and deliver to the Authority all papers necessary to transfer title.

- F. The Authority or its representative shall be afforded full access to all books, correspondence, data and papers of the Contractor relating to this Contract in order to determine the amount due.

## **13.2 TERMINATION FOR DEFAULT OF THE CONTRACTOR**

- 13.2.100 If the Contractor persistently or repeatedly refuses or fails to supply enough properly skilled workmen or proper materials, or persistently disregards laws, ordinances, rules, regulations or orders of any public authority having jurisdiction, or fails to proceed as directed by the Authority, or performs the work unsuitably, or neglects or refuses to remove materials or replace rejected work, or discontinues the prosecution of the work without approval of the Authority, or otherwise is guilty of a substantial violation of a provision of the Contract Documents, then the Authority may, without prejudice to any of its other rights or remedies, give the Contractor and its Surety written notice that the Contractor has seven (7) days from the date of the Authority's notice to cure the default set forth in the notice.

The discretion to declare the Contractor in default is solely the Authority's, and, no party, whether bound by Agreement to the Authority or attempting to raise a third party relationship, which this Contract specifically precludes, has standing to raise the failure of the Authority to exercise its discretion, if default is the basis of a claim against the Authority.

Should the Contractor fail to cure said default within the specified time, the Authority may terminate the Agreement between the Authority and the Contractor and may take possession of the site and of all materials, equipment, tools, construction equipment and machinery, which is owned by the Contractor, located on the property and may finish the work by whatever method it may deem expedient.

- 13.2.101 In such case, the Contractor is not entitled to receive any further payment until the work is finished, at which time the Contractor shall be paid any excess remaining. If the unpaid balance of the Contract sum exceeds the cost of finishing the work, including compensation for the Professional's additional services and any other damages which the Authority has incurred in accordance with the Agreement, such excess shall be paid to the Contractor. If such costs exceed the unpaid balance, the Contractor or the Surety or both shall pay the difference to the Authority.
- 13.2.102 In the event the Authority wrongfully terminates the contract, as determined by disputes resolution procedures in the disputes section of the General Conditions, such termination shall be considered termination for convenience. The Contractor shall be paid only for the work completed to the termination date and for the materials delivered to the site that is peculiar to the project, and for other costs incidental to termination to the date of termination.

## **ARTICLE 14**

### **DEFINITIONS**

- 14.1** As used in these General Conditions, and in the Agreement, the following definitions shall be described herein, unless the context clearly dictates otherwise.
- A. Agreement means the Agreement or Contract, for construction services of which these general conditions are made a part. The term "Agreement" shall be interchangeable with the term "Contract" throughout this document.
  - B. Change Order is a written order to the Contractor, signed by the Authority, and issued after the execution of the Contract, authorizing a change in the work or an adjustment in the Contract sum or the Contract time. The Contract sum and the Contract time may be changed only by change order.



- C. Claim or Disputed Item means a demand or assertion by one of the parties seeking, as a matter of right, adjustment or interpretation of Contract terms, payment of money, extension of time or other relief with respect to the terms of the Contract.
- D. Contract Sum is the sum stated in the Agreement, and, including authorized adjustments, is the total amount payable by the Authority to the Contractor for performance of the work under the Contract Documents.
- E. Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for substantial completion of the work.
- F. Contractor, or Prime Contractor shall be the entity with whom the Authority shall enter into an agreement to provide the means and methods to construct the Project in accordance with the Contract Documents.
- G. Deficiency Item is work performed but which the design professional, the contractor, or the inspector will not certify as being completed according to the contract.
- H. Final Completion is when the project is completed, in accordance with the Contract Documents.
- I. Inspector is the person authorized or engaged by the Authority to inspect the work performed and materials furnished pursuant to a contract to determine whether the work completed is in compliance with the contract.
- J. Professional is a person or entity that acts as an agent for the Authority in the administration of the contract and may perform any functions deemed necessary as determined through agreement with the Authority.
- K. Subcontractor is a person or entity who has contracted to furnish labor or materials to or has performed labor for a contractor or another subcontractor in connection with a contract.
- L. Substantial Completion is the stage in the progress of the work when the work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so the Authority can occupy or utilize the work for its intended use. In no event shall a project be certified as substantially complete until at least 90% of the work on the project is completed.
- M. Authority shall mean the Authority or Pennsylvania Convention Center Authority authorizing the contract or any authorized representative thereof.
- N. Work includes all services and labor necessary to produce the construction required by the Contract Documents. It also includes all material and equipment incorporated or to be incorporated into such construction.

**END OF SECTION**

## **SECTION 27 05 00 - COMMON WORK ELEMENTS FOR COMMUNICATION SYSTEMS**

### **PART 1 – GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and all related Specification Sections, shall all apply to this Section.
  
- B. Related Specification Sections:
  - 1. Division 27 Specifications
  - 2. Related Project Specifications - All Applicable Divisions
  
- C. Reference Symbols:
  - 1. All device symbols are defined by the appropriate symbol schedule on the symbols and abbreviations sheet in the telecommunications systems drawing package. Not all device symbols as indicated may be required for the project.
  - 2. Due to the scale of the drawings, symbols are shown on drawings as close as possible to the mounting location. Contractor shall coordinate exact location of all Division 27 systems, components equipment and infrastructures with all related Contract Documents and affected trades prior to submittal of shop drawings.
  
- D. Abbreviations:
  - 1. PCCA Pennsylvania Convention Center Authority
  - 2. ADA Americans with Disabilities Act
  - 3. AHJ: Authority Having Jurisdiction
  - 4. ANSI/TIA Telecommunications Industry Association
  - 5. EMT Electrical Metallic Tubing
  - 6. ER Equipment Room – See also “IDF”
  - 7. IDF Intermediate Distribution Frame
  - 8. MIMO Multiple-In and Multiple-Out

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9. RCDD BICSI-accredited Registered Communications Distribution Designer  
  
RF A Radio Frequency signal generated by a radio transmitter and sent out through an antenna. The frequency of the transmission is described in terms of the number of cycles per second or Hertz (Hz)
10. TGB Telecommunications Grounding Busbar
11. TR Telecommunications Room (TR) See MDF
12. TMGB Telecommunications Main Grounding Busbar
13. WAN Wide Area Network
14. WAP Wireless Access Point
15. WLAN Wireless Local Area Network
16. WPA/WPA2 WiFi Protected Access / WiFi Protected Access II – IEEE 802.11i-2004
17. WSP Wireless Service Provider

E. Definitions:

1. Cable: An assembly of one or more copper conductors or optical fibers within an enveloping sheath, constructed to permit use of the conductors singly or in groups.
2. Contract Documents: The documents consisting of the Form of Agreement between Authority and Contractor, Conditions of the Contract, (General, Supplementary, and other Conditions), Drawings, Specifications and all Addenda issued prior to the execution of the Contract.
3. Contract Drawings: The drawings that form a part of the Contract Documents that provides the graphical representation of the project requirements intended design and/or performance criteria to be delivered by the Contractor.
4. Equipment: Generally, an endpoint for cable lengths; any hardware device/component. Used to terminate cable for cross-connection or interconnection to other cables or devices.
5. Horizontal Cable: The segment of the premises distribution system that provides connectivity from communications rooms to field devices. Refer to related specification sections for additional information.
6. Owner: Pennsylvania Convention Center Authority (PCCA)
7. Owner Vendor: Third party supplier/provider contracted directly by the Owner to provide goods or services as part of this project.

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8. Pathways: A raceway, conduit, sleeve, or exposed location, for the placing of telecommunications cable that links telecommunications spaces together
9. Project Specifications: Are documents that provide a comprehensive description of objectives which defines a set of technical requirements that a, design, product, material, component, system or service must meet or exceed in order to meet the intent of the Contract Documents.
10. Reference Drawings: A drawing and/or set of drawings produced by a proprietary supplier, manufacturer, subcontractor, or fabricator included in the Contract Documents for informational purposes, providing specific information related to the installation of related appurtenances, components, devices, hardware, products, and/or systems. Reference Drawings shall also include any Contract Drawings from prior bid packages that may have pertinent information or require coordination of trades related to this contract.
11. Record Drawings: Revised set of drawings submitted by a contractor upon completion of a project or a job. They shall reflect all changes made to the contract specifications and Shop Drawings during the construction process, and show the exact dimensions, geometry, and location of all elements of the work completed under the contract.
12. Shop Drawings: A drawing and/or set of drawings produced by the contractor, supplier, manufacturer, subcontractor, or fabricator as a detailed representation of the proper installation of the related, appurtenance, component, device, hardware, product, and/or system to be delivered in conformance to the requirements of the Contract Documents.
13. Telecommunications: Any transmission, emission, or reception of signs, signals, writings, images, and sounds; that is, information of any nature by cable, radio, optical or other electromagnetic systems. (TIA)
14. Telecommunications Infrastructure: The components (telecommunications spaces, cable pathways, grounding, wiring and termination hardware) that together provide the basic support for the distribution of all telecommunications information.
15. Telecommunications Media: Wire, cable, or conductor used for telecommunications.
16. Telecommunications Space: Areas used for the installation and termination of telecommunications equipment and cable, e.g., telecommunications closets, work areas, and maintenance holes (manholes) /handholes.

## 1.2 SUMMARY

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- A. This Section contains the overall requirements associated with all Division 27 specification sections and includes the project design intent and common elements of all network communications, components, equipment, materials, infrastructures, and systems.
- B. Drawings for each Low voltage systems. The Contractor shall coordinate exact locations with reflected ceiling drawings .
  - 1. All symbols are shown on the contract drawings as close as possible to their intended location. Contractor shall coordinate the installation of all equipment, devices, controls, components, cabling conduits/raceways and integration of other systems with all affected trades and sub-contractors. The contractor shall document all coordination requirements at the time of shop drawing submission.
  - 2. Drawings for this work are diagrammatic and intended to convey the extent, general arrangement, and locations of the work. Because of the scale of the drawings, certain basic items such as access panels, conduits, and junction boxes may or may not be shown on the contract drawings. Include all items where required by code, industry standards and manufacturer recommendations and related specification sections as required for the proper installation of all scopes of work.
- C. Project specifications and drawings may not deal individually with every part, control, device, component, or hardware, which may be required to produce the equipment performance for the specified system and/or as required for compliance with all specified systems integration.
  - 1. Include such items and components, as required, for complete operational and fully functional systems as defined by the Contract Documents, whether specifically indicated or not. The contractor shall be responsible for providing all conduits/raceways, cable terminations, systems, equipment, materials, devices, components, electrical power, software, programming, commissioning, testing and all appurtenances as well as the integration of any ancillary systems or Owner provided equipment/components/systems as required by the Contract Documents.
  - 2. Coordinate with all applicable trades in submittal of shop drawings and the installation of all systems. All shop drawings shall detail space conditions in order to accommodate other concerned trades, all equipment locations are subject to final review by the Owner.
- D. All Division 27 scopes of work shall include the necessary labor, software, equipment, materials, devices, cabling, conduits and electrical power as well as the performance of all system programming, testing and commissioning as required to provide fully operational systems in accordance with all requirements of the Project Documents.
  - 1. The Contractor shall also furnish and install all software, and system components as well as all necessary modifications and programming changes to any existing

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systems as required to ensure continuity of PCCA operations between any new systems and all existing systems currently deployed.

- a. Coordinate the installation of all systems, equipment, components, materials, conduits, cabling, and devices as well as the integration and/or modifications of all impacted systems with the Owner prior to the submission of any shop drawings.
- E. The Contractor shall comply with the following requirements as well as all related specification sections in the installation of any cabling and/or system components.
1. All wiring shall terminate on fixed terminal strips, punch blocks, or CAT6A patch panels in accordance with all requirements of the project drawings and related specifications.
  2. All junction boxes containing any system splices shall be uniquely identified.
  3. All equipment enclosures located outside or in all areas with high moisture or high humidity shall be NEMA 4X enclosures and rated for that application.
  4. All devices, components, or equipment installed on the exterior of the facility shall be provided in accordance with all manufacturers' requirements to ensure the proper operation when exposed to the environmental conditions and/or average annual lowest temperature that can be anticipated for the geographic region of the facility.
  5. All interior devices exposed to the general population shall be installed in secured equipment enclosures and installed in such a manner that resists tampering and/or removal without the use of specialized tools.
  6. All work shall be neat in appearance, free of rough edges, scratches, blemishes, cracks, and exposed gaps. All equipment shall be secured to the mounting surface and fastened with hardware approved by the manufacturer and capable of supporting the rated load. All cables within enclosures shall be neatly routed and tie wrapped at 6 inches on center. All wire splices shall be terminated on terminal strips and/or soldered in place. Any splices utilizing wire nuts shall not be acceptable.
  7. All cabling, cable terminations, equipment, conduits, junction boxes and systems shall be properly labeled and shall conform to all requirements of the Contract Documents. Refer to all related specification sections for additional information.
- F. Use of Premises
1. 1. The Contractor shall have limited use of premises for construction operations only as required to meet the scopes of work as delineated by the Contract Documents.

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- a. Elements of this project shall employ a phased construction methodology. Phasing and sequencing of certain construction activities may be critical to PCCA's operations. Contractor shall plan, schedule, and install all cabling, conduits and/or systems in accordance with all requirements of the project construction schedule.
  - b. It shall be the contractor's responsibility to become completely familiar with all existing conditions, cable terminations, and network infrastructures in this facility in order to ensure proper and seamless installation and integration of all communications networks and cabling.
2. Phasing: Demolition and Replacement of WAP is a critical construction task requiring detailed definitions in Contract documents. This work will require extensive coordination between Owner, Contractor, the design team, and existing systems users and is expected to require detailed planning to provide the following results:
- a. Minimal Impacts to network operations
  - b. Planned demolition.
  - c. Owner user coordination
  - d. Structural and architectural routing of cabling
  - e. Cable and plant infrastructure testing and commissioning
  - f. System programming and mapping
  - g. It shall be the Contractors responsibility to ensure that this Owner standard is maintained in their layout and placement of all equipment and cable terminations in any communications room and/or closet.
3. At the completion of each project phase and only after final acceptance by the Owner, the contractor shall provide the demolition of all existing systems related to that area which is not connected to the new communications infrastructure.
4. The Contractor shall submit demolition plan for review by the Owner indicating all elements affected by project demolition. The Contractor shall review and familiarize themselves with all existing conditions and only after receiving approval of the submitted demolition plan prior to the commencement of any work.
- a. The demolition plan shall identify all devices, cabling and/or equipment racks and demarcation points to be demolished. The contractor shall include all procedures, means, methods and precautions to be employed in the demolition of all existing communications devices, cabling, conduits and/or systems.

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- b. The contractor shall be responsible for the complete demolition and removal of all existing communications devices, conduits, and cabling from edge device to demarcation point impacted by the phased construction.
    - c. Only CAT6 cabling shall be removed, all conduits shall remain and fire stopped in accordance with NFPA 70 requirements.
    - d. The contractor shall coordinate all demolition activities so as not to disrupt the daily routine of the Convention Center.
  5. The Contractor shall design, prepare, schedule, and coordinate all scopes of work without disruption of any existing system functions or the daily operation of the Convention Center. All cabling and equipment shall be installed in such a manner that all new controls, equipment, devices and/or systems shall be installed, programmed, and tested prior to modification, switch over and/or disconnecting of any existing systems.
    - a. Include all costs related to any phased construction methodologies having to do with the scope of work defined herein, including, but not limited to, all necessary temporary equipment, devices, components, or systems as well as any labor costs associated with any installation, programming, commissioning, testing demolition of any technology systems required to be performed after normal business hours of the facility.
    - b. Prior to the disabling, modifications, switchover and/or demolition of any existing system components and/or cabling, all new system components, equipment, conduits, cabling, shall be in place, tested and fully operational.
    - c. The contractor shall coordinate all installation activities so as not to disrupt the daily operations of the Convention Center and shall include any costs related to a phased construction methodology where applicable.
    - d. Installation activity and costs shall include but are not limited all necessary temporary equipment, devices, components, or systems as well as any labor costs associated with any installation, commissioning, testing demolition of any systems required to be performed after normal business hours of the Convention Center.
  6. Contractor shall plan, schedule, and install all scopes of work in accordance with all requirements of the project construction schedule.
  7. The contractor shall coordinate all installation and demolition activities so as not to disrupt the daily routine of the existing facility.

G. Coordination



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1. All shop drawings shall detail space conditions in order to accommodate other concerned trades, all equipment and device locations are subject to final review by the Owner.
  - a. If installation of equipment, raceways, cable trays, and/or conduit is performed prior to coordination with all other trades, which interferes with work of other trades or the performance of the system, the contractor shall make necessary changes to correct the condition at no additional cost to the Owner.
  - b. In addition to the support and connectivity requirements for all systems stipulated under Division 27 specifications the Contractor shall provide all communications infrastructure for the support and connectivity of the following ancillary systems as indicated by the Contract Documents.
2. The Contractor shall furnish and install all cabling and connectivity requirements in coordination with the stipulated Division Contractors. All cabling and connectivity shall be installed in accordance with all applicable codes and standards to ensure proper operation of the related systems.
3. Where applicable, contractor shall coordinate all service, rework, and relocation of existing utilities prior to bid. Bid shall include all work required for any connections/interfaces with existing systems and/or utilities.
4. Contractor shall coordinate all work with vendors for rework, relocation, and addition of equipment and devices, including any modification to existing system infrastructure.
5. Coordinate all work involving tenant leased areas or equipment for rework, relocation, and/or addition of cabling, conduits, equipment, and devices, including any modification to existing system infrastructures with the Owner.

### 1.3 SCOPE OF WORK

- A. Refer to related Division 27 specification sections and associated drawings for all related scopes of work and further system requirements.
- B. The Contractor shall have overall responsibility to coordinate with Owner furnished, installed, and vendor work.

### 1.4 REFERENCES

- A. References to industry and trade association standards as well as all building codes are minimum installation requirements. The codes, standards and agencies listed

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below shall form a part of all related specification sections and all work shall comply with the latest adopted standards.

- B. Authority Having Jurisdiction: All systems and system installations shall comply with all applicable Codes, Ordinances and Standards as interpreted and enforced by the local authority having jurisdiction.
- C. Local Adoption and Amendments: Follow the locally adopted version of all codes and standards. Where local jurisdictions or governments include amendments to codes including the National Electrical Codes, national health and safety codes, radio frequency regulations, or other building codes, the Contractor shall follow the locally amended versions and amendments.
- D. Publication Dates: Comply with published standards in effect as of date of the Contract Documents unless otherwise indicated.
  - 1. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity.
  - 2. Copies of applicable standards are not bound within the Contract Documents and shall be the responsibility of the Contractor and all Sub-contractors familiarize themselves with the applicable codes and standards.
  - 3. Where copies of specific codes and standards are needed to perform a required
  - 4. construction activity, obtain copies directly from publication source.
  - 5. In the case where the referenced codes and standards mandate a greater level of performance or installation than what the contract drawings and specifications stipulate, the more stringent shall then apply.
- E. At the minimum, the following codes and standards to be applied to this project:
  - 1. National Fire Protection Association (NFPA):
    - a. NFPA-70: National Electrical Code (NEC)
    - b. NFPA-75: Standard for the Protection of Information Technology Equipment
    - c. NFPA 76: Standard for the Fire Protection of Telecommunications Facilities
  - 2. American National Standards Institute (ANSI) / Telecommunications Industry Association (TIA):
    - a. ANSI/TIA-568-D.0: Generic Telecommunications Cabling for Customer Premises
    - b. ANSI/TIA-568-D.1: Commercial Building Telecommunication Standard

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- c. ANSI/TIA-568-D.2: Balanced Twisted-Pair Telecommunication Cabling and
  - d. Components Standard
  - e. ANSI/TIA-569-D: Telecommunications Pathways and Spaces
  - f. ANSI/TIA-606-B: Administration Standard for Telecommunications Infrastructure
  - g. ANSI/TIA-854: Full Duplex Ethernet Specification for 1000Mbps Operating Over
  - h. Category 6 Balanced Twisted Pair Cabling
  - i. ANSI/TIA-1005-A: Telecommunications Infrastructure Standard for Industrial Premises
  - j. ANSI/TIA-1152: Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
3. Underwriters Laboratories, Inc.:
- a. UL 486A: Wire connectors and soldering lugs for use with copper conductors
  - b. UL 1449: Transient Voltage Surge Suppressors
  - c. UL 1581: Standard for Electrical Wires, Cables, and Flexible Cords
  - d. UL 1666: Standard for Test for Flame Propagation Height of Electrical and Optical- Fiber Cables Installed Vertically in Shafts
  - e. UL 83: Thermoplastic-Insulated Wires and Cables
  - f. UL 910: Test Method for Fire and Smoke Characteristics of Cables Used in Air- Handling Spaces." Provide products which are UL-listed and labeled.
  - g. UL 969: Standard for Marketing and Labeling.
  - h. UL Certified: UL's LAN Cable Certification Program
4. Institute of Electrical and Electronic Engineers (IEEE)
- a. IEEE 802.1, Bridging and Management
  - b. IEEE 802.3, Standard for Ethernet (2012 with published amendments)
  - c. IEEE 802.11 Wireless LANs

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5. NEMA/ICEA Compliance:
  - a. WC-5 - "Thermoplastic-Insulated Wire and Cable for the Transmission and
  - b. Distribution of Electrical Energy,"
  - c. WC30 - "Color Coding of Wires and Cables," pertaining to control and signal transmission media.
  
6. Internet Networking Standards: Network hardware and software shall be able to communicate with the Internet and provide for the creation of IP based networks for the Agency. All supplied hardware shall comply with the following minimum standards and RFC's as appropriate.
  - a. RFC 950 - Internet Standard Sub-Netting Procedure
  - b. RFC 1140 - Official Protocol Standards
  - c. RFC 1156 - MIB Base for IP Networks
  - d. RFC-1213 - MIB-II
  - e. RFC-1757 - Remote Monitoring (RMON)
  - f. RFC 1157 - Simple Network Management Protocol
  - g. RFC 1720 - TCP/IP, OSI Compliant
  - h. RFC 1918 - Address Allocation for Private Subnets
  - i. RFC 1583 - OSPF, Version II
  - j. RFC 1723 - RIP -II
  
7. ASTM Compliance: Comply with applicable requirements of D-2219 and D-2220.
  
8. Building Industry Consulting Service International (BICSI)
  - a. ANSI/BICSI-002, Data Center Design Standard and Recommended Practices
  - b. Electronic Safety and Security Design Reference Manual (ESSDRM)
  - c. Information Technology Systems Installation Manual (ITSIMM V7)
  - d. Telecommunications Distribution Methods Manual (TDMM 14)

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9. Federal Communications Commission:

- a. FCC Regulations Part 15 Title 47.
- b. FCC: Federal Communication Commission Part 68 as modified by Wiring Docket 88-57.

1.5 SYSTEM DESCRIPTION

- A. At the minimum, the scopes of work covered by the Division 27 Specifications and the Contract Drawings shall include but are not limited to necessary labor, equipment, material, cabling, conduits, electrical power, software, software modifications, programming, commissioning, testing and all appurtenances as required for the proper installation necessary to deliver fully operational systems as described herein and by the all related specification sections.
- B. Additional requirements of all related specification sections shall also apply. It shall be the Contractor's responsibility for full compliance with all requirements of 27 05 00 as well as all related specification sections as necessary to deliver complete and fully operational systems and/or infrastructures in accordance with the requirements of all Contract Documents.

1.6 SUBMITTALS

- A. The Contractor shall also conform with all shop drawing submittals in accordance with the following:
  - 1. The Owner approvals shall be obtained for all equipment and material before delivery to the job site. Delivery, storage, or installation of equipment or material which has not had prior approval will not be permitted at the job site.
  - 2. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings, and other data necessary for the Owner to ascertain that the proposed equipment and materials comply with specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted.
  - 3. Prior to any submission, the contractor shall be responsible for performing the following quality control items to ensure compliance with all project requirements:
    - a. Review all Shop Drawings and Product Data
    - b. Review all field measurement criteria.
    - c. Review all field construction criteria and methodologies.

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- d. Review all catalog numbers and similar data.
  - e. Review all coordination requirements of affected trades.
  - f. Review conformance to all appropriate specification sections.
4. The Contractor shall have a registered RCDD professional review and seal shop drawings related to the design, installation, testing, certifications and structured cabling layouts for all communications systems confirming that the proposed work is in conformance with all stipulated codes, standards, related specification sections and requirements as herein specified. Failure to provide RCDD sealed shop drawings shall result in all shop drawings being returned for resubmission without any reviews taking place.
  5. The Owner of the shop drawings and/or samples does not relieve the Contractor from compliance with the requirements of the Contract documents. Unless the Contractor has informed the Owner and/or OAR in writing of such deviation at the time of submission, has noted the deviation on the shop drawings, has given written approval of the specific deviation to the project document, all project requirements shall stand.
  6. The Owner's review also does not relieve the Contractor from responsibility of delivering all scopes of work as defined by the Contract Documents due any errors of omission in the submission of their shop drawings and/or samples.
  7. Submit all system testing, commissioning, and startup procedures to be employed. Include all estimated times for performance of all tests, all test equipment and manpower necessary for testing.
  8. Submit all sub-contractor qualifications and certifications in accordance with the requirements as specified elsewhere in this specification section.
  9. Submit project schedule outlining the time frames for all equipment with long lead times for equipment deliveries; include all system commissioning, testing, and training time expectations. Project schedule shall be submitted as CPM schedule and shall utilize a software-based project management program.
- B. In addition to items to be furnished and installed under this Contract, this project consists of items to be furnished and/or installed by the Owner and Owner Vendors.
1. In order to provide for comprehensive review of all system designs by the Owner, the contractor shall obtain all items required as part of standard submittals specified above from the Owner and or Owner Vendor(s) for Owner- or Owner-Vendor furnished equipment and submit them as part of the Contractor's submittal packages for each system.
- C. The Contractor shall schedule submittals to maintain the project schedule.

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1. Submittals shall be provided as a complete submission; no partial submissions will be accepted. Failure to provide a complete submission shall result in all submittals being returned for resubmission.
  2. In addition to all paper submission requirements ,the Contractor shall also submit one complete set of electronic submittals in a PDF format.
  3. No substituted equipment shall be reviewed without prior approval in accordance with the requirements of “substitutions” under Division 01 specification section.
  4. Mark the submittals, "SUBMITTED UNDER SECTION."
  5. Submittals shall be marked to show specific specification section.
- D. D. All shop drawings shall be Contractor prepared using latest version of AutoCAD or REVIT, drawn accurately, and in accordance with the Owner’s Standards. The Contractor shall not reproduce the Contract Documents or copy standard information as the basis of the technical data, hand drawn mark-ups of the original Contract drawings shall not be acceptable. Failure to provide a complete set of “contractor prepared” installation shop drawings at the time of submittal shall result in all submittals being returned for resubmission.
1. Submission Packaging: The Contractor shall organize the submissions according to the following packaging requirements.
  2. Electronic Copy Submission: One complete set of electronic equipment data sheets and drawings submitted in PDF format and collated in two distinct files:
    - a. Equipment Data Sheets, equipment schedules, alarm matrixes cable termination spread sheets, and all related pertinent information.
    - b. Drawings including all site plans, floor plans, risers, point to point wiring, grounding, installation details and mounting elevations.
  3. Hard Copy Submission: Submit hardcopies of all shop drawings and product datasheets in accordance with the stipulations of Division 01 Specification sections
- E. E. DELAYS
1. 1. Contractor is responsible for any delays in the progress of the project accruing directly or indirectly as a result of late submissions or resubmissions of shop drawings, and/or product data.
- F. RE-SUBMITTALS

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1. Submitted items, found unsuitable, rejected or returned for revision by the Owner, shall be reworked by the Contractor and resubmitted.
2. Review of Contractor's submittals by the Owner's Representative will be limited to examination of an initial submittal and one (1) resubmittal.

G. SHOP DRAWINGS

1. All shop drawings shall include sufficient information, clearly presented, to determine full compliance with all project drawings and specifications.
2. All demolition and construction phasing plans, coordination requirements, switch-over schedules, and termination matrices.
3. Provide a complete termination schedule of all communications devices and cable drop/outlet locations. Indicate on the installation drawings all devices and cable drops/outlet locations, termination room locations, unique identifications, cable types, cable distances and all pertinent data to properly evaluate the performance and capabilities of each cable run.

H. EQUIPMENT SUBMITTALS:

1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
2. Include all equipment data sheets pertinent to equipment, materials and/or components provided. All data sheets shall be highlighted and annotated indicating specific equipment and options supplied. Failure to provide the proper annotation of all equipment shall result in submittals being returned for resubmission.
3. Submit complete technical data necessary to evaluate the material and equipment. Include a complete technical specification for the submitted equipment, noting differences and adherence to this section. Failure to provide the required data will result in all submittals being returned for resubmission.
4. Submit performance data, equipment ratings, cable requirements, control sequences, GUI based control panels, programming matrices, logic diagrams and all other descriptive data necessary to describe the installation and operations of the system being provided.

1.7 QUALITY ASSURANCE

- A. Quality Assurance services as described below shall be provided by the Contractor. The Owner shall provide only Quality Assurance inspections and oversight.



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- B. Quality Assurance services described in this section are a portion of the quality assurance activities which may be necessary to achieve full compliance with the Contract Documents and are not intended to limit the activities of the contractor.
- C. These provisions do not relieve the Contractor of providing quality control services or other inspections to the Owner or authorities having jurisdiction over this project.
- D. A quality assurance supervisor whose responsibility it is to ensure compliance with the Contract Documents shall be included in the quality assurance program. This person shall be assisted by other quality assistance staff as warranted by the specific construction activities and workload.

1.8 DELIVERY STORAGE AND HANDLING

- A. Equipment shall be delivered in original packages with labels intact and identification clearly marked. Equipment and components shall be protected from the weather, humidity, temperature variations, dirt, dust, or other containments. Equipment damaged prior to system acceptance shall be replaced at no cost to the Owner.
- B. Contractor shall store all equipment and materials in a climate controlled environment. Storage environment shall, at a minimum, comply with the following:
  - 1. Temperature not to exceed: 20 degrees C to +50 degrees C (68 degrees F to + 122 degrees F) Relative humidity of 5 percent to 95 percent, non-condensing.
  - 2. Where manufacturer's storage requirements are more restrictive than those listed above, store such equipment and/or materials in compliance with all manufacturer's requirements.
  - 3. Do not store equipment or materials in areas where fire or explosion hazards exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers. Do not store equipment or materials in areas subject to corrosive agents, liquids or gasses.
  - 4. Do not store equipment or materials in areas that contain potential water hazards
  - 5. (including, but not limited to, restrooms, kitchens, or mechanical spaces), or adjacent to liquid-carrying pipes.
  - 6. Contactor shall store materials only in areas designated by the Owner.
  - 7. The Contractor shall coordinate product delivery and movement to installation locations with the Owner within both on- and off-hour periods as required to minimize impact to PCCA's operations.
  - 8. The Contractor shall be responsible for product shipment, delivery and storage/staging/testing location onsite.

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9. The Contractor shall coordinate with the Owner regarding site readiness and refer to architectural drawings regarding placement.

## PART 2 – PRODUCTS

### 2.1 MANUFACTURED PRODUCTS

- A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, that meet and/or exceed the specified performance and features of the equipment and/or systems and for which replacement parts shall be readily available to the contractor and/or Owner.
  1. The equipment specified is based on the acceptable manufacturers listed. Where "or equal" is stated, equipment shall be equivalent in every way to that of the equipment specified, and subject to approval.
  2. When more than one unit, device, or component of the same class of equipment is required, such units, devices, or components shall be the product of a single manufacturer.
  3. Acceptable manufacturers for each system shall be as specified and shall be provided in full compliance with the requirements of this and all related specification sections and contract drawings.
  4. Manufacturers listed as acceptable shall not negate the contractors' responsibility for providing all equipment, devices, components, and/or systems, in accordance with all functions and performance requirements of the Contract Documents.
  5. Where manufacturer and/or manufacturer model numbers reference specific system components in the related specification sections, it is to establish the performance requirements and quality of the systems and components only.
    - a. it is in no way an inference that the referenced model numbers are the manufacturer's current product and are the only manufacturer's acceptable components for this project unless specifically referenced as "no substitutions."
  6. Equivalent UL- listed equipment may not be substituted for the approved Manufacturers unless stipulated by other specification sections as "Approved Equal" "Or Equal." All substitutions shall be submitted for approval by the Owner in accordance with all requirements of Division 01 and Chapter 1.4 "Submittals" of this specification section.
    - a. Where systems and/or components are referenced as "no substitutions" the specific system and/or components shall be provided.

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- b. All substitutions where permitted under the “Approved Equal” “Or Equal” stipulation shall comply with all requirements as specified above, and all system performance standards shall be maintained.
- c. The contractor shall stipulate the following information impacted by such a substitution.
- d. Any and all extensions in time impacted by the substitution.
- e. Any changes to the architectural or structural elements to the project
- f. Differences in operation and/or performance from intended system criteria.
- g. Failure to provide the required substitution information shall result in “without consideration” the immediate rejection of the substituted equipment and/or systems.

B. Equipment Assemblies and Components:

- 1. Components of an assembled unit need not be products of the same manufacturer.
  - a. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
  - b. Components shall be compatible with each other and with the total assembly for the intended service.
  - c. Constituent parts which are similar shall be the product of a single manufacturer.
  - d. Factory wiring shall be identified on the equipment being furnished and on all wiring diagrams.

C. Compatibility and Interoperability of System Components and Devices

- 1. Where multiple components, devices, and/or systems are intended to be interconnected and components of a complete system in accordance with any related specification sections, it shall be the Contractor’s responsibility to verify interoperability and compatibility of said components, devices, and/or systems in full conformance to the specified performance criteria prior to the submission of shop drawings.
- 2. Where specified devices are found to be incompatible or incapable of performing as specified in a seamless manner, the contractor shall notify the Owner in

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writing prior to submission of shop drawings. Failure to properly identify such functional discrepancies shall not relieve the contractor from providing a complete and fully functional system in accordance with the requirements of all related specification sections.

- D. Where Factory or Off-Premises Testing of any equipment, product or assembly is recommended by the product manufacturer or where specified as part of this section and/or any related specification section.
- E. The Owner shall have the option of witnessing all factory tests. The Contractor shall notify the Owner at a minimum of thirty (30) working days prior to the performance of any factory or off premises tests.
- F. Where the factory or assembly point for all off-premises testing is not within two (2) hours driving time from the project location, the contractor shall include as part of this project all per diem costs (travel, meals and lodging) for a minimum of two representatives from the Owner to witness all testing.
- G. Provide four (4) copies of certified test reports containing all preliminary test data and testing procedures shall be furnished to the Owner prior to any final testing and not more than ninety (90) days after completion of any tests.
- H. When equipment, product, or assembly fails to meet any factory or off-premises tests, retesting of equipment, product, or assembly shall be mandated, the manufacturer/contractor shall be liable for all additional expenses, including all expenses incurred by the Owner for witnessing the retesting of any equipment, product, or assembly.

### PART 3 – EXECUTION

#### 3.1 COORDINATION

- A. The contractor shall coordinate with the appropriate trade all conditions impacting the installation of any cables, conduits, cable trays, or systems including but not limited to all equipment locations, communication room/spaces, ceilings, lighting fixtures, fire protection piping, and ductwork layouts to the satisfaction of all concerned trades, subject to final review by the Owner .
  - 1. Coordinate exact location(s) of all ceiling mounted cable, conduits, equipment, and/or devices with all architectural plans, reflected ceiling plans and affected trades prior to installation.
- B. Prior to final programming of all systems review with the Owner all system features, functions, system operations and related operational programming for all systems provided.

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- C. Provide coordination with all system sub-contractors and trades the proper installation of all equipment, components, and all integration requirements in order to provide fully operational systems in accordance with all applicable specification sections.
- D. Each Contractor shall maintain a complete set of current and up to date shop drawings and equipment submissions at the job site at all times. Shop drawings, equipment submissions and all other documents submitted for review shall be made available on site to the Owner upon request.
- E. Coordinate all work scheduled to be provided by Owner or Owner's Vender that impact the scope of work associated with this project. Schedule all work to ensure that the work of the Owner and all Owner Vendors can proceed in accordance with the Project Schedule.

### 3.2 EQUIPMENT INSTALLATION

#### A. General

1. The Contractor shall provide all tools and test equipment required to install, verify, and test the installation and to determine that it meets the specifications. The Contractor shall furnish all necessary materials required to implement and to achieve the required work performance.
2. The Contractor shall install products detailed in the specifications, system requirements, drawings and Contractor designs including those purchased by the Contractor and those provided by other parties.
3. All equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the Specification shall be subject to the control and approval of the Owner.
4. All system equipment installations shall be in accordance with good engineering practices, NEC, local building codes, and all manufacturer's requirements. Cable terminations at all equipment locations shall comply with all state and local electrical codes. All wiring shall test free from all grounds, shorts, stray voltages, and EMI.
5. Follow manufacturers' instructions for installing, components and adjusting all equipment and cabling. Submit two (2) copies of such instructions to the Owner before installing any equipment. Provide an additional copy of such instructions at the equipment during any work on the equipment. Where no instructions are included with the equipment, follow accepted industry practices and workmanlike installation standards.
6. Equipment location shall be as close as practical to locations as indicated on the contract drawings.

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- a. Provide all equipment clearances in accordance with NEC requirements. Arrange equipment to facilitate unrestricted access for maintenance and service around all equipment, components, and/or cable terminations.
7. Where the Owner determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the project.
  - a. "Conveniently accessible" is defined as being capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.
8. Installation\Mounting of all system hardware, components, equipment and/or appurtenances must comply with the appropriate IBC Seismic requirements for the region.
  - a. Where undefined by codes and standards, Contractor shall apply a safety factor of at least 2 times the rated load to all fastenings and supports of system components.
9. For equipment mounted in drawers or on slides, provide the interconnecting cables with a service loop of not less than three feet and ensure that the cable is long enough to allow full extension of drawer or slide.
10. The Contractor's quality assurance Inspector shall conduct a visual inspection of all installations to verify that the installations are in accordance with the applicable codes, standards, manufacturer's and Contract requirements. Record of all inspections shall be signed and dated by the Quality Assurance Inspector and shall be provided to the Owner.
11. Prior to any scheduled inspections, the Owner representative shall be notified by the Contractor of any inspection(s) so they may witness.

### 3.3 COMMUNICATIONS CABLING REQUIREMENTS

- A. All wiring and cables shall be properly dressed and/or bundled with tie-wraps or cable ties with excess cut close to the barbs. Twisted wire, tape, rope, twine, phone wire and similar bits of debris usually available on site are not acceptable substitutes for proper securing hardware. All inter-rack cables and wiring must be properly routed, and where available, in cable trays. Overhead cables must be easily removed or reworked within the cable trays. Proper care must be taken to ensure that new cables added to the trays are not stressed or intertwined with existing cables. Overhead cables may not cross perpendiculars or be suspended in mid-air without supports.
- B. In addition to all related specification sections all cabling shall be sized to support the appropriate communication system. All communications cable installations shall be in accordance with good engineering practices as established by the TIA, IEEE and the NEC. All cabling shall meet all state and local electrical codes. All cabling shall test free from all grounds, shorts, and EMI.

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1. Contractors shall have the option to combine all cable home runs and conductors of same type and voltage “class” in accordance with NEC requirements unless specified elsewhere. Size all conduits and cable trays to meet the required fill ratios and install all conductors in accordance with NEC requirements and manufacturers recommendations.
  - a. All communications cabling located above accessible suspended ceilings shall be installed in conduit.
  - b. Cabling installed above hard ceiling spaces shall be installed in dedicated conduits.
  - c. No exposed cabling will be acceptable in finished or occupied spaces of the facility without approval by the Owner.
  - d. Any communications system cabling installed exterior to the building and/or all cabling being routed from the facility to any remote location external to the project location shall utilize OSP rated fiber optic cable installed in conduit system.
2. Do not install bruised, kinked, scored, deformed, abraded, or otherwise damaged cable. Do not splice cable between indicated terminations, taps, or junction points. Remove and discard cable where damaged during installation and replace it with new cable.
3. Ensure that all communications cabling supports (conduits, support grips, cable trays, and cable termination panels) are fully installed before proceeding with cable installation.
4. At no time shall any cables be installed and left unsupported, nor shall cables be tie wrapped to any other supporting structure in lieu of specified cable supports. Do not tie wrap or permanently affix cable bundles to approved cable supports. NOTE: Cable bundles shall not be cinched too tightly; all cable ties shall be hook-and-loop (“Velcro”) tie-wraps only. Nylon tie-wraps shall not be acceptable on any copper or fiber communications cabling.
5. The Contractor shall not permit any communications cabling to lie unprotected on the floor at any time. If cables must be left on any floor, protect the cables so that they may not be walked on or have any material or equipment placed or rolled on top. Replace all damaged cables from demarcation to termination point; no splicing of damaged cables shall be permitted.
6. Maintain manufacturers recommended minimum bend radiuses of all cabling. Do not stretch, stress, tightly coil, bend, or crimp cables. The Contractor shall keep all cabling out of the way of other trades during staging of any work. The contractor at the contractor’s expense will replace all severely stressed or damaged cables, equipment, and materials as determined by the Owner.

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7. No media, fiber or copper, shall be installed in lengths surpassing Standards based length requirements.
8. Wire and cable routing shown on the Contract Drawings is approximate unless dimensioned. Route wire and cable as required to meet Project conditions.
9. Where wire and cable routing are not shown, and destination only is indicated, determine exact routing and lengths required. Record actual routing on as built for all conduits 2 inches or larger.

C. Unshielded Twisted Pair (UTP) and Shielded Twisted Pair (STP) Cable

1. In addition to all requirements as stipulated by related specification sections the following shall also apply to all UTP and STP cabling;
2. All TCP/IP-based copper network cabling shall be Category 6a rated as noted by all related specification sections.
3. All cabling shall be installed dedicated conduits as herein specified unless stipulated by any related specification section. All communications raceways shall not contain any AC carrying conductors or non-associated communications network cables.
  - a. Refer to related specification sections for additional requirements related to Category 6a cabling types, and testing requirements.
4. All horizontal data drops shall be terminated on Category- 6a patch panels installed on the 19 inch equipment racks\cabinets.
5. All data drops and backbone cabling installed above inaccessible ceiling spaces or areas containing no ceiling shall be installed in dedicated conduits. In no case shall cable be supported on ceiling tiles, T-bars, or tie-wrapped to any conduit or pipes.
6. Category-6 cables shall not be cinched too tightly; all cable bundles at patch panel locations and in the field, shall be VELCRO type tie-wraps only. Plastic wire ties shall not be accepted on any Category- 6a cabling.
7. Each network drop shall be a dedicated Category- 6a cable and shall not exceed a maximum distance of 295 feet from the associated communications room termination panel to the furthest termination point for that network drop.
8. Communications drops installed inside walls shall be installed in dedicated conduit terminating in a junction box at the jack location.
9. Cable and wiring shall not lay loose on ceiling tiles or grids. Cable must be supported in all areas. Bridle rings or tie-wrapped supporting methods are not



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acceptable. Independent dedicated support must be used between conduit stub-ups and cable trays.

10. Install all cabling parallel and perpendicular to building lines and follow building structure. Use cable support equipment/hardware recommended by the manufacturer and/or as herein specified.
11. Provide all terminations, cross-connects, wire management, surge protectors, etc. for a complete and operational system.
12. Any data communications system cabling installed exterior to the building and/or being routed from the facility to any remote location external to the project location shall be outside rated (OSP) category- 6a cable.
13. Ensure that all communications systems cabling supports (conduits, support grips, cable trays, and termination patch panels) are fully installed before proceeding with cable installation.

D. Fiber Optic Cabling

1. In addition to all requirements as stipulated by related specification sections the following shall also apply to all fiber optic cabling.
2. All fiber optic cabling shall be provided to meet the requirements for all network communications systems, at the minimum all fiber optic cabling shall be in accordance with the following;
  - a. All single mode fiber optic cabling shall be a minimum of 8.3/125 $\mu$ m OS2 type cabling.
  - b. All multi-mode fiber optic cabling shall be a minimum of 50/125 $\mu$ m OM4 type cabling.
  - c. Other fiber types for specific uses where explicitly defined in the contract documents.
3. All fiber optic cabling shall be a continuous segment from demarcation to termination point. In addition, the installation of fiber optic cabling shall conform to the following minimum criteria;
  - a. All fiber cabling shall be installed dedicated conduits as herein specified unless stipulated by any related specification section. All fiber raceways shall not contain any AC carrying conductors or non-associated communications network cables.
  - b. Installation of all fiber optic cabling shall be in accordance with all guidelines established by the product manufacturer and all referenced industry standards.

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- c. Special care shall be taken to avoid damage to the cable. While under pulling tension, the cable shall not be bent into a curve with a radius of less than twenty (20) times the cable diameter, or no less than manufacturers minimum.
  - d. Pulling tension shall not exceed manufacturer's recommended maximum tensile load. Contractor shall utilize a winch with tension control or a "break- away" link designed to break away at or below the recommended maximum pulling tension.
  - e. Use methods and lubricating compounds on cables and wires to prevent damage to material and products during roughing-in. Provide compounds that are not injurious to the cable and wire jackets that do not harden or become adhesive.
4. All exterior fiber optic cabling shall be rated for exterior outside plant (OSP) applications and installed in dedicated inner-duct conduit system and routed in the exterior conduit ducts in accordance with the requirements of the contract documents. Outside plant cable shall not extend more than fifty (50) feet into a building interior before terminating and transitioning to standard indoor fiber optic cable.
  5. Fiber optic cabling shall be provided as the primary media for any exterior network components installed remote to building, as well as all network communications links for all backbone communications.
    - a. The contractor shall be responsible for the determination of exterior segment lengths. Actual quantities will be calculated based on connectivity requirements between demarcation and termination points when indicated on the Contract Drawings and/or in the field based on existing conditions and connectivity requirements.
  6. All splices shall be fusion type. Mechanical splices shall not be acceptable.
  7. Refer to related specification sections for additional requirements related to fiber optic cabling types, sizes and testing requirements.

E. Conduits/Raceway/Cable Trays

1. In addition to the requirements of specification Section 27 05 28 the following shall also apply in the furnishing and installation of all conduit and raceway systems for communications network infrastructures. Refer to all related Division 27 specification sections for additional conduit and raceway information.
  - a. Accessible suspended ceilings: Provide conduit stub-up from each outlet location to space above ceiling. All conduit stub-up shall include nylon bushing at exposed edge of conduit for protection of all cabling
  - b. Exposed structure: Provide conduit run from each drop to a height of 12 feet to cable tray where provided.

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- c. Vertical Wire runway shall be installed in dedicated conduits and shall be supported any /all risers between floors in closets or accessible locations; in no case shall any cable risers be unsupported.
    - d. Cables entering all communications equipment rooms shall be supported with Cable tray from entrance to rack/cabinet location in accordance with the Contract Documents and/or as herein specified.
  2. All conduits/raceways shall be concealed and shall be installed above accessible finished ceilings and/or in walls. Any conduits/raceways installed in areas requiring installation to be exposed, shall be installed as tight as possible to ceilings and at right angles to walls/building lines and shall not obstruct any access hatches, equipment service panels, lighting or other equipment and/or devices. No exposed conduits/raceways shall be installed without prior approval of the Owner.
  3. Where conduits cannot be concealed above ceilings or in walls and must be installed in finished or occupied areas of the building, all conduits shall be finished wire-mold type raceways or approved equal. Finished wire-mold type raceways shall not be installed without prior approval in writing by the Owner.
  4. Where any equipment and/or junction boxes are installed above non-accessible finished ceilings, the contractor shall provide access hatches listed for the intended application. Access hatches shall be located so that service access to the equipment and/or junction boxes is unimpeded.
    - a. Access hatches shall not obstruct any equipment, service panels, lighting equipment, devices, or any architectural elements of the ceiling. At the time of submittals, the contractor shall submit all proposed access hatch locations for review by the Design Professional.
  5. All conduits/raceways shall be supported in accordance with NEC requirements and shall be affixed in such a manner that tampering and/or removal without the use of specialized tools shall be prevented.
  6. All conduits/raceways shall be installed in a manner that prevents tampering or removal when installed in areas exposed to the general population.
    - a. Provide tamper-resistant installation utilizing “torx with peg” security-fastening devices for all conduits/raceways, equipment, devices and appurtenances in all areas accessible to the general population and/or areas subjected to tampering or vandalism.
  7. Interior raceways shall be a minimum 1 inch unless otherwise noted. Exterior raceways shall be a minimum 1 1/4-inch. Size all raceways and install conductors in accordance with NEC requirements. Fill ratio shall not exceed 40 percent for indoor raceways or exterior raceways.

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- a. EMT conduit with compression fittings and/or MC cabling may be utilized in all inaccessible ceiling areas unless otherwise restricted by code.
  - b. Threaded Rigid metal conduit shall be used on all exterior applications, stub-ups and all interior areas where concealed conduit requirements cannot be met and are exposed to tampering or damage by the general population.
  - c. All areas considered being of high risk due to the nature of the occupancy or the need to protect and maintain the integrity of the cabling shall be installed in rigid threaded conduits.
8. Conduit expansion couplings shall be furnished and installed in all areas where expansion/contraction of structure may occur in order to couple two sections of a conduit runs to support longitudinal movement. The contractor shall refer to architectural drawings for exact locations of all building expansion joints.
- a. Conduit expansion couplings shall be consistent with the size the conduit being installed, shall be steel electrogalvanized, and shall meet all environmental and seismic conditions.
  - b. Expansion couplings shall be weatherproof and approved for use indoors or outdoors without an external bonding jumper.
  - c. Expansion couplings shall be UL Listed and approved for use in wet locations.
  - d. Expansion couplings shall comply with UL 514B, CSA 22.2 No. 18 3-12, NEMA FB1.

F. Penetrations of Walls and Floors:

1. All wall/floor penetrations are to be sleeved and fire stopped with approved fire stopping material or sealant as applicable for the type of penetration. Coordinate all cable and conduit penetrations of building with all affected trades. Refer to all related specification sections for additional wall/floor penetration requirements.
2. All penetrations of rated walls and floors shall be fire stopped in accordance with the ASTM and UL standards. Refer to specification Section 078100 and all related Division 07 specification sections for additional requirements related to fire stopping.
3. Floor and rated wall penetrations shall be sleeved with a maximum sleeve diameter of 4 inches. An additional penetration shall be provided for future use, sleeved, and capped and fire stopped as required.
  - a. Coordinate size of floor and wall penetration sleeves with conduit size, number of conductors. Comply with all NEC requirements.

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4. The fire rating of all penetrated walls, floors, and ceiling structures shall be strictly maintained. All penetrations shall be fire-stopped and sealed by the Contractor.
5. Install fire-stopping in open penetrations and in the annular space of penetrations for fire rated barriers.
6. Installation of firestops shall be performed by an applicator/installer qualified and trained by the manufacturer. Installation shall be performed in strict accordance with manufacturer's detailed installation procedures.
7. Installation of all fire-stopping shall be in accordance with fire test reports, fire resistance requirements, acceptable sample installations, manufacturer's recommendations, local fire and building authorities, and applicable codes and shall be installed in a manner acceptable to the authority having jurisdiction.

### 3.4 WARRANTY

- A. The warranty period shall commence from the date the Contractor received written notification of final acceptance from the Owner and/or OAR. At the minimum, the contractor shall provide the following warranty provisions:
  1. Warrant the replacement of defective components/materials and/or correct defective work when given notice by the Owner during the warranty period.
  2. At no time is the contractor to use the extra materials provided under the scope of this project to replace malfunctioning or damaged equipment and or components. The Contractor shall replace all malfunctioning or damaged equipment and or components with new.
    - a. The repair and then reinstallation of malfunctioning or damaged equipment shall not be acceptable.
- B. During the Warranty period, replace failed equipment per the terms specified in this section. The Owner shall not be bound to the terms and conditions of the manufacturer's warranty, pertaining to the replacement of failed equipment.
- C. In any situation, it is the Vendor's responsibility to keep the system operational during any hardware or software failures. Replacement equipment shall be provided to maintain operations while equipment manufacturer addresses warranty issues.
  1. Warranty replacements and repairs shall include any necessary shipping, handling, and materials.
- D. Establish a single point of contact for the Owner and provide any coordination responsibilities with manufacturers, suppliers, or contractors to resolve warranted issues and on all maintenance and service actions related to items included in the

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Warranty. Process and procedures for engaging technical support shall be developed and communicated to the Owner.

1. Warranty excludes liability for consequential incidental, or special damages due to vandalism, misuse, or acts of God.
  2. Onsite warranty response time by qualified technician shall be no more than 8 hours upon receipt of request from Owner, unless otherwise noted in related Division 27 specification sections.
  3. Warranty repairs shall be provided to the Owner at no cost. This shall include but not limited to replacement of all defective components/materials, all labor charges, all travel costs and all vehicle charges.
  4. Response time shall be 7 days a week / 24 hour a day / 365 day a Year.
  5. Provide test, inspection, and service of each system on a semi-annual basis at six-month intervals.
  6. Contractor must provide verification that they maintain their principle base of operation along with the personnel that will be responsible for providing service within 3 hours driving time to the project site. This tenet shall remain in effect for the life of the warranty.
  7. All TCP/IP-based communication systems cabling, and related appurtenances shall be provided with the manufacturer's 25-year extended warranty in addition to all requirements above.
- E. The Contractor shall, as a condition of final payment, execute a written warranty certifying all contract requirements have been completed in accordance with all requirements of the Contract Documents.
1. All system testing, commissioning, demonstration and training shall be performed prior to final system acceptance. All defects or damages due to faulty materials or workmanship shall be replaced without delay, to the satisfaction of the Owner's Representative, at the Contractor's expense.
  2. The contractor shall provide written documentation of test results and stating what was done to correct any deficiencies. The first inspection shall occur 90 calendar days after the acceptance date. The last inspection shall occur 30 calendar days prior to the end of the warranty.
  3. The warranty period shall be extended until the last inspection and associated corrective actions are complete. Where any equipment and/or labor covered by Contractor's or manufacturer's warranty, has been replaced, due to failure, the warranty period for any replaced equipment or restored work shall be reinstated for a period equal to the original warranty period, and commencing with the date of completion of the replacement or restoration work.

4. In the event any manufacturer customarily provides a warranty period greater than one (1) year, the Contractor's warranty shall be for the same duration for that component.

### 3.5 PROJECT CLOSEOUT REQUIREMENTS

- A. The Contractor shall comply with all requirements of this section.
- B. Final System Acceptance
  1. The Contractor shall prepare and issue a Certificate of Project Completion, containing:
    - a. The date of project completion.
    - b. A list of items that have been corrected by the Contractor.
    - c. The time and date the Owner will assume possession of the system (transfer of ownership).
    - d. The date that warranty begins.
  2. The Owner will perform an inspection after receipt of written certification. The project completion inspection shall include, but not be limited to:
    - a. The project's contracted work and any additional change orders.
    - b. All equipment and systems tested and shown operational in the presence of the Owner.
  3. After the inspection, the Owner will prepare and submit to the Contractor, a list of items to be completed or corrected, as determined by the inspection, along with the designated timeframe for completion.
  4. Should the Owner or OAR consider the work not to be complete, the Owner or OAR will immediately notify the Contractor, in writing, stating the reasons. The Contractor shall complete the work, and then send a second written notice to the Owner certifying that the Project is complete. The Owner will then re-inspect the work upon Contractor's request at a scheduled re-inspection time.
    - a. At any time, the Owner shall have the right to Contract with a third party in order to complete and/or inspect any work of which Contractor failed to conform with the Contract requirements. All cost for this third party shall be borne by the original Contractor responsible for delivering the project.

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C. Inspections

1. At the completion of the project and prior to final acceptance of the Work, provide evidence of final inspections and approvals to The Owner, in accordance with all requirements of the Contract Documents as well as required by the authorities having jurisdiction.
2. Owner approval is required prior to final system acceptance and payment.

**END OF SECTION 27 05 00**



## **SECTION 271513 COMMUNICATIONS COPPER HORIZONTAL CABLING**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The following specification sections are related to this work.
  - 1. 270500 - Common Work Elements for Communication Systems
  - 2. 275400 - Wireless Local Network

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Category 6a twisted pair cable.
  - 2. Twisted pair cable hardware, including plugs and jacks.
  - 3. Cabling identification products.
  - 4. Source quality control requirements for twisted pair cable.

#### **1.3 DEFINITIONS**

- A. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- B. EMI: Electromagnetic interference.
- C. FTP: Shielded twisted pair.
- D. F/FTP: Overall foil screened cable with foil screened twisted pair.
- E. F/UTP: Overall foil screened cable with unscreened twisted pair.
- F. IDC: Insulation displacement connector.
- G. LAN: Local area network.
- H. Jack: Also commonly called an "outlet," it is the fixed, female connector.

- I. Plug: Also commonly called a "connector," it is the removable, male telecommunications connector.
- J. RCDD: Registered Communications Distribution Designer.
- K. Screen: A metallic layer, either a foil or braid, placed around a pair or group of conductors.
- L. Shield: A metallic layer, either a foil or braid, placed around a pair or group of conductors.
- M. S/FTP: Overall braid screened cable with foil screened twisted pair.
- N. S/UTP: Overall braid screened cable with unscreened twisted pairs.
- O. UTP: Unscreened (unshielded) twisted pair.

#### 1.4 COPPER HORIZONTAL CABLING DESCRIPTION

- A. Horizontal cable cabling system shall provide interconnections between patch panels, switches and the equipment outlet. Cabling system consists of horizontal cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for horizontal-to-horizontal cross-connection.
  - 1. TIA-568-C.1 requires that a minimum of two equipment outlets 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 equipment outlet.
  - 3. Bridged taps and splices shall not be installed in the horizontal cabling.
- B. A work area is approximately 100 sq. ft. (9.3 sq. m), and includes the components that extend from the equipment outlets to the station equipment.
- C. The maximum allowable horizontal cable length is 295 feet (90 m). This maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) to the workstation equipment or in the horizontal cross-connect.

#### 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 and installation details of telecommunications equipment, to show location and layout of telecommunications equipment, including the following:
    - a. Telecommunications rooms plans and elevations.
    - b. Telecommunications pathways.
    - c. Telecommunications system access points.
    - d. Telecommunications grounding system.
    - e. Telecommunications conductor drop locations.
    - f. Typical telecommunications details.
- C. Twisted pair cable testing plan.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For installation supervisor, and field inspector.
- B. Product Certificates: For each type of product.
- C. Source quality-control reports.
- D. Field quality-control reports.

#### 1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For splices and connectors to include in maintenance manuals.
- B. Software and Firmware Operational Documentation:
  1. Software operating and upgrade manuals.
  2. Program Software Backup: On USB media or compact disk, complete with data files.
  3. Device address list.
  4. Printout of software application and graphic screens.

## 1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Installer qualifications must be submitted for approval. Installer must have equivalent experience to 5 similar projects of scope and size.
  - 1. Installation Supervision: Installation shall be under the direct supervision of Technician, who shall be present at all times when Work of this Section is performed at Project site.
  - 2. Testing Supervisor: Testing shall be observed by the owner or their designee, without exception.

## 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
  - 1. Test each pair of twisted pair cable for open and short circuits.

## 1.10 PROJECT CONDITIONS

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

## 1.11 COORDINATION

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

## 1.12 WARRANTY

- A. The entire structured cabling systems must come with a minimum 25 year MISSION CRITICAL CHANNEL warranty including all cables, jacks & patch cords.

## **PART 2 - PRODUCTS**

### 2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.
- B. Telecommunications Pathways and Spaces: Comply with TIA-569-D.
- C. Grounding: Comply with TIA-607-C.

## 2.2 GENERAL CABLE CHARACTERISTICS

- A. 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.
- 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-Spread Index: 25 or less.
  - 2. Smoke-Developed Index: 50 or less.
- C. RoHS compliant.
- D. Basis of Design By (or approved equal):
  - 1. Hubble Premise Wiring – NextSeed
  - 2. CommScope – Systimax
  - 3. Panduit – Advanced Matrix Technology

## 2.3 CATEGORY 6a TWISTED PAIR CABLE

- A. Description: Four-pair, balanced-twisted pair cable, with internal spline, certified to meet transmission characteristics of Category 6a cable at frequencies up to 500MHz.
- B. Standard: Comply with TIA-568-C.2 for Category 6a cables.
- C. Conductors: 100-ohm, 23 AWG solid copper.
- D. Low OD .265"
- E. Shielding/Screening: Shielded twisted pairs (STP).
- F. Cable Rating: Plenum.
- G. Jacket: Gray thermoplastic.

## 2.4 TWISTED PAIR CABLE HARDWARE

- A. Description: Hardware designed to connect, splice, and terminate twisted pair copper communications cable.
- B. General Requirements for Twisted Pair Cable Hardware
  - 1. Comply with the performance requirements of Category 6a.

2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
  3. Cables shall be terminated with connecting hardware of same category or higher.
- C. Source Limitations: Obtain twisted pair cable hardware from single source from single manufacturer.
- D. Connecting Blocks:
1. 110-style IDC for Category 6a.
  2. Provide blocks for the number of cables terminated on the block, plus 30 percent spare, integral with connector bodies, including plugs and jacks where indicated.
- E. 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.
- F. Patch Panel: Modular panels housing numbered jack units with IDC-type connectors at each jack location for permanent termination of pair groups of installed cables.
1. Features:
    - a. Universal T568A and T568B wiring labels.
    - b. Labeling areas adjacent to conductors.
    - c. Replaceable connectors.
    - d. 24 or 48 ports.
    - e. Construction: 16-gauge steel and mountable on 19-inch (483 mm) equipment racks.
  2. Number of Jacks per Field: One for each four-pair cable indicated.
- G. Patch Cords: Factory-made, four-pair cables in 36-inch (900-mm) or shorter lengths; terminated with an eight-position modular plug at each end retain one of two subparagraphs below. Retain first for Category 6 or Category 6a; retain second for Category 5e patch cords.
1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure performance. Patch cords shall have latch guards to protect against snagging.
  2. Patch cords shall have color-coded boots for circuit identification.
  3. Patch cord colors:

- a. Each system shall utilize a unique patch cable color, it... WAP shall use ORANGE patch cords. The contractor shall select and submit a patch cord color scheme.

H. Plugs and Plug Assemblies:

1. Male; eight position; color-coded modular telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
2. Standard: Comply with TIA-568-C.2.
3. Marked to indicate transmission performance.
4. Basis of design; Hubbell Premise SP6A, SP6A90 or pre-approved equal.

I. Jacks and Jack Assemblies:

1. Female; eight position; modular; fixed telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
2. Designed to snap-in to a patch panel or faceplate.
3. Standard: Comply with TIA-568-C.2.
4. Marked to indicate transmission performance.
5. Basis of Design; Hubbell Premise HJU6Axx or pre-approve equal.

J. Faceplate:

1. Up to two port, vertical single gang faceplates designed to mount to single gang wall boxes.
2. Basis of Design; Hubbell Premise IFP series or pre-approved equal.

K. Legend:

1. Machine printed, in the field, using adhesive-tape label.
2. Snap-in, clear-label covers and machine-printed paper inserts.

## 2.5 IDENTIFICATION PRODUCTS

- A. Comply with TIA-606-C and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- B. Comply with TIA-607-C.

## 2.6 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory test cables on reels according to TIA-568-C.1.
- C. Factory test twisted pair cables according to TIA-568-C.2.
- D. Cable will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

## PART 3 - EXECUTION

### 3.1 WIRING METHODS

- A. Wiring Method: Install cables in raceways and cable trays, except within consoles, cabinets, desks, and counters. Conceal raceway and cables, except in unfinished spaces.
  - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
  - 2. Comply with requirements for raceways and boxes specified in Section 270528 "Pathways for Communications Systems."
- B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools. Install conductors parallel with or at right angles to sides and back of enclosure.

### 3.2 INSTALLATION OF TWISTED-PAIR HORIZONTAL CABLES

- A. Comply with NECA 1 and NECA/BICSI 568.
- B. General Requirements for Cabling:
  - 1. Comply with TIA-568-C.0, TIA-568-C.1, and TIA-568-C.2.
  - 2. Comply with BICSI's "Information Transport Systems Installation Methods Manual (ITSIMM), Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section.
  - 3. Install 110-style IDC termination hardware unless otherwise indicated.
  - 4. Do not untwist twisted pair cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.



5. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
  6. MUTOA shall not be used as a cross-connect point.
  7. Consolidation points may be used only for making a direct connection to equipment outlets:
    - 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 twisted-pair cables at least 49 feet (15 m) from communications equipment room.
  8. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
  9. Install lacing bars to restrain cables, prevent straining connections, and prevent bending cables to smaller radii than minimums recommended by manufacturer.
  10. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI Information Transport Systems Installation Methods Manual , Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section. Use lacing bars and distribution spools.
  11. 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.
  12. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
  13. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
  14. Pulling Cable: Comply with BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Pulling and Installing Cable" Section. Monitor cable pull tensions.
- C. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
  2. Suspend twisted pair cabling, not in a wireway or pathway, a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1524 mm) apart.

3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- D. Group connecting hardware for cables into separate logical fields.
- E. Separation from EMI Sources:
1. Comply with recommendations from BICSI's "Telecommunications Distribution Methods Manual" and TIA-569-D for separating unshielded copper communication cable from potential EMI sources, including electrical power lines and equipment.
  2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
    - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
    - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
    - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (600 mm).
  3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
    - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
    - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
    - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
  4. Separation between communications cables in grounded metallic raceways, power lines, and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
    - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
    - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
    - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
  5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).

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

### 3.3 FIRESTOPPING

- A. Comply with requirements in Section "Firestopping."
- B. Comply with TIA-569-D, Annex A, "Firestopping."
- C. Comply with "Firestopping Systems" Article in BICSI's "Telecommunications Distribution Methods Manual."

### 3.4 GROUNDING

- A. Install grounding according to the "Grounding, Bonding, and Electrical Protection" chapter in BICSI's "Telecommunications Distribution Methods Manual."
- B. Comply with TIA-607-C and NECA/BICSI-607.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall, allowing at least a 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar to suitable electrical building ground, using a minimum No. 4 AWG grounding electrode conductor.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than a No. 6 AWG equipment grounding conductor.

### 3.5 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA-606-C. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."
  1. Administration Class: Class 1.
  2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.
- B. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- C. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

D. Cable and Wire Identification:

1. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at the device if wire color is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m).
4. Label each terminal strip, and screw terminal in each cabinet, rack, or panel.
  - a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group, extended from a panel or cabinet to a building-mounted device, with the name and number of a particular device.
  - 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.

E. Labels shall be preprinted or computer-printed type, with a printing area and font color that contrast with cable jacket color but still comply with TIA-606-C requirements for the following:

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

### 3.6 FIELD QUALITY CONTROL

- A. Testing must be completed by a qualified, capable individual or individuals. All testing certifications shall be submitted for review. All persons intended to perform testing must have prior approved qualifications.
- B. Perform tests and inspections.
- C. Tests and Inspections:
  1. Visually inspect jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments and inspect cabling connections for compliance with TIA-568-C.1.
  2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

3. Test twisted pair cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
  - a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
4. Permanent link testing shall be completed on all horizontal (station) cables. The contractor will be responsible to supply a channel warranty, owner requires that the contractor supply all manufacturer patch cords.
5. Category 6A cabling systems shall be tested as an installed horizontal permanent link configuration. Jacks and faceplates shall be assembled complete and properly mounted into outlet boxes. Panels shall be terminated complete and fully dressed with proper cable management
6. All test will be performed to 500 MHz for CAT 6A.
7. Field testing shall include the following parameters for each pair of each cable installed:
  - a. Name of the person performing the test.
  - b. Test equipment manufacturer and model number.
  - c. Cable i.d. The test sheets will be in numerical order by cable id.
  - d. Date of test.
  - e. Wire map (pin to pin connectivity and polarity check)
  - f. Length (in feet)
  - g. Insertion loss.
  - h. Near end crosstalk (next).
  - i. Power sum near end crosstalk (psnext).
  - j. Equal-level far end crosstalk (elfext).
  - k. Power sum equal-level far end crosstalk (pselfext).
  - l. Return loss.
  - m. Delay skew.
  - n. Attenuation to crosstalk ratio (acr).

- o. A “pass” indication shall be obtained for each link, using at minimum
  - p. In addition, CAT6A cable must include the Alien Foreign Cross Talk test and be compliant with ANSI/TIA-1152A
- D. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similarly to Table 10.1 in BICSI's "Telecommunications Distribution Methods Manual," or shall be transferred from the instrument to the computer, saved as text files, printed, and submitted.
- E. Remove and replace cabling where test results indicate that they do not comply with specified requirements.
- F. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.
- H. Comply with commissioning plan.

**END OF SECTION 271513**

## **SECTION 275400 – WIRELESS LOCAL AREA NETWORK**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings, Standard Contract Requirements, Special and General Provisions and all Specification Sections, apply to this Section.
- B. Contractor shall review in detail all project drawings and specifications, construction material and methods, and other issues requiring coordination.

#### **1.2 SUMMARY**

- A. In addition to all requirements stipulated in Specification 27 05 00 this section contains the overall requirements and design intent associated with all Division 27 infrastructures as it relates to the installation of communications cabling, equipment, and systems.
- B. The intent of this specification is to establish a standard of quality, functionality, and features for the installation of a Wireless Local Area Network System (WLAN) throughout the project works. The WLAN shall provide wireless network connectivity to PCCA and extend coverage in the lobby area and exhibit halls.
- C. The Contract Drawings reflect the design intent and device quantities based on an RF Coverage Model.

#### **1.3 DESCRIPTION OF WORK**

- A. Refer to related Division 27 specification sections and related drawings for all Division 27 project scopes of work including but not limited to all cabling infrastructures, network equipment, software, and connected systems.
- B. At the minimum, the scopes of work covered as herein specified shall include but are not limited to all necessary labor, equipment, material, cabling, conduits, commissioning, and testing as well as all appurtenances as required for the proper installation necessary to deliver fully functional wireless local area network system.
- C. Additional requirements of all related specification sections shall also apply. It shall be the Contractor's responsibility for full compliance with all requirements of 27 05 00 as well as all related specification sections as required to deliver complete and fully functional solution in accordance with the requirements of all Contract Documents.
- D. Standard products: Equipment and materials shall be standard products of a manufacturer regularly engaged in the manufacture of wireless network devices

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and supporting hardware products and shall be the manufacturer's latest standard design in satisfactory use for at least one year prior to bid opening.

- E. Items of the same classification shall be identical. This requirement includes equipment, modules, assemblies, parts, and components.
- F. The overall WLAN system Scope of Work shall include:
  - 1. Field Devices: The Contractor will furnish and install Wireless Access Points (WAPs), antennas. The Contractor shall furnish and install housings, and mounting brackets. Contractor shall furnish CAT6A patch cords and coordinate unique device identifiers with the Owner and label WAPs accordingly.
  - 2. Headend and Software: The current PCCA WLAN system will require an upgrade and replacement of existing infrastructure. The Contractor shall coordinate any programming and setup with the Owner. The Contractor shall furnish and install all connections to access layer switches. The Contractor shall coordinate communications room (MDF / IDF) space requirements and availability.
  - 3. Interfaces: The Contractor shall install and configure all Wi-Fi vendor furnished hardware, software, programming, interface devices and appurtenances as required for communication between the WLAN and other related systems which require WLAN connectivity.
  - 4. The Contractor shall be responsible for integration of the WLAN with the existing Owner network(s) and connected tele/data systems. Any configuration shall be performed in coordination with, and after approval by the Owner.
  - 5. The WLAN shall utilize the Project Structured Cabling Network and Data Communications Network installations. This connectivity shall form part of the Structured Cabling Network and Data Communications Network as applicable.
- G. The Contractor shall be responsible for providing all cabling, cable terminations, conduits/raceways, racks, cabinets, commissioning, and testing of all network communications cabling and equipment in accordance with all related Division 27 Specification Sections.
  - 1. The Contractor shall have a registered RCDD professional review and seal all system shop drawings demonstrating industry standard design, installations and certifications of all structured cabling networks related to the installation and operation of the Wireless Local Area Network System.
  - 2. Refer to Specification Sections 271513 PCCA- Communications Copper Horizontal Cabling for all TCP/IP based system cabling requirements.

1.4 REFERENCES

- A. Refer to Specification Section 27 05 00 for requirements.



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1.5 SYSTEMS DESCRIPTIONS

- A. Refer to Specification Section 27 05 00 for requirements.

1.6 SUBMITTALS

- A. Refer to Specification Section 27 05 00 for requirements in addition to the following.

1. The Contract Drawings detail typical mounting conditions do not necessarily reflect all possible mounting configurations. The Contractor shall submit all WAP mounting details as part of Shop Drawings.

1.7 QUALITY ASSURANCE

- A. Refer to Specification Section 27 05 00 for requirements.

1.8 DELIVERY STORAGE AND HANDLING

- A. A. Refer to Specification Section 27 05 00 for requirements.

1.9 RECORD DOCUMENTS

- A. A. Refer to Specification Section 27 05 00 for requirements.

1.10 OPERATIONS AND MAINTENANCE

- A. A. Refer to Specification Section 27 05 00 for requirements.

1.11 SOFTWARE AGREEMENT

- A. A. Refer to Specification Section 27 05 00 for requirements.

1.12 SPARE MATERIAL

- A. A. Refer to Specification Section 27 05 00 for requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURED PRODUCTS

- A. In addition to all requirements as stipulated by Specification Section 27 05 00 as well as all related specifications sections, the following shall also apply:

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1. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, that meet and/or exceed the specified performance and features of the equipment and/or systems and for which replacement parts shall be readily available to the contractor and/or Owner.

a. The equipment specified is based on the acceptable manufacturers listed. Where "or equal" is stated, equipment shall be equivalent in every way to that of the equipment specified, and subject to approval.

2. When more than one unit, device, or component of the same class of equipment is required, such units, devices, or components shall be the product of a single manufacturer.

3. Acceptable manufacturers for each system shall be as specified and shall be provided in full compliance with the requirements of this and all related specification sections and contract drawings.

4. Manufacturers listed as acceptable shall not negate the contractors' responsibility for providing all equipment, devices, components, and/or systems, in accordance with all functions and performance requirements of the Contract Documents.

5. Where manufacturer and/or manufacturer model numbers reference specific system components in the related specification sections, it is to establish the performance requirements and quality of the systems and components only. It is in no way an inference that the referenced model numbers are the manufacturer's current product and are the only manufacturer's acceptable components for this project unless specifically referenced as "no substitutions."

## 2.2 PERFORMANCE REQUIREMENTS

A. The following paragraphs define the performance requirements for this Section in addition to those described in Section 27 05 00.

B. 802.11ax Wi-Fi 6 capabilities

C. Minimum WLAN Performance Criteria:

1. WLAN Architecture: Lightweight Access Points with Wireless Controllers.

2. WLAN Minimum Guaranteed Rx Signal: -65 dBm RSL over minimum 90% of the coverage area.

3. WLAN Data Rate: Minimum 25 Mbps over 90% of the coverage zone

4. WLAN Signal to Noise Ratio: Minimum 25 dB over 90% of the zone

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5. Co-Channel Interference: max 4 per channel over 90% of the wireless coverage zone
6. Wireless Access Point Output Power: 17 dB at 2.4GHz
7. Wireless Access Point Output Power: 20 dB at 5GHz
  - a.
8. WLAN Radio Management: Power output automatically adjustable.
9. WLAN Interfaces: LAN: minimum 1 x 1000BASE-T Ethernet (RJ-45), auto-sensing; Power: 802.3af or 802.3at power-over-Ethernet+ (PoE+) and Universal Power Over Ethernet (UPOE).
10. WLAN Minimum Service Set Identifier (SSID): 25. However, ultimately the Minimum SSID must be confirmed with Owner.
11. WLAN Security and Authentication: 802.11x with RADIUS Servers.
12. WLAN Roaming: Uptime - Seamless transfer without re-authentication within the 90% of the coverage area. A minimum of 99.9% uptime would be recommended
13. WLAN Quality of Service: 802.11e
14. WLAN Other Requirements: IPv4/IPv6, 802.1Q VLAN enabled, VPN enabled, Multicast to Unicast Support, 802.1P CoS, and Mac OS support.

## 2.3 SYSTEM REQUIREMENTS

- A. The Contractor shall provide WLAN system configuration shall include, but not be limited to, the following:
  1. All network configuration tasks including, but not limited to, assignment of IP addresses or configuration of DHCP as directed by the Owner.
  2. Setup of system administrative features such as traffic monitoring, security/firewall settings, and other functions as directed by the Owner.
  3. Configuration of public WLAN such that users encounter a seamless experience.
  5. Adjustment of WAP antenna orientation and configurations to achieve the desired signal coverage, throughput, and wayfinding functionality in areas of the Convention Center as specified in the contract documents. The Contractor shall continue to provide adjustments until performance is achieved to the satisfaction of the Owner and at no additional cost to the Owner.

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- B. Contractor shall coordinate with the WiFi vendor to ensure proper, vendor-certified and approved configuration and performance of the WLAN in accordance with the Vendor's published system and device documentation and all requirements of the Contract Documents.

2.4 SOFTWARE REQUIREMENTS

- A. The Owner shall provide all WLAN software requirements.

2.5 HARDWARE REQUIREMENTS

- A. General Wireless Access Point Requirements

1. Cambium WiFi6
2. Wi-Fi 6 Compatible unless noted otherwise.
3. Operating Bands - Dual-band 802.11a/g/n/ac/ax
4. 802.11ax capabilities
  - a. Multi- and single-user MIMO
  - b. Maximal ratio combining (MRC)
  - c. 802.11ax beamforming (transmit beamforming)
  - d. 20-, 40-, 80- and 160-MHz channels
  - e. Packet aggregation: A-MPDU (Tx/Rx) and A-MSDU (Tx/Rx)
  - f. 802.11 dynamic frequency selection (DFS)
  - g. Cyclic-shift-diversity (CSD) support
5. Integrated Bluetooth Low Energy (BLE) radio.
6. Maximum number of non-overlapping channels
  - a. 802.11n 2.4 GHz at 20Mhz: 3
  - b. 802.11ax 5 GHz at 20/40/80 MHz: 27/13/6 respectively

- B. Interfaces

1. Management console port (RJ-45)
2. Multicolor LED

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3. DC power input

4. Reset button

5. Compliance

a. Safety

1) UL60950, 2nd Edition

2) CAN/CSA-C22.2 No. 60950, 2nd Edition

3) IEC 60950, 2nd Edition

4) EN 60950, 2nd Edition

b. Radio approvals:

1) FCC Part 15.107, 15.109, 15.247, 15.407, 14-30

2) FCC Bulletin OET-65C

3) EMI and susceptibility (Class B)

c. IEEE standards:

1) IEEE 802.11a/b/g, 802.11n, 802.11h, 802.11d, 802.11r,  
802.11k, 802.11v, 802.11u, 802.11w

2) IEEE 802.11ac

d. Security:

1) 802.11i, Wi-Fi Protected Access 2 (WPA2), WPA

2) 802.1X

3) Advanced Encryption Standards (AES), Temporal Key Integrity  
Protocol

(TKIP)

4) VPN pass-through

5) IP Security (IPsec)

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6) Layer 2 Tunneling Protocol (L2TP)

7) MAC address filtering

e. Extensible Authentication Protocol (EAP) types:

1) EAP-Transport Layer Security (TLS)

2) EAP-Tunneled TLS (TTLS) or Microsoft Challenge Handshake Authentication Protocol Version 2 (MSCHAPv2)

3) Protected EAP (PEAP) v0 or EAP-MSCHAPv2

4) EAP-Flexible Authentication via Secure Tunneling (FAST)

5) PEAP v1 or EAP-Generic Token Card (GTC)

6) EAP-Subscriber Identity Module (SIM)

f. Multimedia:

1) Wi-Fi Multimedia (WMM)

g. Other:

1) FCC Bulletin OET-65C

2) RSS-102

C. Indoor Wireless Access Points (WAP) - shall comply with general requirements in addition to the following additional requirements or variances:

1. 802.11ax capabilities

a. Internal Antennas Unit: 8 x 8 MU-MIMO with three spatial streams.

b. PHY data rates up to 10 Gbps

2. Maximum Conducted transmit power

a. Internal Omni-directional Antenna

1) 2.4 GHz: 4 dBm

2) 5 GHz: 6 dBm

3. Interfaces

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- a. 2 ethernet ports
  - b. 100/1000/2500/5000 Multigigabit Ethernet (RJ-45) – IEEE 802.3bz
  - c. 100/1000BASE-T autosensing (RJ-45 AUX port)
4. Environmental
- a. Operating temperature: 0 to 40°C (32 to 104°F)
  - b. Operating humidity: 10% to 90% noncondensing
  - c. Storage temperature: –30 to 70°C (–22 to 158°F)
5. Powering Options
- a. 802.3at POE+, Cisco Universal Power over Ethernet (UPOE)
  - b. 802.at power injector
  - c. 50W Power Supply
- D. Power Consumption
- 1. 30W at the PSE (25.5W at the PD) will all features enabled except for the USB 2.0 port
  - 2. 32W at the PSE (31.1W at the PD) will the USB 2.0 port enabled.
- E. Outdoor Wireless Access Points (WAP) - shall comply with general requirements in addition to the following additional requirements:
- 1. Operating Bands - Dual-band 802.11a/g/n/ac
    - a. Wi-Fi 6 compatibility not required for exterior WAPs
  - 2. 802.11ac Wave 2 capabilities
    - a. Internal Antennas Unit: 3 x 3 MIMO with three spatial streams.
    - b. External Antennas Unit: 2 x 2 MIMO with two spatial streams.
    - c. Multi- and single-user MIMO
    - d. Maximal ratio combining (MRC)
    - e. 802.11ac beamforming (transmit beamforming)
    - f. 20-, 40- and 80-MHz channels

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- g. PHY data rates up to 1.3 Gbps (80 MHz in 5 GHz)
- h. Packet aggregation: A-MPDU (Tx/Rx) and A-MSDU (Tx/Rx)
- i. 802.11 dynamic frequency selection (DFS)
- j. Cyclic-shift-diversity (CSD) support

3. Frequency band and 20- MHz operating channels (regulatory domains) (-M)

- a. 2.412 to 2.472 GHz, 13 channels
- b. 5.500 to 5.580 GHz, 5 channels
- c. 5.660 to 5.700 GHz, 3 channels
- d. 5.745 to 5.805 GHz, 4 channels

4. Maximum number of non-overlapping channels

- a. 802.11n 2.4 GHz at 20Mhz: 3
- b. 802.11ac 5 GHz at 20/40/80 MHz: 27/13/6 respectively

5. Maximum Conducted transmit power

a. Internal Omni-directional Antenna

- 1) 2.4 GHz: 29 dBm with 3 antennas
- 2) 5 GHz: 29 dBm with 3 antennas

b. Internal Directional Antenna

- 1) 2.4 GHz: 27 dBm with 2 antennas
- 2) 5 GHz: 27 dBm with 2 antennas

c. External Omni-directional Antenna

- 1) 2.4 GHz: 27 dBm with 2 antennas
- 2) 5 GHz: 27 dBm with 2 antennas

6. Interfaces

- a. WAN port 10/100/1000BASE-T Ethernet, autosensing (RJ-45), PoE in



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b. SFP port (fiber or electrical)

7. Uplink options

a. Ethernet

b. SFP

8. Environmental

a. Operating temperature:

1) –40 to 65°C (–40 to 149°F) ambient air with no solar loading

2) –40 to 55°C (–40 to 131°F) ambient air with solar loading

b. Storage temperature: –40 to 85°C (–40 to 185°F)

c. Wind resistance:

1) Up to 100-mph sustained winds

2) Up to 165-mph wind gusts

9. Environmental Ratings

a. IEC 60529 IP67

b. NEMA Type 4X

c. Icing protection NEMA 250-2008

d. Corrosion NEMA 250-2008 (600 hours)

e. Solar radiation EN 60068-2-5 (1200 W/ m<sup>2</sup>)

f. Vibration MIL-STD-810

10. Powering Options

a. Building Mounted: via Universal Power of Ethernet (UPoE), 802.3at

b. Pole Mounted: via PoE Extender.

11. Power Consumption

a. Internal Antenna-Semi-Omni-directional antenna = 32W

b. External Omni-directional antennas = 25W

12. Compliance

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a. Immunity

- 1)  $\leq 5$  mJ f or 6kV/3kA @ 8/20 ms waveform
- 2) ANSI/IEEE C62.41
- 3) EN61000-4-5 Lev el 4 AC Surge Immunity
- 4) EN61000-4-4 Lev el 4 Electrical Fast Transient Burst Immunity
- 5) EN61000-4-3 Lev el 4 EMC Field Immunity
- 6) EN61000-4-2 Lev el 2 ESD Immunity
- 7) EN60950 Overvoltage Category IV

13. WLAN Controllers

- a. The Owner shall provide new or existing WLAN controllers to support the additional WAPs to be installed as part of the Project Works.

14. WAP Housings

- a. Contractor shall furnish and install housings as specified below.

b. Right-angle Wall Mount Housing

- 1) Wedge-shaped housing capable of mounting WAP on a wall in a horizontal orientation
- 2) Direct mounting over standard data outlet/back box
- 3) 18-Gauge steel, white powder coat
- 4) Locking, hinged cover for access to rear of access point and data outlet
- 5) Support for Cambium WAPs, or approved equal

c. Suspended Tile Ceiling Housing

- 1) 2'x2' lay-in ceiling tile form factor
- 2) Extra deep backbox with single-gang electrical knock-out for electrical box

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mounting above ceiling

3) White ABS plastic dome

4) 25lb load capacity

5) Compatibility with Cambium WAPs or approved equal

d. Outdoor Locations

1) AP's mounted outdoors shall be manufactured with outdoor rated housings.

2) Other housing form factors as required to protect the WAP from the surrounding environment, restrict access to authorized personnel, and to match the surrounding architectural features. Housings shall be as manufactured by Oberon or approved equal.

PART 3 - EXECUTION

3.1 COORDINATION

A. Refer to Specification Section 27 05 00 for requirements.

3.2 EQUIPMENT PROTECTION

A. Refer to Specification Section 27 05 00 for requirements.

3.3 WORK PERFORMANCE

A. Refer to Specification Section 27 05 00 in addition to the following:

1. Refer to related specification sections for additional project coordination requirements. In addition to the requirements defined in this specification section, the Contractor shall coordinate and meet all requirements addressed in Division 27 specifications.

2. The Contractor shall supply all end-user cabling and connectivity components for interconnection of system equipment. This shall consist of, but not be limited to:

a. The installation of CAT6A horizontal cabling.

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b. The installation of Category 6A UTP patch cords for interconnection from outlet to WAPs.

c. The installation of CAT6A Patch panels.

3.4 INSTALLATION REQUIREMENTS

A. Refer to Specification Section 27 05 00 for requirements in addition to the following:

1. The Contractor shall assign a unique device identifier associated with each device's MAC address and manufacturer serial number.

3.5 COMMUNICATIONS CABLING REQUIREMENTS

A. Refer to Specification Section 27 05 00 for requirements.

3.6 ELECTRICAL POWER DISTRIBUTION

A. Refer to Specification Section 27 05 00 for requirements

3.7 TRANSIENT VOLTAGE SUPPRESSION

A. Refer to Specification Section 27 05 00 for requirements.

3.8 GROUNDING AND BONDING

A. Refer to Specification Section 27 05 00 for requirements.

3.9 EQUIPMENT IDENTIFICATION

A. Refer to Specification Section 27 05 00 for requirements.

3.10 MAINTENANCE & SERVICE

A. Refer to Specification Section 27 05 00 for requirements.

3.11 WARRANTY

A. Refer to Specification Section 27 05 00 for requirements.

3.12 FIELD SERVICES

A. Refer to Specification Section 27 05 00 for requirements.

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3.13 TRAINING

- A. All training shall be provided by the Owner and Wi-Fi Vendor.

3.14 PROJECT CLOSEOUT REQUIREMENTS

- A. Refer to Specification Section 27 05 00 for requirements.

END OF SECTION 27 54 00