

# Request for Competitive Sealed Proposals

# UNT ADVANCED AIR MOBILITY (UAAM) TEST CENTER

**RFCSP752-23-261209CS** 

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### DOCUMENT 001100 RFCSP752-23-261209CS ADVERTISEMENT FOR COMPETITIVE SEALED PROPOSAL

University of North Texas UAAM Test Center Response due: November 30, 2022, at 2:00 PM CST HUB Plan due: December 1, 2022, at 2:00 PM CST Date of Virtual Opening: December 6, 2022, at 2:00PM CDT

In accordance with Education Code 51.783, the University of North Texas (UNT), subsequently referred to as Owner, is accepting proposals and intends to enter into an agreement with a vendor that specializes in General Construction in accordance with the terms and conditions and requirements set forth in this RFCSP. Sealed proposals for **RFCSP752-23-261209CS** will be received by the Owner electronically through Jaggaer link provided below.

Proposals will be received up to 2:00 p.m. CST on **November 30, 2022.** HUB Sub-contracting Plans must be received up to 2:00 p.m. CST on **December 1, 2022.** Proposals received after the date and hour above stated will not receive consideration. Proposals will then be virtually opened and read aloud promptly at 2:00p.m. CST on **December 6, 2022, via Teams meeting:** 

Microsoft Teams meeting Join on your computer, mobile app or room device Click here to join the meeting Meeting ID: 221 676 703 497 Passcode: aBeizn Download Teams | Join on the web Or call in (audio only) +1 940-304-2772,.5448542# United States, Denton Phone Conference ID: 544 854 2# Find a local number | Reset PIN Learn More | Meeting options

### **Project Description**

This project is for the building of a 120' L x300' W x80' H netted facility will support current and anticipated sponsored research in unmanned air systems and ground autonomous vehicles by Center for Integrated Intelligent Mobility Systems (CIIMS). The contained facility will allow researchers to conduct field tests in all-weather conditions with full compliance of Federal Aviation Agency (FAA) regulations. The facility will also enable testing and analysis of Unmanned Aircraft Vehicle (UAV) physical robustness and safety criteria including impact with hard ground, collision with other vehicles, and effects of very high-speed maneuvers on flight dynamics and controls, which are not addressed in existing research. The facility could be used by faculty in CIIMS team from multiple departments in College of Engineering (CENG), G. Brint Ryan College of Business (RCOB), College of Science (COS), College of Health and Public Services (HPS). It will also benefit faculty from geography for research in remote sensing and geospatial information study.

### Questions

Questions concerning this proposal should be directed to:

Carrie Stoeckert Senior Construction Contract Coordinator University of North Texas System Strategic Infrastructure, Planning & Construction

### Carrie.stoeckert@untsystem.edu

All questions must be received no later than 2:00 p.m. CST on November 16, 2022. All questions and answers will be posted to the website by 5:00 p.m. CST on November 18, 2022.

UAAM Test Center Walter P. Moore #M04.22008.00 The Owner may in its sole discretion respond in writing to questions concerning this Proposal. Only the Owner's responses made by formal written Addendum to this Proposal shall be binding and shall be posted on the UNT System's website located at <a href="https://finance.untsystem.edu/vendor-resources/bid-inquiry/bid-opportunities.php">https://finance.untsystem.edu/vendor-resources/bid-inquiry/bid-opportunities.php</a> . Oral or other written interpretations or clarifications shall be without legal effect.

### **Pre-Proposal Meeting**

The pre-proposal meeting will be held virtually via Microsoft Teams at 3:00p.m. CST on November 10, 2022.

Microsoft Teams meeting Join on your computer, mobile app or room device <u>Click here to join the meeting</u> Meeting ID: 227 492 516 952 Passcode: MS5iNU <u>Download Teams | Join on the web</u> Or call in (audio only) +1 940-304-2772,129898072# United States, Denton Phone Conference ID: 129 898 072# <u>Find a local number | Reset PIN</u> <u>Learn More | Meeting options</u>

**Site Visit:** Site visit will be conducted on **November 14, 2022**, beginning at **10:00 a.m**. We will meet at UNT Discovery Park. 3940 Elm St., Denton, Tx. Vendors will be able to park in Lot 93 and meet North of J wing, South of perimeter road and West of fire pump house. This will be the only site visit conducted.

### **Bid Documents**

Proposers may obtain or access plans, specifications, and addenda for this project through the following sources:

**Online** - Proposers can view bid documents at Electronic State Business Daily (<u>http://www.txsmartbuy.com/sp</u>), at the UNT System website at <u>https://finance.untsystem.edu/vendor-resources/bid-inquiry/bid-opportunities.php</u> and the UNTS Jaggaer website: <u>https://bids.sciquest.com/apps/Router/PublicEvent?CustomerOrg=UNTS</u>.

**Plan Rooms** with bid documents on file include: McGraw-Hill Construction Plan Center (Irving), ABC Plan Room (Irving), DFW Minority (Dallas), AGC TEXO and iSqFt Plan Room (Dallas).

### Historically Underutilized Business (HUB)

In accordance with Texas Government Code 2161, RFCSP for contracts with an expected value of \$100,000 or more will require HUB Subcontracting Plan. All subcontracted work whether identified by the Owner or not, are required to be identified in the HUB Subcontracting Plan. The Plan should reflect all subcontracting opportunities to be utilized in this project and can be found online at (<u>http://www.window.state.tx.us/procurement/prog/hub/hub-forms/hub-sbcont-plan--allfms.pdf</u>). Complete, print, sign and submit the HUB Subcontracting Plan form with the proposal response.

# Only RFCSP responses with approved HUB Subcontracting Plans will be opened. Please submit the HUB Subcontracting Plan as a separate document, <u>separate</u> from your RFCSP electronic response through the UNTS Jaggaer link provided above.

Questions regarding the completion of the HUB Subcontracting Plan should be directed to Lisa Martinez-Tovar or Ashley Salazar-Hernandez at 940-369-5500 or <u>hub@untsystem.edu</u>.

The Owner is not bound to accept the lowest priced offer if that offer is not in its best interest, as determined by the Owner. The Owner reserves the right to: (a) enter into agreements or other contractual arrangements for all or any portion of the Scope of Work set forth in this Proposal with one or more respondents; (b) reject any and all offers and re-solicit offers; or (c) reject any and all offers and temporarily or permanently abandon this procurement, if deemed to be in the best interest of the Owner.

### END OF SECTION

UAAM Test Center Walter P. Moore #M04.22008.00

### DOCUMENT 002100 RFCSP752-23-261209CS INSTRUCTIONS FOR PROPOSAL

University of North Texas (UNT), subsequently referred to as the Owner, is accepting sealed proposals from contractors for a General Construction project, pursuant to Sec. 51.783, *Texas Education Code*, in accordance with the terms and conditions and requirements set forth in this Request for Competitive Sealed Proposal (RFCSP).

### 1. PRE-PROPOSAL MEETING:

A virtual pre-proposal meeting will be conducted to answer any questions regarding the scope of the project and the submission of the HUB Subcontracting Plan. Attendance is not mandatory but highly recommended. The pre-proposal meeting will be held virtually via Microsoft Teams.

November 10, 2022, at 3:00 p.m. CST

Microsoft Teams meeting Join on your computer, mobile app or room device Click here to join the meeting Meeting ID: 227 492 516 952 Passcode: MS5iNU Download Teams | Join on the web Or call in (audio only) +1 940-304-2772,129898072# United States, Denton Phone Conference ID: 129 898 072# Find a local number | Reset PIN Learn More | Meeting options

There will be a site visit on **November 14, 2022, at 10:00 a.m.** This will be the only site visit conducted. We will meet at UNT Discovery Park. 3940 Elm St., Denton, Tx. Vendors will be able to park in Lot 93 and meet North of J wing, South of perimeter road and West of fire pump house.

### 2. PROJECT PROPOSED SCHEDULE

November 4, 2022 November 10, 2022 3:00 p.m. November 14, 2022 10:00 a.m. November 16, 2022 2:00 p.m. November 18, 2022 5:00 p.m. November 30, 2022 2:00 p.m. December 1, 2022 2:00 p.m. December 6. 2022 2:00 p.m. December 2022 December 2022 December 2022

Issue RFCSP Pre-Proposal Conference - Virtual Site Visit Deadline for Submission of Questions Responses to Questions Post on Website Deadline for Submission of Proposal Deadline for HUB Sub-Contracting Plan Public Opening - Virtual Formal Contract Award Notification Agreement Authorized Anticipated Notice to Proceed

### 3. GENERAL REQUIREMENTS

3.1 Pricing

Your proposal must include all labor, material, equipment and services necessary to complete the work required by the construction documents. Pricing reflects the full Scope of Work defined herein; inclusive of all associated cost for delivery, labor, insurance, taxes, overhead and profit, or as otherwise defined, as appropriate. The Contractor shall base their base proposal price on the set of 100 percent Construction Documents and Specification. Contractor must complete Division 00, Section 004100, *Proposal Form.* Proposal must also include all alternates.

### 3.2 Unit Prices

When requested, Respondents must price per unit shown. Unit prices shall govern in the event of extension errors. Respondents must give unit prices for each item to be purchased. An "All or None" response by Respondent may be rejected at the option of the Owner. Quote F.O.B destination, freight prepaid and allowed. Otherwise, specify exact delivery cost and terms.

3.3 Schedule

Time is of the essence in the performance of the Contractor's duties. It is critical that a realistic expedited schedule is provided.

- 3.4 Purchasing Items
  - A. Catalogs, brand names or manufacturer's references are descriptive only, and indicate type and quality desired. Substitution requests of like nature and quality will be considered if response specifies such. If responding on other than referenced, response should show manufacturer, brand or trade name, and other description of product offered. If other than brand(s) specified is offered, illustrations and a complete description of product offered are requested to be made part of the response. Failure to take exception to specifications or reference data will require respondent to furnish specified brand names, numbers, etc.
  - B. Unless otherwise specified, all material shall be new and unused.
  - C. In addition, all electrical items must meet all applicable state and federal standards and regulations, and bear the appropriate listing such as ANSI, FCC, NEMA, NTRL, and OSHA standards.
  - D. Samples, when requested, must be furnished free of expense to the Owner. If not destroyed in examination, they will be returned to Respondent, on request, at Respondent's expense. Each sample should be marked with Respondent's name, address, and requisition number. Do not enclose in or attach offer to sample.
  - E. A one (1) year warranty from substantial completion is required.
  - F. Delivery
    - i. Show number of days required to complete project under normal conditions.
    - ii. No substitutions permitted without written approval of Owner.
  - G. Inspection and Tests

All work will be subject to inspection and test by the Owner. All costs shall be borne by the respondent in the event of failed inspection or tests.

### 3.5 Eligible Respondents

Only individual firms or formal joint ventures may apply. Two (2) firms may not apply jointly unless they have formed a joint venture. Any associates will be disqualified. (This does not preclude a respondent from having consultants.)

### 4. SUBMISSION OF PROPOSALS

- 4.1 Submit a total of one (1) complete copy of the entire response. Please submit your Hub-Subcontracting Plan as a separate file. Your HUB Sub-Contracting Plan will be due 24 hours after submission of your proposal. No QR codes will be accepted as part of your response and may disqualify your response. An original signature must appear on the Proposal Form (Division 00, Section 004100).
- 4.2 Your response and HSP should be electronically submitted through the UNTS Jaggaer website link as follows:

https://bids.sciquest.com/apps/Router/PublicEvent?CustomerOrg=UNTS

In order to submit proposals electronically, Proposer must have a working, registered vendor username and password to login. If this is the first time Proposer has attempted to submit a response electronically, please register at:

### https://bids.sciquest.com/apps/Router/PublicEvent?CustomerOrg=UNTS

Proposers are highly encouraged to ensure you have a working login in advance of the submission deadline. Proposer is responsible for ensuring it has the technical capability to submit its proposal via electronic submission.

Browser requirements: Chrome

### Proposer shall be solely responsible for ensuring timely submission of the Proposal.

UNTS is not responsible for equipment or software failure, internet or website downtime, corrupt or unreadable data, or other technical issues that may cause delay or non-delivery of a Proposal of inaccessibility of the submitted data. Proposers are highly encouraged to prepare and allow for sufficient time to familiarize themselves with the electronic submission requirements and to address any technical or data issues Prior to the Proposal due date and time.

- A. Late proposals will not be considered under any circumstances.
- B. The Owner reserves the right to accept late proposals; however, proposals received after opening time will not be accepted.
- C. Facsimile ("FAX") or emailed proposals are not acceptable.
- D. The Proposal must be submitted no later than 2:00 p.m. CST on November 30, 2022. Proposals received after the date and hour previously stated will not receive consideration. The HUB Sub-Contracting Plan must be submitted no later than 2:00 p.m. CST on December 1, 2022. Failure to submit the HUB Sub-contracting plan will disqualify your proposal.

Please submit your response electronically thru the UNT System Jaggaer site at:

https://bids.sciquest.com/apps/Router/PublicEvent?CustomerOrg=UNTS

Proposals will be received until the date and time established for receipt, then opened. The names of the respondents who submitted proposals will be made public. A public opening shall be held virtually on December 6, 2022, promptly at 2:00 p.m. CST. Public bid opening will be held virtually via Microsoft Teams meeting:

Microsoft Teams meeting Join on your computer, mobile app or room device Click here to join the meeting Meeting ID: 221 676 703 497 Passcode: aBeizn Download Teams | Join on the web Or call in (audio only) +1 940-304-2772,,5448542# United States, Denton Phone Conference ID: 544 854 2# Find a local number | Reset PIN Learn More | Meeting options

4.3 After proposals are received in response hereto and notice of intent to award a contract is made, the successful Contractor will be required to enter into a contract in the form of the Owner's standard General Construction Agreement. The Contractor should review the contract (Division 00, Section 005200, *Agreement Forms*). No changes to the standard contract will be accepted.

Any questions or concerns regarding this Request for Proposals shall be directed to:

Carrie Stoeckert, Senior Construction Contract Coordinator University of North Texas System Strategic Infrastructure, Planning & Construction

Please submit solicitation questions to: carrie.stoeckert@untsystem.edu

# All questions must be received no later than November 16, 2022, at 2:00 p.m. CST. All questions and answers will be posted to the website by 5:00 p.m. CST, November 18, 2022.

The Owner specifically requests that Respondents restrict all contact and questions regarding this RFCSP to the above-named individual except as provided in 4.2 above.

Responses to inquiries which directly affect an interpretation or change to this RFCSP will be issued in electronically by addendum (amendment) and posted at:

https://finance.untsystem.edu/vendor-resources/bid-inquiry/bid-opportunities.php, https://bids.sciquest.com/apps/Router/PublicEvent?CustomerOrg=UNTS, and http://www.txsmartbuy.com/sp

All such addenda issued by the Owner prior to the time that proposals are received shall be considered part of the RFCSP, and the Respondent shall be required to consider and acknowledge receipt of such on the proposal form. Contractors are responsible for obtaining any addenda posted on the websites listed above.

Only those inquiries the Owner replies to which are made by formal written addenda shall be binding. Oral and other interpretations or clarifications will be without legal effect. The Respondent must acknowledge all addenda in Division 00, Section 004100, *Proposal Form*.

### 4.4 Compliance with Law

Contractor is aware of, is fully informed about, and in full compliance with its obligations under existing applicable law and regulations, including Title VI of the Civil Rights Act of 1964, as amended (42 USC 2000(D)), Executive Order 11246, as amended (41 CFR 60-1 and 60-2), Vietnam Era Veterans Readjustment Act of 1974, as amended (41 CFR 60-250), Rehabilitation Act of 1973, as amended (41 CFR 60-741), Age Discrimination Act of 1975 (42 USC 6101 et seq.), Non-segregated Facilities (41 CFR 60-1), Omnibus Budget Reconciliation Provision, Section 952, Fair Labor Standards Act of 1938, Sections 6, 7, and 12, as amended, Immigration Reform and Control Act of 1986, and Utilization of Small Business Concerns and Small Business Concerns Owned and Controlled by Socially and Economically Disadvantaged Individuals (PL 96-507), the Americans with Disabilities Act of 1990 (42 USC 12101 et seq.), the Civil Rights Act of 1991, and all other laws and regulations and executive orders as are applicable.

#### 4.5 University's Right to Audit

At any time during the term of any Contract resulting from this solicitation and for a period of seven (7) years thereafter, the Owner or a duly authorized audit representative of the Owner or the State of Texas, at its expense and at reasonable times, reserves the right to audit Contractor's records and books relevant to all services provided under this Contract. In the event such an audit by the Owner reveals any errors/overpayments by the Owner, Contractor shall refund the Owner the full amount of such overpayments within thirty (30) days of such audit findings, or the Owner, at its option, reserves the right to deduct such amounts owing the Owner from any payments due Contractor.

#### 4.6 Access to Documents

To the extent applicable to this procurement, in accordance with Public Law 99-499 under TEFRA, Contractor agrees to allow, during and for a period of not less than seven (7) years after the Contract term, access to this Contract and its books, documents, and records; and contracts between Contractor and its subcontractors or related organizations, including books, documents and records relating to same, by the Comptroller General of the United States, the U.S. Department of Health and Human Services, and their duly authorized representatives.

### 4.7 Insurance and Bonds

The Contractor shall provide and maintain insurance, performance bond, and payment bond as required. The minimum insurance coverage and bonding requirements are stated in Division 00, Section 007000, *UGC*.

### 4.8 Other Benefits

It is understood and agreed that no benefits, payments or considerations received by Contractor for the performance of services associated with and pertinent to the resultant Agreement shall accrue, directly, or indirectly, to any employees, elected or appointed officers or representatives, or any other person identified as agents of, or who are, by definition, an employee of the State.

### 4.9 Non-Disclosure

Contractor and Owner acknowledge that they or their employees may, in the performance of the resultant Contract, come into the possession of proprietary or confidential information owned by or in the possession of the other. Neither party shall use any such information for its own benefit or make such information available to any person, firm, corporation, or other organization, regardless of whether directly or indirectly affiliated with Contractor or Owner, unless (i) required by law, (ii) required by order of any court or tribunal, (iii) such disclosure is necessary for the assertion of a right, or defense of an assertion of a right, by one party against the other party hereto, or (iv) such information has been acquired from other sources.

### 4.10 Publicity

Contractor agrees that it shall not publicize this potential Contract or disclose, confirm or deny any details thereof to third parties or use any photographs or video recordings of the Owner's employees or use the Owner's name in connection with any sales promotion or publicity event without prior written approval.

### 4.11 Assignment

The potential agreement with Contractor resulting from this RFCSP is a personal service contract for the services of Contractor, and Contractor's interest in such agreement, duties thereunder and/or fees due thereunder may not be assigned or delegated to a third party without the Owner's prior written consent. The benefits and burdens of such agreement are, however, assignable by the Owner.

### 4.12 Assignment of Overcharge Claims

Contractor hereby assigns to the Owner any and all claims for overcharges associated with the Contract arising under the antitrust laws of the United States, 15 U.S.C.A., Sec. 1 et seq. (1973), or arising under the antitrust laws of the State of Texas, Texas Business and Commerce Code Annotated, Sec. 15.01, et seq. (1967).

### 4.13 Patent and Copyright

Contractor shall pay for any royalties, license fees, copyrights or trade and service marks required to perform the services required by any resulting Contract.

### 4.14 Texas Public Information Act

The Owner considers all information, documentation and other materials requested to be submitted in response to this solicitation to be of a non-confidential and/or non-proprietary nature and therefore shall be subject to public disclosure under the Texas Public Information Act (Texas Government Code, Chapter 552.001, et seq.) after a contract is awarded.

Respondents are hereby notified that the Owner strictly adheres to all statutes, court decisions, and opinions of the Texas Attorney General regarding the disclosure of RFCSP information.

### 4.15 Freedom of Access and Use of Facilities

Contractor's employees shall have reasonable and free access to use only those facilities of the Owner that are necessary to perform services under a resulting Contract and shall have no right of access to any other facilities of the Owner.

4.16 Observance of University Rules and Regulations

Contractor agrees that at all times its employees will observe and comply with all regulations of the facilities, including but not limited to, no smoking, parking and security regulations.

4.17 Section Headings

All section headings are for convenience of reference only and are not intended to define or limit the scope of any provisions of this RFCSP.

- 4.18 Governing Law
  - A. This RFCSP, and any resulting Contract, agreement or purchase order shall be construed and governed by the laws of the State of Texas.
  - B. The parties understand and agree that any purchase order/contract may be subject to the Health Insurance Portability and Accountability Act of 1996 (HIPAA), the administrative regulations and/or guidance which have been issued or may in the future be issued pursuant to HIPAA, including, but not limited to, the Department of Health and Human Services regulations on privacy and security, and Texas state laws pertaining to medical privacy (collectively, "Privacy Laws"). Vendor agrees to comply with all Privacy Laws that are applicable to this purchase order/contract and to negotiate in good faith to execute any amendment to this purchase order/contract that is required for the terms of this purchase order/contract to comply with applicable Privacy Laws. In the event the parties are unable to agree on the terms of an amendment pursuant to this paragraph within thirty (30) days of the date the amendment request is delivered by one party to the other, this order may be terminated by either party upon written notice to the other party.
  - C. **Important Notice:** Any purchase order may be funded wholly or partially with federal funds subject to the American Recovery and Reinvestment Act of 2009 (ARRA). The vendor shall comply with all applicable provisions of ARRA, which may include, but are not limited to, the provision of Division A, Titles XV and XVI (e.g., audit provisions, whistleblower protection, and preferences for American products).
  - D. Federal Funds: All procurements of supplies equipment, and services utilizing Federal Funds (e.g. Federal Grant or Contract) shall be made in accordance with all applicable federal rules and regulations: Federal Acquisition Regulations (FAR), Federal Office of Management and Budget (OMB) Educational Institutions, even if part of a State or local government follow: OMB A-21 for cost principles, A-110 for administrative requirements, and A-133 for audit requirements. All procurement requirements contained in the above referenced circulars are incorporated herein by reference. By signing this solicitation document, vendor certifies that vendor is in compliance with OMB A-110 and that vendor is not on the Debarred Bidders List.
- 4.19 Owner's Special Conditions

The Owner requires full compliance with Division 00 and Division 01 Specifications, Contract and General Requirements. The documents shall be a part of this RFCSP and the Contract.

4.20 Prevailing Wage Schedule, University of North Texas System

Prevailing wage schedule shall in accordance with Texas Government Code, Chapter 2258. The hourly wage rate for work over forty (40) hours a week and work on legal holidays shall be not less than one and one-half (1.5) times the hourly rates.

Respondents shall base their proposals on rates they expect to pay. The Owner will not consider claims for extra payment to the Contractor on account of payment of wages higher than those required by Texas Government Code, Chapter 2258.

4.21 Pursuant to Section 231.006 of the Family Code, response must include names and social security numbers of each person with at least twenty-five (25) percent ownership of the business entity submitting the response. Vendors that have pre-registered this information on the Texas Comptroller of Public Accounts Centralized Master Bidders List (CMBL) have satisfied this requirement. If not pre-registered, list the name and social security numbers for each person. Otherwise, this information must be provided prior to contract award.

- 4.22 Note to Vendors: Any terms and conditions attached to any response will not be considered unless specifically referred to on the Solicitation and may result in disqualification of the response.
  - A. **Dispute Resolution:** Chapter 2260 of the Texas Government Code establishes a dispute resolution process for contracts involving goods, services, and certain types of projects. If Chapter 2260 applies to this Purchase Order, then the statutory dispute resolution process must be used by the vendor to attempt to resolve all of its disputes arising under this Purchase Order.
  - B. Excess Obligations Prohibited: The Texas Constitution (Article XVI, Section 10) prohibits obligators beyond the current appropriations, which the Owner applies annually. Any purchase order may be canceled at any time without penalty if legislative and/or Owner funds are not appropriated for goods or services obligated on any purchase order beyond the current fiscal year (September 1 through August 31 of any given year.)
  - C. **Cancellation**: Items or orders may be canceled without the consent of the vendor due to failure to fulfill their contractual obligations. If cancellation is requested by the Owner for some other reason through no fault of the vendor, the vendor will be contacted. The Owner reserves the right to cancel this contract upon thirty (30) days written notice to the Contractor. The Contractor must request and secure in writing the approval of the Purchasing Department to be released from this contract or any portion thereof should unforeseeable conditions occur.
  - D. Miscellaneous: The laws of the State of Texas shall prevail, including the Public Information Act. Any Order is not confidential. All transactions associated with this Order may be subject to audit. Vendor, by accepting this Order agrees to allow access to all records regarding this transaction upon written request by UNTS Internal Auditors and/or UNTS Business Support Services Procurement department.

### 5. EVALUATION

5.1 The successful offer will be the offer that is submitted in response to this Proposal by the Submittal Deadline and provides the Best Value to the Owner in the Owner's sole discretion. Offers will be evaluated by an evaluation committee that will include employees of the Owner and other persons invited by the Owner to participate. The evaluation of offers and the selection of the Successful Offer will be based on the information provided to the Owner by the respondent in response to the Specifications section of this Proposal. Consideration may also be given to any additional information and comments if such information or comments increase the benefits to the Owner. The successful respondent will be required to enter into a contract acceptable to the Owner.

The evaluation committee will determine if Best and Final Offers are necessary. Award of a contract may be made without Best and Final Offers. The Owner may, at its discretion, elect to have Respondents provide oral presentations and respond to inquiries from the evaluation committee related to their Proposals. A request for a Best and Final Offer is at the sole discretion of the Owner and will be extended in writing

In evaluating Proposals to determine the best value for the State, the Owner may consider information related to past contract performance of a Respondent including, but not limited to, Texas Comptroller of Public Account's Vendor Performance Tracking System.

### 5.2 Evaluation Criteria

Proposals will be opened publicly to identify the names of the proposers and their respective proposed agreement amounts. Other contents of the Proposals will be afforded security sufficient to preclude disclosure of the contents prior to award. Proposals will be evaluated by the Owner. The criteria for evaluation, Best Value determination using Education Code 51.783 and selection of the successful proposer for this award, will be based upon the equally weighted factors listed below:

- A. Proposed agreement amount listed on Proposal form.
- B. Proposed number of calendar days indicated on Proposal form.
- C. The qualifications and experience of the proposer's key personnel and subcontractors committed to the project. Three (3) years' experience with similar scale projects, resumes of key team members working on project.

- D. Proposer's current workload and availability of personnel and equipment required to timely complete the project.
- E. The quality of references from owners and architects for similar projects completed by the proposer within the last five (5) years.
- F. The proposer's proposed project schedule and the demonstrated ability to have met expedited schedules on similar projects. Demonstrate how you will mitigate the ever-changing material availability and long lead times of construction material and equipment needed to complete the project in a timely manner.
- G. The responsibility and reputation of the proposer, including claims and litigation experiences.
- H. The proposer's safety record.
- I. The sufficiency of the proposer's financial resources.

### 6. AWARD PROCESS

6.1 After the opening of the offers and upon completion of the initial review and evaluation of the offers submitted, selected respondents may be invited to participate in oral presentations. The selection of the Successful Offer may be made by the Owner on the basis of the offers initially submitted, without discussion, clarification or modification. In the alternative, selection of the Successful Offer may be made by the Owner on the basis of the offers submitted by selected respondents with any of the respondents. At the Owner's sole option and discretion, it may discuss and negotiate all elements of the offers submitted by selected respondents within a specified competitive range. For purposes of negotiation, a competitive range of acceptable or potentially acceptable offers may be established comprising the highest-rated offers. The Owner will provide each respondent within the competitive range with an equal opportunity for discussion and revision of its offer. The Owner will not disclose any information derived from the offers submitted by competing respondents in conducting such discussions. Further action on offers not included within the competitive range will be deferred pending the selection of the Successful Offer; however, the Owner reserves the right to include additional offers in the competitive range if deemed to be in its best interest.

After the submission of offers but before final selection of the Successful Offer is made, the Owner may permit a respondent to revise its offer in order to obtain the respondent's best final offer. The Owner is not bound to accept the lowest-priced offer if that offer is not in its best interest, as determined by the Owner.

The Owner reserves the right to: (a) enter into agreements or other contractual arrangements for all or any portion of the Scope of Work set forth in this Proposal with one or more respondents; (b) reject any and all offers and re-solicit offers; or (c) reject any and all offers and temporarily or permanently abandon this procurement, if deemed to be in the best interest of the Owner.

6.2 Respondent's Acceptance of Evaluation Methodology

Submission of an offer by a respondent indicates: (1) the respondent's acceptance of the Selection Process, the Evaluation of Criteria for selection, and all other requirements and specifications set forth in this Proposal; and (2) the respondent's recognition that some subjective judgments must be made by the Owner during this Proposal process.

- 6.3 Contract
  - A. A response to this Solicitation is an offer to contract based upon the terms, conditions and specifications contained herein. Responses do not become contracts until a UNTS Agreement is issued and accepted. The contract shall be governed, construed, and interpreted under the laws of the State of Texas as the same may be amended from time to time. The Education Code 51.9335 shall be considered in making an award when specified. Venue for any suit filed against UNTS shall be subject to the mandatory venue statute set forth in §105.151 of the Texas Education Code.
    - i. An award is made to the Vendor submitting the lowest and/or best value response conforming to this specification. To determine the lowest and/or best value response, in addition to price, <u>BEST VALUE</u> may be considered.
    - ii. DEBTS TO THE STATE: Any party indebted to the State of Texas or any party who is more than thirty (30) days delinquent for Child Support is not entitled to payment on this purchase order or any accompanying contract.
    - iii. If a "best offer" vendor shows not to be in "good standing," this agency may reject the response and award to the next best response.

- iv. The Owner reserves the right to award the entire contract to a single Vendor or to award different components to different Vendors, whichever the Owner, at its sole discretion, determines to be in its overall best interest, as solely determined by the responsible parties of the Owner.
- B. Respondent understands that acceptance of funds under this contract acts as acceptance of the authority of the State Auditor's Office, or any successor agency, to conduct an audit or investigation in connection with those funds. Respondent further agrees to cooperate fully with the State Auditor's Office or its successor in the conduct of the audit or investigation, including providing all records requested. Respondent will ensure that this clause concerning the authority to audit funds received indirectly by subcontractors through proposer and the requirement to cooperate is included in any subcontract it awards
- 6.4 Response Results: It is not the policy of the Owner to furnish results over the telephone. Bid tabulations may be requested by email to <u>carrie.stoeckert@untsystem.edu</u>.
- 6.5 Historically Underutilized Businesses (HUB)
  - A. If Owner elects to award the future Construction Phase Services to the Construction Manager, the proposed contract is expected to exceed \$100,000.00. A Good Faith Effort Program in the form of a HUB Subcontracting Plan (HSP) is a mandatory condition precedent to the award of any such extension of the contract. The HSP will become a part of the General Construction Agreement Refer to Division 00, Section 006000, *Project Forms* herein for HSP Forms.
  - B. Centralized Master Bidders List (CBML): The Owner utilizes the Texas Comptroller of Public Accounts CMBL to locate potential HUB vendors. The CMBL is located at: <u>http://comptroller.texas.gov/purchasing/vendor/cmbl/</u>. Non-HUB respondents are identified from various sources including the CBML.
  - C. Questions regarding completing the HSP should be directed to Lisa Martinez-Tovar, Assistant HUB Coordinator or Ashley Salazar-Hernandez at 940-369-5500 or <u>hub@untsystem.edu</u>. Additional information can also be found at the Texas Comptroller for the Public Accounts website at:

http://www.window.state.tx.us/procurement/prog/hub/hub-forms/ .

# FAILURE TO MEET HUB REQUIREMENTS MAY RESULT IN THE TERMINATION OF THE CONTRACT.

END OF SECTION

### DOCUMENT 004100 RFCSP752-23-261209CS UNT UAAM Test Center

### **PROPOSAL FORM**

Proposal of: \_\_\_\_\_

(Company Name)

In accordance with Education Code 51.783, the University of North (UNT), subsequently referred to as the Owner, is accepting proposals and intends to enter into an agreement with a General Construction contractor in accordance with the terms, conditions and requirements set forth in this Request for Competitive Sealed Proposal (RFCSP).

UNTS is accepting sealed bids no later than 2:00 p.m. CST on November 30, 2022. Bids received after the date and hour previously stated will not receive consideration. The HUB Sub-Contracting Plan is due no later than 2:00 p.m. CST on December 1, 2022. Failure to submit the HUB plan will disqualify your proposal.

The scope of work of this RFCSP is General Construction for the UNT UAAM Test Center project. A set of the one hundred percent (100%) Construction Documents and Specifications have been included for use in preparation of the proposal. A sample copy of the agreement has been included (Division 00, Section 005200, *Agreement Forms*) for review.

# PROPOSERS ARE CAUTIONED TO READ THE INFORMATION CONTAINED OR REFERRED TO IN THIS RFCSP CAREFULLY AND TO SUBMIT A COMPLETE RESPONSE TO ALL REQUIREMENTS AS DIRECTED.

TO: Carrie Stoeckert Senior Construction Contract Coordinator University of North Texas System

### Via Electronic Delivery through Jaegger Website Link below:

https://bids.sciquest.com/apps/Router/PublicEvent?CustomerOrg=UNTS

### **BASE BID**

Pursuant to and in compliance with the Contract Documents and any attachments thereto, including the Advertisement for Competitive Sealed Proposal and Instruction for Proposals, the Proposer hereby certifies that it has, carefully examined the Contract Documents entitled:

UNT UAAM Test Center Prepared by: Walter P. Moore

Proposal can be bid on both of the following or just one based on the service the contractor can provide: Provide required materials, services for either or both scopes:

1. Civil, structural, ground cover, power/data infrastructure

### 2. Poles and netting

**Base Bid #1:** The conditions affecting the Work, and being familiar with the site; and having made the necessary examinations, proposes to furnish all labor, materials, equipment, and services necessary to complete the Work in strict accordance with the Contract Documents for the above referenced project for the civil, structural, ground cover, power/data infrastructure, etc. excluding poles and netting for the following sum (Not including bond cost):



**Base Bid #2:** The conditions affecting the Work, and being familiar with the site; and having made the necessary examinations, proposes to furnish all labor, materials, equipment, and services necessary to complete the Work in strict accordance with the Contract Documents for the above referenced project for the poles and netting for the following sum (Not including bond cost):



### ALTERNATE BIDS

Number	Description of Alternate Bid:	Additive/Deductive	Bid Amount:
1	No Alternates	<ul> <li>Additive</li> <li>Deductive</li> </ul>	\$

### PAYMENT TERMS

The Owner shall be billed in accordance with Chapter 2251 of the Texas Government Code and payment shall be made no later than thirty (30) days following the later of (i) delivery of the goods or completion of the services and (ii) delivery of an invoice to Customer; and (c) interest, if any, on past due payments shall accrue and be paid in accordance with Chapter 2251 of the Texas Government Code. Payee must be in good standing, not indebted to the State of Texas, and current on all taxes owed to the State of Texas for payment to occur. Payment Applications and any required supporting documents must be presented to: University of North Texas System Facilities; 1155 Union Circle #311040, Denton, Texas 76203-5017.

- a. Payment on any contract will be withheld from Proposer if Proposer is determined to be more than thirty (30) days delinquent for Child Support.
- b. Successful Proposer shall be responsible for referencing the purchase order number(s) resulting from this proposal on any invoice(s), packing list(s), correspondence, etc. Invoicing must correlate to prices quoted either on a unit, hourly, etc. basis.
- c. **DISQUALIFICATION**: Response is subject to disqualification if Proposer provides revisions and/or exclusions to the terms and conditions listed in this solicitation that the Owner is limited by law from accepting (i.e. offers with the laws of a State other than Texas), requirements for prepayment not defined in or allowed for in this Solicitation, limitations on remedies, any revision to stated terms and conditions of the Solicitation, etc.
- d. Proposer agrees that any payments due under this contract may be applied towards any debt, including but not limited to delinquent taxes and child support that is owed to the State of Texas.

### SALES TAX

Purchases made for the Owner's use are exempt from the State Sales tax and Federal Excise tax. Do not include tax in response. Excise Tax Exemption Certificates are available upon request.

### INSURANCE

The Proposer shall provide and maintain, until the work covered in this Contract is completed and accepted by the Owner, the minimum insurance coverage as stated in Division 00, Section 007000, *UGC*.

### TIME OF COMPLETION

Consecutive Calendar Days needed to complete the project: \_\_\_\_\_\_ calendar days

### LIQUIDATED DAMAGES

Liquidated damages will be in accordance with Division 00, Section 007000 "UGC".

### BOND

In accordance with Texas Government Code 2253, a Payment Bond is required for all public works agreements over \$25,000.00 and a Performance Bond for all public works agreements over \$100,000.00. It is estimated that this agreement will be over \$100,000.00 so a Payment and Performance Bond is required. Please provide the amount as a total bond cost. The Owner will pay bonding costs to the awarded vendor as a pass-through amount with proper documentation provided along with an invoice.

Payment and Performance Bond cost: 
\$\_\_\_\_\_

### ADDENDA

Receipt is hereby acknowledged of the following addenda to this RFCSP. (Initial, if applicable)

No. 1:	No. 2:	No. 3:	No. 4:	No. 5:	No. 6:
Dated:	Dated:	Dated:	Dated:	Dated:	Dated:

### QUALIFICATIONS

Refer to Attachment A of this document. Qualifications must be submitted on the enclosed form and no other document will be accepted. Not providing qualifications on the provided form will be cause for disqualification.

An incomplete proposal or one having additional information or other modifications inscribed thereon, may be cause for rejections of the entire proposal. This proposal is valid and will be honored for a period of one hundred eighty (180) days following the proposal opening.

# THIS SECTION MUST BE COMPLETED, SIGNED, AND RETURNED WITH RESPONDENT'S PROPOSAL. FAILURE TO SIGN AND RETURN THIS SECTION WILL RESULT IN DISQUALIFICATION OF YOUR FIRM.

- 1. By signature hereon, Respondent offers and agrees to furnish the products and/or services in compliance with all terms, conditions, requirements set forth per the RFP documents and contained herein.
- 2. By signature hereon, Respondent affirms that it has not given, nor intends to give at any time hereafter, any economic opportunity, future employment, gift, loan, gratuity, special discount, trip, favor or service to a public servant in connection with the submitted proposal. Failure to sign hereon, or signing with a false statement, shall void the submitted proposal or any resulting contracts, and the Respondent shall be removed from all proposal lists at this Agency.
- 3. By signature hereon, a corporate Respondent certifies that it is not currently delinquent in the payment of any Franchise Taxes due under Chapter 171, Texas Tax Code, or that the corporation is exempt from the payment of such taxes, or that the corporation is an out-of-state corporation that is not subject to the Texas Franchise Tax, whichever is applicable. A false certification shall be deemed a material breach of contract and, at UNTS's option, may result in cancellation of any resulting contract or purchase order.
- 4. By signature hereon, the Respondent hereby certifies that neither the Respondent nor the firm, corporation, partnership or institution represented by the Respondent, or anyone acting for such firm, corporation, or institution has violated the antitrust laws of this state, codified in Section 15.01, et. seq., Texas Business and Commerce Code, or the Federal antitrust laws, nor communicated directly or indirectly the proposal made to any competitor or any other person engaged in such line of business.
- 5. By signature hereon, Respondent certifies that all statements and information prepared and submitted in response to this solicitation are current, complete and accurate.
- 6. By signature hereon, Respondent certifies that the individual signing this document and the documents made part of the RFP is authorized to sign such documents on behalf of the company and to bind the company under any contract which may result from the submission of this proposal. Unsigned responses will not be considered under any circumstances.

- 7. By signature hereon, Respondent certifies that if a Texas address is shown as the address of the Respondent, Respondent gualifies as a Texas Resident Respondent as defined in Texas Administrative Code (TAC) Title 34. In the case of a tie, the award will be made in accordance with TAC, Title 34, amended. Check below preference claimed under TAC, Title 34, amended:
  - Supplies, materials, or equipment produced in Texas/offered by Texas bidders
  - $\Box$ Agricultural products produced or grown in Texas
  - $\Box$ Agricultural products and services offered by Texas bidders
  - USA produced supplies, materials, or equipment
    - Products of persons with mental or physical disabilities
    - Recycled, remanufactured, or environmentally sensitive products, including recycled steel products Energy efficient products
  - Rubberized asphalt paving material
    - Recycled motor oil and lubricants
    - Products produced at facilities located on formerly contaminated property
    - Products and services from economically depressed or blighted areas
    - Vendors that meet or exceed air quality standards

Consistent and continued tie Responses could cause rejection of offers by UNTS and/or investigation for antitrust violations.

By signature hereon, Respondent certifies it is a small business and/or minority/female owned business as defined 8. by the State of Texas. Check status below:

- **Historically Underutilized Business**
- Small Business (House Bill 366, 64th Legislature)
- Minority/Female Owned Business (House Bill 2626, 73rd Legislature)
- Certified by Texas Department of Commerce
- Status not claimed
- 9. By signature hereon, Respondent certifies as follows:

"Under Section 231.006, Texas Family Code, the vendor or applicant certifies that the individual or business entity named in this contract, bid, or application is not ineligible to receive the specified grant, loan, or payment and acknowledges that this contract may be terminated and payment may be withheld if this certification is inaccurate."

"Under Section 2155.004, Texas Government Code, the vendor or applicant certifies that the individual or business entity named in this bid or contract is not ineligible to receive the specified contract and acknowledges that this contract may be terminated and payment withheld if this certification is inaccurate."

- 10. By signature hereon, Respondent certifies that no relationship, whether by relative, business associate, capital funding agreement or by any other such kinship, exist between Respondent and an employee of any UNTS component, or Respondent has not been an employee of any UNTS component within the immediate twelve (12) months prior to RFP response. All such disclosures will be subject to administrative review and approval prior to UNTS entering into any contract with Respondent.
- 11. Respondent certifies that they are in compliance with Section 669.003 of the Texas Government Code, relating to contracting with the executive head of a State agency. If Section 669.003 applies, respondent will complete the following information in order for the response to be evaluated:

Name of former Executive:	
Name of State Agency:	
Date of separation from State agency:	
Position with Respondent:	Date of employment with Respondent:

12. By signature hereon, Respondent affirms that no compensation has been received for participation in the preparation of the specifications for this RFP. (ref. Section 2155.004, Texas Government Code).

- 13. Respondent represents and warrants that all articles and services quoted in response to this RFP meet or exceed the safety standards established and promulgated under the Federal Occupational Safety and Health Law (Public Law 91-596) and its regulations in effect or proposed as of the date of this solicitation.
- 14. **Suspension, Debarment, and Terrorism:** Respondent further certifies that the Respondent and its principals are eligible to participate in this transaction and have not been subjected to suspension, debarment, or similar ineligibility determined by any federal, state or local governmental entity and that Respondent is in compliance with the State of Texas statutes and rules relating to procurement and that Respondent is not listed on the federal government's terrorism watch list as described in Executive Order 13224. Entities ineligible for federal procurement are listed at <a href="http://www.epls.gov">http://www.epls.gov</a>.
- 15. By signature hereon, Respondent signifies his compliance with all federal laws and regulations pertaining to Equal Employment Opportunities and Affirmative Action.
- 16. By signature hereon, Respondent will comply with and agree to use E-Verify System in accordance with State of Texas Executive Order RP-80 throughout this project as appropriate.
- 17. Respondent affirmatively states that it does not boycott Israel, pursuant to Texas Gov't Code, Section 2270.002. Additionally, Respondent shall not engage in a boycott of Israel during the term of this agreement.
- 18. Respondent hereby represents, verifies, and warrants, pursuant to Texas Gov't Code 2272.02, that it does not have a practive, policy, guidance, or directive that discriminates against a firearm entity or firearm trade association and willnot discriminate against a firearm entity or firearm trade association during the term of this agreement.
- 19. Respondent hereby represents, verifies, and warrants, pursuant to Texas Gov't Code 2274.02, that it does not boycott energy companies and will not boycott energy companies during the term of this agreement.
- 20. By signature hereon, Respondent hereby represents, verifies, and warrants, pursuant to Texas Gov't Code 2252.201-2252.205, that it is in compliance with the requirement that any iron or steel project produced through a manufacturing process and used in the Project is produced in the United States.
- 21. Respondents should give Payee ID Number, full firm name, and address of Respondent below in the space provided. The Payee ID Number is the taxpayer number assigned and used by the Texas Comptroller of Public Accounts. If this number is not known, complete the Federal Employer's Identification Number.

Payee ID No	If a Corporation State of Incorporation:
FEI No	Charter No:
Company Information:	Submitted by:
(Company Name)	(Authorized Signature)
(Street Address Line 1)	(Printed Name/Title)
(Street Address Line 2)	(Date)
(City, State, Zip Code)	(Telephone Number)
	(Facsimile Number)
	(Email Address)

Complete the following:

# ATTACHMENT A

### QUALIFICATIONS RFCSP752-23-261209CS UNT UAAM Test Center

## **ITEMS 1 THROUGH 5 TO BE SUBMITTED WITH PROPOSAL**

Proposer's Name:		
Point of Contact:		
Address:		
City, State, Zip:		
Telephone No.:	Fax No	
Email:		
State Comptroller Vendor Identification Number:		

## 1. GENERAL

- A. Qualification information submitted shall be applicable only to the company entity or branch that will perform this Work.
- B. Attach your Project Organization Chart and resumes of individuals who would be assigned to this project.
- C. Proposed demolition schedule (Bar chart acceptable).

## 2. HISTORY

A.	Corporation Partnership Sole Proprietorship Joint Venture
	State of Incorporation:
В.	In continuous business since:
	Remarks (if required):
C.	Corporate Officers, Partners or Owners of Organization:
	Name Branch Manager Telephone Number
D.	Check box(es) corresponding to the nature of your business:
	Large Business (100 or more employees)
	Small Business (fewer than 100 employees)
	HUB Business
	Other (Define)
E.	Has your organization ever defaulted or failed to complete any work awarded?
	Yes No
	If yes, stipulate where and why:
F.	Has your organization ever paid liquidated damages or a penalty for failure to complete a contract on time?
	□ Yes □ No
	If yes, stipulate where and why:

# 3. EXPERIENCE

A.	Normal	ly performs% of the work with own forces. List trades below:
B.	Propose	e to perform% of the work for project with own forces. List trades below:
C.	List all r form us	najor projects of your organization has in-progress. If more space is needed attach pages to this ing format below identified by item and sub-item:
	i.	Name, Location and Description of Project:
		Contract Amount:
		Percent Complete:
		Owner Reference Contact and Telephone Number:
		Architect Reference Contact and Telephone Number:
	ii.	Name, Location and Description of Project:
		Contract Amount:
		Percent Complete:
		Project Completion Date:

Owner Reference Contact and Telephone Number:

		Architect Reference Contact and Telephone Number:
	iii.	Name, Location and Description of Project:
		Contract Amount:
		Percent Complete:
		Project Completion Date:
		Owner Reference Contact and Telephone Number:
		Architect Reference Contact and Telephone Number:
D.	Total nu	mber and dollar amount of contracts currently in progress:
		Number \$
E.	Largest	contract currently in-process:
		Anticipated date of completion:
F.	Volume	of work completed over last five (5) years: (Through 12/31)
		Year \$
		\$
		\$
		\$
		\$

G. List five (5) major projects of similar scope your organization has completed in the last five (5) years with completion date, photos and references. Other projects of particular significance may also be listed.

Contract Amount:	
Percent Complete:	
Project Completion Date:	
Owner Reference Contact and Telephone Number:	
Name	Telephone Number
Architect Reference Contract and Telephone Number:	
Name	Telephone Number
Name	Telephone Number
Name Name, Location and Description of Project:	Telephone Number
Name Name, Location and Description of Project:	Telephone Number
Name Name, Location and Description of Project:	Telephone Number
Name	Telephone Number
Name Name, Location and Description of Project:	Telephone Number
Name Name, Location and Description of Project: Contract Amount: Percent Complete:	Telephone Number
Name Name, Location and Description of Project: Contract Amount: Percent Complete: Project Completion Date:	Telephone Number
Name         Name, Location and Description of Project:         Contract Amount:         Percent Complete:         Project Completion Date:         Owner Reference Contact and Telephone Number:	Telephone Number
Name         Name, Location and Description of Project:	Telephone Number
Name         Name, Location and Description of Project:         Name         Contract Amount:         Percent Complete:         Project Completion Date:         Project Completion Date:         Owner Reference Contact and Telephone Number:         Name         Architect Reference Contract and Telephone Number:	Telephone Number

Name, Location and Description of Project:	
Contract Amount:	
Percent Complete:	
Project Completion Date:	
Owner Reference Contact and Telephone Number:	
Name	Telephone Number
Architect Reference Contract and Telephone Number:	
Name	Telephone Number
lame, Location and Description of Project:	
Contract Amount:	
Percent Complete:	
Project Completion Date:	
Owner Reference Contact and Telephone Number:	
lame	Telephone Number
rchitect Reference Contract and Telephone Number:	
termeet Reference Contract and Telephone Number.	

Name, Location and Description of Project:		
Telephone Number		
Talankana Numbar		

H. Has your organization had any claims and/or litigations in the last five (5) years?

If yes, attach a list with project name, date or project, owner, owner's contact person with telephone number and summary explanation.

## 4. SAFETY PROGRAM

A. List your organization's Workers Compensation Experience Modification Rate (EMR) for the last three (3) years, as obtained from your insurance agent.

YEAR		
EMR		

B. Complete matrix for the three (3) past years, as obtained from OSHA N. 200 Log:

	Vaar				
	Year Number of injuries and illness				
	Number of lost time accidents				
	Number of recordable cases				
	Number of fatalities				
	Total Injury & illness rate from OSHA 300 log				
	Please provide your SIC Code				
C.	Are regular project safety meetings held for Field Supervisor(s)?				
	□ Yes □No				
	If yes, frequency:				
	Weekly Bi-monthly Monthly As Needed				
D.	D. Are project safety inspections conducted? Yes				
	If yes, who performs inspection? How often?				
		-			
E.	Does organization have a written safety program? Yes				
	If yes, provide a copy. It will become a compliance document upon contract award.				
F.	Does your organization have a safety orientation program for new employees?  Yes	□No			
	For employees promoted to Field Supervisors?				
	If yes, does your Supervisor Safety Program include instructions on the following:				
	YesNoSafety work practices				

# 5. FINANCIAL

A. Attach an audited Financial Statement, including a profit and loss statement and other supporting schedules. If the last audited statement is over twelve (12) months old, include the most current unaudited statement.

В.					
	Age	ent:			
	Nar	me of Contact:T	elephone No		
C.	Bor	nding Capacity:			
	Limit per project:				
	Unencumbered bonding capacity:				
D. Trade References (Additional references may be included as attached sheets.)					
	i.	Organization:			
		Agent:			
		Name of Contract:	Telephone No		
	ii.	Organization:			
		Agent:			
		Name of Contract:	Telephone No		
	iii.	Organization:			
		Agent:			
		Name of Contract:	Telephone No.		



# **GENERAL CONSTRUCTION AGREEMENT**

(For Use with Competitive Sealed Proposals)

This Agreement is made and entered into by and between **University of North Texas {System or Institution Name}** ("Owner"), and by **{Firm Name}** ("Contractor"), duly authorized by the laws of the State of Texas to act as contractor for construction, rehabilitation, alteration, or repair services. The capitalized term "Party" refers to either Owner or Contractor individually and the term "Parties" refers to Owner and Contractor collectively. The effective date ("Effective Date") of this Agreement shall be the date of last signature by the parties hereto.

### ARTICLE 1 PROJECT

1.1 Owner does hereby engage Contractor and Contractor does hereby agree to provide all labor, materials, equipment, and services necessary to complete the Work, all of which shall be provided in full accord with the Contract Documents to construct the {Project Name} ("Project"), on the {Campus}, to be completed in accordance with the requirements herein, and generally described as follows:

{General Description of the Project}

1.2 Contractor has overall responsibility for and shall furnish all materials, equipment, tools, and labor as necessary or reasonably inferable to complete the Work, or any phase of the Work, in accordance with Owner's requirements and the terms of the Contract Documents.

### ARTICLE 2 CONTRACT DOCUMENTS

- 2.1 Owner, through its Design Professional, shall provide all architectural and engineering design services necessary for the completion of the Work. The Drawings, Specifications, and addenda have been prepared for Owner by {Architect/Engineer} ("Design Professional").
- 2.2 The Contract Documents consist of:
  - 2.2.1 This Agreement and all exhibits and attachments listed, contained or referenced in this Agreement;
  - 2.2.2 The Uniform General Conditions for Construction and Design Contracts for the University of North Texas System ("Uniform General Conditions" or "UGC");
  - 2.2.3 Supplementary General Conditions or Special Conditions, if any;
  - 2.2.4 Owner's Specifications;
  - 2.2.5 All Addenda issued prior to the Effective Date of this Agreement;
  - 2.2.6 All Change Orders issued after the Effective Date of this Agreement;
  - 2.2.7 The Drawings, Specifications, details and other documents developed by Design Professional to describe the Project and accepted by Owner;
  - 2.2.8 The Drawings and Specifications developed or prepared by Owner's other consultants, if any, and accepted by Owner; and

- 2.2.9 The Historically Underutilized Business (HUB) subcontracting plan submitted or amended by Contractor and approved by Owner for this Project.
- 2.3 The Contract Documents form the entire and integrated agreement between Owner and Contractor and supersede all prior negotiations, representations or agreements, written or oral.
- 2.4 To the extent the terms of this Agreement conflict with the Uniform General Conditions and/or the Supplemental Conditions, the terms of this Agreement will control.
- 2.5 If there is an irreconcilable conflict between or among the various documents that make up the Contract Documents, the interpretation that provides for the higher quality of material and/or workmanship will prevail over all other interpretations.

### ARTICLE 3 DEFINITIONS

- 3.1 Terms, words, and phrases used in the Contract Documents shall have the meanings given in the Uniform General Conditions.
- 3.2 The following terms, words, and phrases used in the Contract Documents shall have the following meanings, and if more specific than the definition given in the Uniform General Condition, the more specific given in this Agreement shall control.
  - 3.2.1 "Baseline Schedule" means the initial time schedule prepared by Contractor for Owner's information and acceptance that conveys Contractor's and Subcontractors' activities (including coordination and review activities required in the Contract Documents to be performed by the Design Professional and Owner), durations, and sequence of work related to the entire Project to the extent required by the Contract Documents. The schedule shall clearly demonstrate the longest path of activities, critical activities durations, and necessary predecessor conditions that drive the end date of the schedule. The accepted Construction Baseline Schedule shall not change.
  - 3.2.2 "Design Professional" means licensed professionals, or firms employing such licensed professionals, engaged by Owner as independent architects or engineers for design of all or a portion of the Project and to prepare Drawings and Specifications for the construction of the Project. More than one such professional or firm may be employed by Owner, and all such professionals or firms, regardless of number, are referred to in the singular herein.
  - 3.2.3 "Longest Path" means the sequence of directly related activities that comprise the longest continuous chain of activities from the start of the first activity to the finish of the last activity. Each activity in the Longest Path is critical and directly related in that it prevents its successor from being scheduled earlier than it is. For this Project, "Longest Path" shall also include ten percent (10%) Total Float and Weather Days.
  - 3.2.4 "Subcontractor" means a person or entity who has an agreement with Contractor to perform any portion of the Work. The term Subcontractor does not include the Design Professional or any person or entity hired directly by Owner.
  - 3.2.5 "Work" means the provision of all services, labor, materials, supplies, and equipment that are required of Contractor to complete the Project in strict accordance with the requirements of the Agreement and the Construction Documents. Work includes, but is not limited to, the construction services, additional work required by Change Orders, and any other work reasonably inferable from the Construction Documents. The term "reasonably inferable" takes into consideration the understanding of the parties that some details necessary for completion of the Work may not be shown on the Drawings or included in the Specifications, but they are a requirement of the Work if they are a

usual and customary component of the Work or otherwise necessary for complete installation and operation of the Work.

### ARTICLE 4 CONTRACTOR'S RESPONSIBILITIES

- 4.1 Contractor's responsibilities include but are not limited to supervision, furnishing labor, materials, equipment, employment of and responsibility for subcontractors, payment of taxes where applicable, patent fees, royalties, approval fees, license fees, permit fees, filing fees, registration fees, and other governmental charges.
- 4.2 Contractor represents that it is an independent contractor and that it is familiar with the type of Work it is undertaking. Contractor shall furnish construction administration and management services and use Contractor's diligent efforts to perform the Work in an expeditious manner consistent with the Contract Documents. Contractor will cause all persons connected with Contractor directly in charge of the Work to be duly registered and/or licensed under all applicable laws.
- 4.3 Neither Contractor nor any of its agents or employees shall act on behalf of or in the name of Owner except as provided in this Agreement or unless authorized in writing by Owner's Representative.
- 4.4 Contractor shall be responsible for the supervision and coordination of the Work, including the construction means, methods, techniques, sequences, procedures, safety provisions, precautions, and programs utilized, unless the Contract Documents give other specific instructions. In such case, Contractor shall not be liable to Owner for damages resulting from compliance with such instructions unless Contractor recognized and failed to timely report to Owner any error, inconsistency, omission, or unsafe practice that it discovered in the specified construction means, methods, techniques, sequences, procedures, safety provisions, precautions, or programs.
- 4.5 Contractor shall perform Work only within locations allowed by the Contract Documents, applicable laws and regulations, and applicable permits. Laws and regulations include federal, state, and local laws, ordinances, codes, rules, and regulations applicable to the Work that are enacted as of the Agreement date, with which the Constructor must comply.
- 4.6 Contractor shall: (a) proceed with the Work in a manner that does not hinder, delay, or interfere with the work of Owner or others or cause the work of Owner or others to become defective; (b) afford Owner or others reasonable access for introduction and storage of their materials and equipment and performance of their activities; and (c) coordinate Contractor's Work with the work of Owner and others.
- 4.7 Before proceeding with any portion of the Work affected by the construction or operations of Owner or others, Contractor shall give Owner written notification within forty-eight (48) hours of any defects Contractor discovers in Owner's or other's performance or work, which will prevent the proper execution of the Work. Contractor's obligations in this subsection do not create a responsibility for the performance or work of Owner or others, but are for the purpose of facilitating the Work. If Contractor does not notify Owner of defects interfering with the performance of the Work, Contractor acknowledges that the performance or work of Owner or others is not defective and is acceptable for the proper execution of the Work. Following receipt of written notice from Contractor of defects, Owner shall promptly inform Contractor what action, if any, Contractor shall take with regard to the defects.
- 4.8 Prior to commencing the Work, Contractor shall examine and compare the Drawings and Specifications with information furnished by Owner, relevant field measurements made by Contractor, and any visible conditions at the site affecting the Work. During the visit to the site, Contractor shall inspect the existing facilities, systems and conditions to ensure an accurate understanding of the existing conditions as required.

4.9 Should Contractor discover any discrepancies, errors, omissions, or inconsistencies in the Contract Documents, Contractor shall report them to Owner within forty-eight (48) hours of discovery. It is recognized, however, that Contractor is not acting in the capacity of a licensed design professional, and that Contractor's examination is to facilitate construction and does not create an affirmative responsibility to detect discrepancies, errors, omissions, or inconsistencies or to ascertain compliance with applicable laws and regulations, including building codes. Following receipt of written notice from Contractor of defects, Owner shall promptly inform Contractor what action, if any, Contractor shall take with regard to the defects.

4.9.1 Contractor shall have no liability for discrepancies, errors, omissions, or inconsistencies discovered under this section unless Contractor fails to promptly report a discovered or apparent discrepancy, error, omission, or inconsistency to Owner. This does not relieve Contractor of responsibility for its own discrepancies, errors, inconsistencies, or omissions.

- 4.10 Contractor shall provide competent supervision for the performance of the Work. Before commencing the Work, Contractor shall notify Owner in writing of the name and qualifications of its proposed superintendent(s) and project manager, so Owner may review the individual's qualifications. If, for reasonable cause, Owner refuses to approve the individual, or withdraws its approval after giving it, Contractor shall name a different superintendent or project manager for Owner's review. Any disapproved superintendent shall not perform in that capacity thereafter at the site. Contractor's superintendent(s) and project manager shall possess full authority to receive instructions from Owner and to act on those instructions. If Contractor changes its superintendent(s) or project manager or their authority, Contractor shall immediately notify Owner in writing.
- 4.11 Contractor shall be responsible to Owner for acts or omissions of parties or entities performing portions of the Work for or on behalf of Contractor or any of its Subcontractors.
- 4.12 Contractor shall permit only qualified persons to perform the Work. Contractor shall enforce safety procedures, strict discipline, and good order among persons performing the Work.
- 4.13 Contractor shall submit to Owner and the Design Professional all shop drawings, samples, product data, and similar submittals required by the Contract Documents for review and approval. Submittals shall be submitted in accordance with the Uniform General Conditions. Contractor shall be responsible for the accuracy and conformity of its submittals to the Contract Documents requirements.
- 4.14 Contractor acknowledges that it has visited, or has had the opportunity to visit, the site to visually inspect the general and local conditions of the facilities, systems and conditions to ensure an accurate understanding of the existing conditions which could affect the Work.
- 4.15 The Work shall be executed in accordance with the Contract Documents and Contractor agrees that (a) it will use its best efforts to perform the Work in a good and workmanlike manner and in accordance with the highest standards of Contractor's profession or business, and (b) all the Work to be performed will be of the quality that prevails among similar businesses of superior knowledge and skill engaged in providing similar services. All materials used in the Work shall be furnished in sufficient quantities to facilitate the proper and expeditious execution of the Work.
- 4.16 If the Work includes installation of materials or equipment furnished by Owner or others, it shall be the responsibility of Contractor to examine the items so provided and thereupon handle, store, and install the items, unless otherwise provided in the Contract Documents, with such skill as to provide a satisfactory and proper installation. Loss or damage due to acts or omissions of Contractor shall be the responsibility of Contractor and may be deducted from any amounts due or to become due to Contractor. Any defects discovered in such materials or equipment shall be reported at once to Owner. Following receipt of written notice from Contractor of defects, Owner shall promptly inform Contractor what action, if any, Contractor shall take with regard to the defects.

- 4.17 Contractor shall have overall responsibility for safety precautions and programs in the performance of the Work. However, such obligation does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work or for compliance with applicable laws and regulations.
  - 4.17.1 Contractor shall seek to avoid injury, loss, or damage to persons or property by taking reasonable steps to protect: (a) its employees and other persons at the site; (b) materials and equipment stored at onsite or offsite locations for use in the Work; and (c) property located at the site and adjacent to Work areas, whether or not the property is part of the site.
  - 4.17.2 Contractor's site safety representative shall have a duty to prevent accidents. The safety representative shall perform their duty in accordance with the Uniform General Conditions.
  - 4.17.3 If Owner deems any part of the Work or site unsafe, Owner, without assuming responsibility for Contractor's safety program, may require Contractor to stop performance of the Work or take corrective measures satisfactory to Owner, or both. If Contractor does not adopt corrective measures, Owner may perform them and deduct their cost from the Contract Sum. If Owner determines that a particular person does not follow safety procedures, or is unfit or unskilled for the assigned Work, Contractor shall immediately reassign the person upon receipt of Owner's written notice to do so. Contractor agrees to make no claim for damages, for an increase in the Contract Sum or for a change in the Contract Time based on Contractor's compliance with Owner's reasonable request.
- 4.18 If the conditions encountered at the site are: (a) subsurface or other physical conditions materially different from those indicated in the Contract Documents; or (b) unusual and unknown physical conditions materially different from conditions ordinarily encountered and generally recognized as inherent in Work provided for in the Contract Documents, then Contractor shall stop affected Work after the condition is first observed and give written notice of the condition to Owner and the Design Professional within forty-eight (48) hours.
- 4.19 Contractor shall regularly remove debris and waste materials at the site resulting from the Work. Prior to discontinuing Work in an area, Contractor shall clean the area and remove all rubbish and its construction equipment, tools, machinery, waste, and surplus materials. Contractor shall minimize and confine dust and debris resulting from construction activities. At the completion of the Work, Contractor shall remove from the site all construction equipment, tools, surplus materials, waste materials, and debris.
  - 4.19.1 If Contractor fails to commence compliance with cleanup duties within two (2) business days after written notification from Owner of non-compliance, Owner may implement appropriate cleanup measures without further notice and shall deduct the reasonable costs from any amounts due or to become due Contractor in the next payment period.
- 4.20 Contractor shall facilitate the access of Owner, Design Professional, and others to Work in progress.
- 4.21 Contractor shall comply with all applicable laws and regulations at its own costs. Contractor shall be liable to Owner for all loss, cost, or expense attributable to any acts or omissions by Contractor, its employees, subcontractors, and agents for failure to comply with applicable laws and regulations, including fines, penalties, or corrective measures.
- 4.22 Contractor warrants that all materials and equipment shall be new unless otherwise specified, of good quality, in conformance with the Contract Documents, and free from defective workmanship and materials. Contractor shall furnish satisfactory evidence of the quality and type of materials and equipment furnished. Contractor further warrants that the Work shall be free from material

defects not intrinsic in the design or materials required in the Contract Documents. Contractor's warranty shall commence on the Date of Substantial Completion of the Work.

- 4.22.1 Contractor shall obtain from its Subcontractors and Material Suppliers any special or extended warranties required by the Contract Documents. Contractor's liability for such warranties shall be limited to a one-year period. After that period, Contractor shall provide reasonable assistance to Owner in enforcing the obligations of Subcontractors or Material Suppliers for such extended warranties.
- 4.22.2 If, prior to Substantial Completion and within one year after the date of Substantial Completion of the Work, any Work not complying with the contract requirements ("Defective Work") is found, Owner shall promptly notify Contractor in writing. Unless Owner provides written acceptance of the condition, Contractor shall promptly correct the Defective Work at its own cost and time and bear the expense of additional Work required for correction of any Defective Work for which it is responsible.
- 4.22.3 With respect to any portion of Work first performed after Substantial Completion, the one-year period shall be extended by the period between Substantial Completion and the actual performance of the later Work. Correction periods shall not be extended by corrective work performed by Contractor.
- 4.22.4 If Contractor fails to correct Defective Work within a reasonable time after receipt of written notice from Owner prior to final payment, Owner may correct it in accordance with Owner's right to carry out the Work. In such case, an appropriate Change Order shall be issued deducting the cost of correcting the Defective Work from payments then or thereafter due Contractor. If payments then or thereafter due Contractor are not sufficient to cover such amounts, Contractor shall pay the difference to Owner.
- 4.22.5 If Contractor's correction or removal of Defective Work causes damage to or destroys other completed or partially completed Work or existing buildings, Contractor shall be responsible for the cost of correcting the destroyed or damaged property.

## ARTICLE 5 SUBCONTRACTS

- 5.1 With the prior written approval of Owner, Contractor may subcontract such services as Contractor deems necessary to meet its obligations under this Agreement. Subcontractors shall be qualified and experienced in the type of work they will be performing. Owner shall have the right to reject any subcontractor but such right shall not relieve the responsibility of Contractor for his work and the work of the subcontractors. Contractor expressly assumes such responsibility and liability.
- 5.2 Contractor shall be responsible for the management of the Subcontractors in the performance of the Work.
- 5.3 If this Agreement is terminated, each subcontract agreement shall be assigned by Contractor to Owner, subject to the prior rights of any surety, provided that: (a) this Agreement is terminated by Owner pursuant to Section 11.1; and (b) Owner accepts such assignment, after termination by notifying the Subcontractor and Contractor in writing, and assumes all rights and obligations of Contractor pursuant to each subcontract agreement.
- 5.4 Contractor agrees to bind every Subcontractor and material supplier (and require every Subcontractor to so bind its sub-subcontractors and material suppliers) to all provisions of this Agreement as they apply to the Subcontractors' or material Suppliers' portions of the Work.
- 5.5 Contractor shall comply with the HUB Program as defined by Tex. Gov't Code, Chapter 2161. Failure to comply with the HUB Program may constitute a material breach of this Contract as determined by Owner's sole discretion.

5.6 Contractor agrees to comply with the established HUB Subcontracting Approach and shall make no changes to the HUB Subcontracting Approach without the prior written approval of Owner. Contractor will work with the Business Support Services HUB Coordinator to develop the HUB Subcontracting Plan (HSP). Further details concerning the HSP are located within the Uniform General Conditions.

### ARTICLE 6 OWNER'S RESPONSIBILITIES

- 6.1 Owner shall provide Contractor with reasonable access to the site to assist Contractor in its performance of all tasks reasonably necessary for the completion of Work.
- 6.2 Owner hereby expressly reserves the right from time to time to designate by notice to Contractor one or more representatives to act partially or wholly for Owner in connection with the performance of Owner's obligations hereunder. Contractor shall act only upon instructions from such representatives unless otherwise specifically notified to the contrary.
- 6.3 Owner's Designated Representative shall: (a) be fully acquainted with the Project, Work, and site; (b) agree to furnish the information and Work required of Owner in a timely manner; and (c) have the authority to bind Owner (to the extent of their authority) in all matters requiring Owner's approval or authorization. If Owner changes its representative, Owner shall promptly notify Contractor in writing.
- 6.4 Owner will furnish the site plan to document existing conditions to the extent requested by Contractor and as reasonably necessary for the completion of Contractor's Work.
- 6.5 Owner shall examine, or cause its representative(s) to examine documents submitted by Contractor and render decisions pertaining thereto promptly or within a reasonable time to avoid unreasonable delay in the progress of Contractor's Work. Review and approval of a document by Owner shall not waive the contractual responsibility or liability of Contractor.
- 6.6 Owner shall furnish information required as expeditiously as necessary for the orderly progress of Contractor's Work.
- 6.7 Except for those permits and fees related to the Work which are the responsibility of Contractor, Owner shall secure and pay for all other permits, approvals, easements, assessments, and fees required for the development, construction, use or occupancy of permanent structures or for permanent changes in existing facilities, including the building permit.
- 6.8 Owner may perform work at the site directly or by others. Contractor and Owner shall coordinate the activities of all forces at the site and agree upon fair and reasonable schedules and operational procedures for site activities.

### ARTICLE 7 SCHEDULE, COMMENCEMENT, AND COMPLETION

- 7.1 Owner shall provide a Notice to Proceed in which a date for commencement of the Work to be performed shall be stated. Contractor shall achieve Substantial Completion of the work no later than {Written Number} ({#}) calendar days from the date of the Notice to Proceed, subject to extension only by approved Change Orders. Final Completion, including correction of deficiencies, shall be achieved no later than thirty (30) calendar days from the date of the Substantial Completion. Contractor understands that the Substantial Completion and Final Completion dates shall not be extended regardless of weather, strikes, or for any other reason unless Change Orders so approve.
  - 7.1.1 Time is of the essence for this Agreement and the Contract Documents.

- 7.1.2 Unless instructed by Owner in writing, Contractor shall not knowingly commence the Work before the effective date of insurance to be provided by Contractor.
- 7.2 Schedule.

7.2.1

Contractor shall submit for review and approval a Baseline Schedule to Owner and Design Professional when submitting the response to request for competitive sealed proposal. The Baseline Schedule shall indicate the dates for starting and completing the various aspects required to complete the work and shall utilize the Longest Path method with fully editable logic. The schedule shall include mobilization, procurement, installation, testing, inspection, delivery of Close-out Documents, and acceptance of all Work. This Baseline Schedule shall become the comparison to the actual conditions throughout the Contract duration and become a part of the Work Progress Schedule (WPS).

- 7.2.1.1 A Baseline Schedule that does not have at least the minimum amount of Total Float at submission will result in the Contractor forfeiting all claims to WPS extensions and/or delays as a result of contract changes and/or excusable delays as described in the UGCs.
- 7.2.1.2 In accordance with the UGCs, the WPS shall include at least ten percent (10%) Total Float and Weather Days from the effective date of Notice to Proceed for construction services to Substantial Completion Date.
- 7.2.1.3 Total Float shall not be shown as a single activity, but rather the results of the relationship between the early and late finish dates or early and late start dates of each activity. The allocation of project float shall be determined by the Project Team as conditions warrant.
- 7.2.2 As construction proceeds, Contractor shall update and submit the WPS with the Owner, Architect, and Contractor (OAC) meeting minutes. The WPS is to indicate detailed listing for all activity sequences, durations, or milestone dates for activities of the Project, including, without limitation:
  - 7.2.2.1 commencement, milestones, and completion dates for bidding/proposals phase, construction phase, and project stages;
  - 7.2.2.2 times of commencement and completion, duration, and allocation of labor and materials for each Subcontractor;
  - 7.2.2.3 other detailed schedule activities as directed by Owner including, but not limited to, Owner-managed work under separate contracts such as equipment, furniture and furnishings, telephones, project security, property protection, life-safety systems, integration with central campus monitoring systems, information and instructional technology, data-transmission systems, and computer technology systems;
  - 7.2.2.4 a recommended schedule for Owner's purchase of materials and equipment requiring long lead-time procurement, delivery dates of products requiring long lead time procurement, and methods to expedite and coordinate delivery of long lead-time procurements including coordination of the schedule;
  - 7.2.2.5 Owner's occupancy requirements and estimated date of Substantial Completion of the Project;
- 7.2.2.6 potential and actual variances between scheduled and probable completion dates;
- 7.2.2.7 review of schedules for Work not started or incomplete and recommendation to Owner of adjustments in the schedules to conform to the probable completion dates;
- 7.2.2.8 summary reports to Owner of each schedule update and documentation of all changes in construction schedules; and
- **7.2.2.9** evaluation of Subcontractor's personnel, equipment, and availability of supplies and materials, with respect to each Subcontractor's ability to meet the schedule and recommendation to Owner when any subcontract requirements are not met, or appear unlikely to be met.
- During OAC meeting, Contractor shall: review progress since last meeting with the Owner and Design Professional; determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's WPS; determine how construction behind schedule will be expedited; secure commitments from parties involved to do so; discuss whether schedule revisions are required to ensure the current and subsequent activities will be completed within the Contract Time; and review WPS for next period.
- 7.2.4 In addition to attending regularly scheduled OAC Project progress meetings, Contractor shall schedule, direct and attend interim progress meetings (i.e., commissioning meetings, coordination meetings, pre-installation meetings) with other members of the Project Team as required to maintain Project progress. Contractor shall record and distribute the minutes of each meeting to each Project Team member. The minutes shall identify critical activities that require action and the dates by which each activity must be completed.
- 7.2.5 If WPS updates indicate the Longest Path contained in prior WPS will not be met, Contractor shall notify the Owner in writing within forty-eight (48) hours and make recommendations to Owner. Should the item be critical in nature, Contractor shall have a follow-up discussion with Owner.
- 7.2.6 Contractor, concurrently with revising the schedule, shall prepare tabulated reports showing the following:
  - 7.2.6.1 Identification of activities that have changed
  - 7.2.6.2 Changes in early and late start dates
  - 7.2.6.3 Changes in early and late finish dates
  - 7.2.6.4 Changes in activity durations in workdays
  - 7.2.6.5 Changes in the Longest Path
  - 7.2.6.6 Changes in Contract Time
  - 7.2.6.7 Show relationship between activities on initial and updated schedule.
- 7.2.7 Contractor shall provide the necessary Longest Path schedule control with a goal to attain the Substantial Completion Date of the Project, so that Owner can occupy and utilize the entire Project facilities on such date as well as a Punch List and Final Completion date;

7.2.3

- 7.2.7.1 Punch List and Final Completion: The Longest Path schedule control shall include not more than thirty (30) days or an agreed to timeframe approved by Owner for punch list and final completion.
- 7.2.8 Contractor shall coordinate preparation of the Schedule of Values with preparation of WPS.
- 7.2.9 Contractor shall create and maintain the WPS in a format acceptable to Owner (the license and training for which shall be at Contractor's sole expense).
- 7.2.10 Contractor shall notify Owner within forty-eight (48) hours should a periodic update to the WPS indicates the Work is fourteen (14) or more calendar days behind the current approved WPS. Contractor shall submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the WPS and indicate changes to working hours, working days, crew sizes, and equipment required for compliance, and date by which recovery will be accomplished.
  - 7.2.10.1 Owner's Notice Not to Accelerate to Contractor shall not be considered acceleration by Owner and Owner shall not be responsible for any increased costs incurred by Contractor.
- 7.2.11 Contractor shall refer to the Uniform General Conditions for schedule extension and delay processes.
- 7.2.12 Owner may determine the sequence in which the Work shall be performed, provided it does not unreasonably interfere with the WPS. Owner may require Contractor to make reasonable changes in the sequence at any time during the performance of the Work in order to facilitate the performance of work by Owner or others. To the extent such changes increase Contractor's costs or time, the Contract Sum and Contract Time shall be equitably adjusted.

#### ARTICLE 8 COMPENSATION AND PAYMENT

8.1 In full consideration of Contractor's performance of the Work and services under this Agreement, Owner shall pay to Contractor, subject to additions and deductions provided herein, the sum of {Amount} and No/100 Dollars ({#.00), in periodic progress payments as hereinafter provided.

The Contract Sum is the total of the following:

Base Bid

Alternate 1 -

Alternate 2 -

Alternate 3 -

Payments and Performance Bonds

\${Amount} \${Amount} \${Amount} \${Amount} \${Amount}

## TOTAL

\${Amount}

8.1 On a monthly basis and subject to procedures set forth in the Uniform General Conditions, Contractor shall submit an Application for Payment, in accordance with Division 01 Specifications. Supporting documentation should include, without limitation: a certified statement as to the Work completed and current schedule of values; a project-to-date job cost report and a current period job cost report; a breakdown of materials and labor; supporting subcontractor invoices and sworn statements and waivers of lien for all amounts paid to Contractor for materials, labor, equipment, and other costs; and copies of third-party invoices, receipts, and other third-party supporting documentation.

- 8.2 Based on the Application for Payment, Owner shall make a periodic progress payment to Contractor for the cost of labor, materials, and equipment incurred by Contractor in relation to the Work during the previous month, except that the percentage of the total amount paid shall not exceed the percentage amount of the Work that has been completed as determined in the reasonable judgment of Owner. Upon verification of costs incurred and percentage of Work completed, Owner will make payment to Contractor within thirty (30) working days or will notify Contractor of any objection to the invoiced amount.
- 8.3 Owner shall have the right to withhold from payments due Contractor such sums as are necessary to protect Owner against any loss or damage which may result from negligence by Contractor or failure of Contractor to perform Contractor's obligations under this Agreement and as set forth in the Uniform General Conditions.
- 8.4 The final request for payment shall not be made until Contractor delivers to Owner a complete release of all liens arising out of this Agreement and an affidavit that so far as Contractor has knowledge or information, the release includes and covers all materials and Work over which Contractor has control for which a lien could be filed, but Contractor may, if any agent or consultant refuses to furnish a release in full, furnish a bond satisfactory to Owner to indemnify Owner against any lien. If any lien remains unsatisfied after all payments are made, Contractor shall refund to Owner all moneys Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees, and Owner shall have all remedies at law and in equity.
- 8.5 In addition to the procedures contained in the Uniform General Conditions, Owner shall have no obligation to make Final Payment until a final accounting of the Work has been submitted by Contractor and has been verified by Owner or Owner's representatives. The aggregate total of payments to Contractor shall not exceed the total of the actual Work as verified by Owner or Owner's representative from Contractor's final accounting, as certified for payment in accordance with the Agreement. If payments made to Contractor exceed that which is due and owing pursuant to this Article, then Contractor shall promptly refund such excess to Owner.
- 8.6 Nothing contained herein shall require Owner to pay Contractor an aggregate amount exceeding the Contract Sum or to make payment if in Owner's belief the cost to complete the Work would exceed the Contract Sum less previous payments to Contractor. Any provision to the contrary notwithstanding, Owner shall not be obligated to make any payment (whether a periodic progress payment or Final Payment) to Contractor hereunder if any one or more of the following conditions precedent exist:
  - 8.6.1 Contractor is in breach or default under this Agreement;
  - 8.6.2 Any part of such payment is attributable to services which are not performed in accordance with this Agreement; provided, however, such payment shall be made as to the part thereof attributable to services which were performed in accordance with this Agreement;
  - 8.6.3 Contractor has failed to make payments promptly to consultants or other third parties used in connection with the services for which Owner has made payment to Contractor;
  - 8.6.4 If Owner, in its good faith judgment, determines that the portion of the compensation then remaining unpaid will not be sufficient to complete the services in accordance with this Agreement, no additional payments will be due Contractor hereunder unless and until Contractor, at Contractor's sole cost, performs a sufficient portion of the remaining services so that such portion of the compensation then remaining unpaid is determined by Owner to be sufficient to so complete the then remaining services; or

- 8.6.5 To the extent Liquidated Damages or actual damages are imposed by Owner for failure of Contractor to complete the Work within the Contract Time.
- 8.7 No partial payment made hereunder shall be, or shall be construed to be, final acceptance or approval of that part of the services to which such partial payment relates, or a release of Contractor of any Contractor's obligations hereunder or liabilities with respect to such services.
- 8.8 Contractor shall promptly pay all bills validly due and owing for labor and material performed and furnished by others in connection with the performance of the construction of the Work.
- 8.9 The acceptance by Contractor or Contractor's successors of Final Payment under this Agreement, shall constitute a full and complete release of Owner from any and all claims, demands, and causes of action whatsoever which Contractor or Contractor's successors have or may have against Owner under the provisions of this Agreement except those previously made in writing and identified by Contractor as unsettled at the time of the final request for payment.

#### ARTICLE 9 BONDS

- 9.1 Prior to commencing work, Contractor shall provide performance and payment bonds in accordance with the requirements set forth in the Uniform General Conditions. The penal sum of the payment and performance bonds shall be for 100% of the Contract Sum. Any increase in the Contract Sum shall require a rider to the Bonds increasing penal sums accordingly. Contractor shall endeavor to keep its surety advised of changes potentially impacting the Contract Time and Contract Sum. Owner will pay Contractor the bonding costs as a pass through amount not to exceed {Amount} (\${#}.00) with proper documentation provided along with an Application for Payment. No retainage is to be withheld with respect to the cost of the required bonds.
- 9.2 Contractor shall not cause or allow any of its bonds to be canceled nor permit any lapse during the term of this Agreement.

## ARTICLE 10 INDEMNITY AND INSURANCE

10.1 Contractor covenants and agrees to FULLY INDEMNIFY and HOLD HARMLESS Owner and its component institutions, the UNTS Board of Regents, elected and appointed officials, directors, officers, employees, agents, representatives, and volunteers, individually or collectively, from and against any and all costs, claims, liens, damages, losses, expenses, fees, fines, penalties, proceedings, actions, demands, causes of action, liability, and suits of any kind and nature, including but not limited to, personal or bodily injury, death, or property damage, made upon Owner directly or indirectly arising out of, resulting from, or related to Contractor's activities under the Contract, including any acts or omissions of Contractor, or any director, officer, employee, agent, representative, consultant, or Subcontractor of Contractor, and their respective directors, officers, employees, agents, and representatives while in the exercise of performance of the rights or duties under the Contract. The indemnity provided for in this paragraph does not apply to any liability resulting from the negligence of Owner or separate contractors in instances where such negligence causes personal injury, death, or property damage. IN THE EVENT CONTRACTOR AND OWNER ARE FOUND JOINTLY LIABLE BY A COURT OF COMPETENT JURISDICTION, LIABILITY WILL BE APPORTIONED COMPARATIVELY IN ACCORDANCE WITH THE LAWS OF THE STATE OF TEXAS, WITHOUT WAIVING ANY GOVERNMENTAL IMMUNITY AVAILABLE TO THE STATE UNDER TEXAS LAW AND WITHOUT WAIVING ANY DEFENSES OF THE PARTIES UNDER TEXAS LAW.

- 10.1.1 The provisions of this indemnification are solely for the benefit of the parties hereto and not intended to create or grant any rights, contractual or otherwise, to any other person or entity.
- 10.1.2 Contractor shall promptly advise Owner in writing of any claim or demand against Owner or against Contractor known to Contractor related to or arising out of Contractor's activities under this Contract.
- 10.2 Insurance.

10.2.1

Contractor shall not commence work under the Agreement until it has obtained all insurance required in accordance with this Agreement and the Uniform General Conditions and until such insurance has been reviewed and approved in writing by Owner. Approval of the insurance by Owner shall not relieve nor decrease the liability of Contractor hereunder. Prior to commencing of the Work Contractor shall provide evidence as required by this Article that demonstrates coverage for Employer's Liability, Workers' Compensation, Commercial General Liability, and Automobile Liability as set forth in the Uniform General Conditions are in full force and effect. Prior to commencing any construction work, Builder's Risk as set forth in the Uniform General Conditions shall be increased as necessary for each separate bid package, phase, or stage of construction prior to the commencement of construction for that package, phase, or stage. No retainage is to be withheld with respect to the cost of the required insurance.

Owner shall obtain builder's risk insurance coverage for the Project. In the event of an insured loss caused by the action or inaction of Contractor, or by any subcontractor or sub-subcontractor, or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable, Contractor shall be responsible for, and reimburse to Owner, any applicable deductible under the builder's risk insurance policy, which may be up to \$25,000. Any costs associated with Contractor's responsibility for the applicable deductible shall not be considered cost of Work.

- 10.2.2 Contractor shall include Owner, {Campus if different from Owner} and the Board of Regents of the University of North Texas System as loss payees and Additional Insured's on General Liability and Business Automobile Liability. The Commercial General Liability, Business Automobile Liability, and Worker's Compensation policies shall include a waiver of subrogation in favor of Owner.
- 10.2.3 Insurance policies required under this Article shall contain a provision that the insurance company must give Owner written notice transmitted in writing: (a) thirty (30) calendar days before coverage is non-renewed by the insurance company and (b) within ten (10) business days after cancellation of coverage by the insurance company. Prior to start of Services and upon renewal or replacement of the insurance policies, Contractor shall furnish Owner with certificates of insurance until one year after acceptance of the Services. If any insurance policy required under this Article is not to be immediately replaced without lapse in coverage when it expires, exhausts it limits, or is to be cancelled, Contractor will give Owner written notice within forty-eight (48) hours upon actual or constructive knowledge of such condition.
- 10.2.4 Owner reserves the right to review the insurance requirements set forth in this Article during the effective period of the Agreement and to make reasonable adjustments to the insurance coverage and their limits when deemed necessary and prudent by Owner based upon changes in statutory law, court decisions, or the claims history of the industry as well as Contractor.
- 10.2.5 Owner shall be entitled, upon request, and without expense, to receive copies of the policies, all endorsements thereto and documentation to support costs and may make

any reasonable requests for deletion, or revision or modification of particular policy terms, conditions, limitations, exclusions and costs, except where policy provisions are established by law or regulation binding upon either of the Parties or the underwriter of any of such polices. Any price credits determined in the insurance review will be refundable to Owner. Actual losses not covered by insurance as required by this Article shall be paid by the Contractor.

10.2.6

Contractor shall not cause or allow any of its insurance to be canceled nor permit any lapse during the term of the Agreement or as required in the Agreement.

#### ARTICLE 11 TERMINATION AND SUSPENSION

- 11.1 With or without cause, Owner reserves and has the right to terminate this Agreement or to cancel, suspend or abandon execution of all or any Work in connection with this Agreement at any time upon written notice to Contractor. Contractor may terminate this Agreement upon seven (7) days written notice to Owner only if Owner substantially fails to perform its obligations under Article 6 of this Agreement or fails to timely pay Contractor as required under Article 8, and after adequate written notice is delivered to Owner and Owner has failed to take action within thirty (30) days in order to begin to correct the problem.
  - 11.1.1 In the event of termination, cancellation, suspension, or abandonment that is not the fault of Contractor, Owner shall pay to Contractor as full payment for all services performed and all expenses incurred under this Agreement, the appropriate portion of Contract Sum due under Article 8 as shall have become payable for Work actually rendered hereunder by Contractor.
  - 11.1.2 In ascertaining the services actually rendered hereunder up to the date of termination, cancellation, suspension, or abandonment of this Agreement, consideration shall be given to both completed work and work in progress, to complete and incomplete Drawings, and to other related documents, whether delivered to Owner or in possession of Contractor.
  - 11.1.3 For any said sum paid under this Article, Contractor agrees to accept same in full settlement of all claims for services rendered under this Agreement.
- 11.2 If, upon payment of the amount required to be paid under this Article following the termination of this Agreement, Owner thereafter should determine to complete the original project or, substantially, the same project without major change in scope; Owner, for such purposes, shall have the right of utilization of any and all original tracings, Drawings, calculations, design analysis, Specifications, estimates, related data, and other documents including Construction Documents, prepared under this Agreement by Contractor who shall make them available to Owner upon request, with compensation to Contractor limited to actual reproduction costs. Owner agrees to credit Contractor with such authorship as may be due but is not required to renew this Agreement.
- 11.3 Upon request at the termination, cancellation, suspension, or abandonment of this Agreement, Contractor agrees to furnish to Owner copies of the latest documents prepared by Contractor for the Project.
- 11.4 A termination, cancellation, suspension, or abandonment under this Article shall not relieve Contractor or any of its employees of liability for violations of this Agreement, or any willful, negligent or accidental act or omission of Contractor. In the event of a termination under this Article, Contractor hereby consents to employment by Owner of a substitute contractor to complete the services under this Agreement, with the substitute contractor having all rights and privileges of the original contractor of the Project.

#### ARTICLE 12 MISCELLANEOUS

- 12.1 <u>Assignment.</u> The terms and conditions of this Agreement shall be binding upon the Parties, their partners, successors, permitted assigns, and legal representatives. This Agreement is a service contract for the services of Contractor, and Contractor's interest in this Agreement, duties hereunder and/or fees due hereunder may not be assigned or delegated to a third party. The benefits and burdens of this Agreement are, however, assignable by Owner to a component or affiliate of Owner or a branch or agency of the State of Texas.
- 12.2 Death or Incapacity. If Contractor transacts business as an individual, his death or incapacity shall automatically terminate this Agreement as of the date of such event, and neither he nor his estate shall have any further right to perform hereunder; and Owner shall pay him or his estate the compensation payable under the Agreement for any services rendered prior to such termination. If Contractor is a firm comprised of more than one principal and any one of the members thereof dies or becomes incapacitated and the other members continue to render the services covered herein, Owner will make payments to those continuing as though there had been no such death or incapacity, and Owner will not be obliged to take any account of the person who died or became incapacitated or to make any payment to such person or his estate. This provision shall apply in the event of progressive or simultaneous occasions of death or incapacity among any group of persons named as Contractor; and if death or incapacity befalls the last one of such group before this Agreement is fully performed, then the rights shall be as if there had been only one Contractor. In any event, notice of the death or incapacity of any principal shall be given to Owner by any surviving principal within a reasonable time.
- 12.3 <u>Irreparable Injury.</u> It is acknowledged and agreed that Contractor's services to Owner are unique, which gives a peculiar value to Owner and for the loss of which Owner cannot be reasonably or adequately compensated in damages; accordingly, Contractor acknowledges and agrees that a breach by Contractor of the provisions hereof will cause Owner irreparable injury and damage. Contractor, therefore, expressly agrees that Owner shall be entitled to injunctive and/or other equitable relief in any court of competent jurisdiction to prevent or otherwise restrain a breach of this Agreement, but only if Owner is not in breach of this Agreement.

## 12.4 <u>Certifications.</u>

- 12.4.1 Pursuant to Texas Family Code, Section 231.006, Contractor certifies that it is not ineligible to receive the award of or payments under this Agreement and acknowledges that this Agreement may be terminated and payment may be withheld if this certification is inaccurate.
- 12.4.2 Pursuant to Texas Government Code, Section 2155.004, Contractor certifies that the business entity named in this Agreement is not ineligible to receive the award of or payments under this Agreement and acknowledges that this Agreement may be terminated and payment withheld if this certification is inaccurate.
- 12.4.3 If a corporate or limited liability company, Contractor certifies that it is not currently delinquent in the payment of any Franchise Taxes due under Texas Tax Code, Chapter 171, or that the corporation or limited liability company is exempt from the payment of such taxes, or that the corporation or limited liability company is an out-of-state corporation or limited liability company that is not subject to the Texas Franchise Tax, whichever is applicable.
- 12.4.4 Pursuant to Texas Government Code Sections 2107.008 and 2252.903, Contractor agrees that any payments owing to Contractor under this Agreement may be applied directly toward any debt or delinquency that Contractor owes the State of Texas or any

agency of the State of Texas regardless of when it arises, until such debt or delinquency is paid in full.

- 12.4.5 Pursuant to Texas Government Code Chapter 2252, Subchapter F, Contractor certifies that it is not engaged in business with Iran, Sudan, or a foreign terrorist organization. Contractor acknowledges this Agreement may be terminated if this certification is inaccurate.
- 12.4.6 Pursuant to Texas Government Code Sections 2252.201-2252.205, Contractor certifies that it is in compliance with the requirement that any iron or steel product produced through a manufacturing process and used in the Project is produced in the United States.
  - 12.4.7 If the Agreement is subject to Texas Gov't Code Section 2271.002, Contractor hereby represents, verifies, and warrants that it does not boycott Israel and will not boycott Israel during the term of the Agreement. If the Agreement is subject to Texas Gov't Code Section 2274.002, Contractor hereby represents, verifies, and warrants that it does not have a practice, policy, guidance, or directive that discriminates against a firearm entity or firearm trade association and will not discriminate against a firearm entity or firearm trade association during the term of the Agreement. If the Agreement. If the Agreement is subject to Texas Gov't Code Section 2274.002, Contractor hereby represents, verifies, and warrants that it does not boycott energy companies and will not boycott energy companies during the term of the Agreement.
  - 12.4.8 Contractor certifies that no member of the Board of Regents of the University of North Texas System, or executive officers, including component institutions, has a financial interest, directly or indirectly, in the transaction that is the subject of this Agreement.
- 12.5 <u>Illegal Dumping.</u> Contractor shall ensure that it and all of its subcontractors and assigns prevent illegal dumping of litter in accordance with Title 5, Texas Health and Safety Code, Chapter 365.
- 12.6 Asbestos Containing Materials.
  - 12.6.1 Contractor shall provide a notarized certification to Owner that all equipment and materials used in fulfillment of its Contract responsibilities are non-Asbestos Containing Building Materials (ACBM) no later than Contractor's application for Final Payment as required by the Uniform General Conditions.
  - 12.6.2 All materials used in this Project shall be certified as non-ACBM. Contractor shall take whatever measures it deems necessary to insure that all employees, suppliers, fabricators, material men, subcontractors, or their assigns, comply with the following acts:
    - 12.6.2.1 Asbestos Hazard Emergency Response Act (AHERA—40 CFR 763, Subpart E)
    - 12.6.2.2 National Emission Standards for Hazardous Air Pollutants (NESHAP— EPA 40 CFR 61, Subpart M, National Emission Standard for Asbestos)
    - 12.6.2.3 Texas Asbestos Health Protection Rules (TAHRP—Tex. Admin. Code Title 25, Part 1, Ch. 295, Subchapter C, Asbestos Health Protection)
- 12.7 <u>State Auditor's Right to Audit.</u> Pursuant to Section 2262.154 of the Texas Government Code, the state auditor may conduct an audit or investigation of any entity receiving funds from the state directly under any contract or indirectly through a subcontract under the contract. The acceptance of funds by Contractor or any other entity or person directly under the Agreement or indirectly through a subcontract of the authority of the state auditor,

under the direction of the legislative audit committee, to conduct an audit or investigation in connection with those funds. Under the direction of the legislative audit committee, the Contractor or other entity that is the subject of an audit or investigation by the state auditor must provide the state auditor with access to any information the state auditor considers relevant to the investigation or audit. Contractor shall ensure that this paragraph concerning the authority to audit funds received indirectly by Subcontractors through the contract and the requirement to cooperate is included in any subcontract awards.

12.8 <u>Records and Right to Audit.</u> Owner shall have the right to verify and audit the details set forth in Contractor's billings, certificates, accountings, cost data, and statements, either before or after payment therefore, by: (a) inspecting the books and records of Contractor during normal business hours; (b) examining any reports with respect to this Project; (c) interviewing Contractor's business employees; (d) visiting the Project site; and (e) other reasonable action. Records of Contractor's costs, reimbursable expenses pertaining to the Project and payments shall be kept on a generally recognized accounting basis and shall be made available to Owner or its authorized representative during business hours for audit or other purposes as determined by Owner and in accordance with the requirements in the Uniform General Conditions.

12.9 <u>Notices.</u> All notices, consents, approvals, demands, requests or other communications provided for or permitted to be given under any of the provisions of this Agreement shall be in writing and shall be deemed to have been duly given or served when delivered by hand delivery or when deposited in the U.S. Mail by registered or certified mail, return receipt requested, postage prepaid, and addressed as follows:

If to Owner: {Name} {Title} University of North Texas {System or Institution Name} 1155 Union Circle #311040 Denton, Texas 76203-5017 If to Contractor: {Contact Name} {Firm Name} {Street Address} {City, State Zip}

or to such other person or address as may be given in writing by either party to the other in accordance with the aforesaid.

- 12.10 <u>Independent Contractor.</u> Contractor recognizes that it is engaged as an independent contractor and acknowledges that Owner will have no responsibility to provide transportation, insurance or other fringe benefits normally associated with employee status. Contractor, in accordance with its status as an independent contractor, covenants and agrees that it shall conduct itself consistent with such status, that it will neither hold itself out as nor claim to be an officer, partner, employee or agent of Owner by reason hereof, and that it will not by reason hereof make any claim, demand or application to or for any right or privilege applicable to an officer, partner, employee or agent of Owner, including, but not limited to, unemployment insurance benefits, social security coverage or retirement benefits. Contractor hereby agrees to make its own arrangements for any of such benefits as it may desire and agrees that it is responsible for all income taxes required by applicable law.
- 12.11 Loss of Funding. Performance by Owner under the Agreement may be dependent upon the appropriation and allotment of funds by the Texas State Legislature (the "Legislature") and/or allocation of funds by the Board of Regents of The University of North Texas System (the "Board"). If the Legislature fails to appropriate or allot the necessary funds, or the Board fails to allocate the necessary funds, then Owner shall issue written notice to Contractor and Owner may terminate the Agreement. Contractor acknowledges that appropriation, allotment, and allocation of funds are beyond the control of Owner.

- 12.12 Confidentiality. All information owned, possessed or used by Owner which is communicated to, learned, developed or otherwise acquired by Contractor in the performance of services for Owner. which is not generally known to the public, shall be confidential and Contractor shall not, beginning on the date of first association or communication between Owner and Contractor and continuing through the term of this Agreement and any time thereafter, disclose, communicate or divulge, or permit disclosure, communication or divulgence, to another or use for Contractor's own benefit or the benefit of another, any such confidential information, unless required by law. Except when defined as part of the Work. Contractor shall not make any press releases, public statements, or advertisement referring to the Project or the engagement of Contractor as an independent contractor of Owner in connection with the Project, or release any information relative to the Project for publications, advertisement or any other purpose without the prior written approval of Owner. Contractor shall obtain assurances similar to those contained in this subparagraph from persons, and subcontractors retained by Contractor. Contractor acknowledges and agrees that a breach by Contractor of the provisions hereof will cause Owner irreparable injury and damage. Contractor. therefore, expressly agrees that Owner shall be entitled to injunctive and/or other equitable relief in any court of competent jurisdiction to prevent or otherwise restrain a breach of this Agreement.
- 12.13 <u>Open Records.</u> Owner shall release information to the extent required by the Texas Public Information Act and other applicable law. If required, Contractor shall make public information available to Owner in an electronic format. The requirements of Subchapter J, Chapter 552, Government Code, may apply to this Agreement and Contractor agrees that the Agreement can be terminated if Contractor knowingly or intentionally fails to comply with a requirement of that subchapter.
- 12.14 <u>Governing Law and Venue</u>. This Agreement and all of the rights and obligations of the parties hereto and all of the terms and conditions hereof shall be construed, interpreted and applied in accordance with and governed by and enforced under the laws of the State of Texas and venue shall be as provided in Texas Education Code Section 105.151 for any legal proceeding pertaining to this Agreement.
- 12.15 <u>Waivers.</u> No delay or omission by either of the parties hereto in exercising any right or power accruing upon the non-compliance or failure of performance by the other party hereto of any of the provisions of this Agreement shall impair any such right or power or be construed to be a waiver thereof. A waiver by either of the parties hereto of any of the covenants, conditions or agreements hereof to be performed by the other party hereto shall not be construed to be a waiver of any subsequent breach thereof or of any other covenant, condition or agreement herein contained.
- 12.16 <u>Severability.</u> Should any term or provision of this Agreement be held invalid or unenforceable in any respect, the remaining terms and provisions shall not be affected and this Agreement shall be construed as if the invalid or unenforceable term or provision had never been included.

IN WITNESS WHEREOF the parties hereto have executed this Agreement in the day and year first above written.

#### OWNER: UNIVERSITY OF NORTH TEXAS {SYSTEM OR INSTITUTION NAME}

By: \_\_\_\_\_ (signature)

[Authorized Signatory Name] [Authorized Signatory Title]

Date: \_

CONTRACTOR:

# {FIRM NAME}

By: \_\_\_\_\_ (signature)

(typed name and title)

Date:

Street/PO Box

City, State, ZIP

Telephone

State of TX Vendor ID Number

# EXHIBIT A

## SPECIFICATIONS, DRAWINGS, AND ADDENDA

## SPECIFICATIONS

As listed in project manual titled [Title], prepared by [Professional], issued for construction on [Date].

# DRAWINGS

Entitled [Title], as prepared by [Professional], issued for construction on [Date], consisting of the following pages:

Sheet Number	<u>Title</u>
ADDENDA	
Number	Title
Number	THUE

# PROJECT MANUAL

University of North Texas UNT Advanced Air Mobility (UAAM) Test Center Denton, Texas

> Prepared by: Walter P. Moore 500 N Akard Street Suite 2300 Dallas, Texas 75201 214.740.6200

Issued for Construction Bid Package – October 7, 2022 Project Number M04.22008.00

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**END OF SECTION** 



Walter P. Moore and Associates, Inc. TBPE Firm Registration No. 1856



Walter P. Moore and Associates, Inc TBPE Firm Registration No. 1856



B&H Engineers, Inc TBPE Firm Registration No 9102

#### SECTION 01 45 29

#### STRUCTURAL TESTING AND INSPECTIONS

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes requirements for quality assurance and quality control to be completed by the Testing Laboratory, Contractor, and/or the Geotechnical Engineer for the following structural items:
  - 1. Concrete Forming and Accessories.
  - 2. Concrete Reinforcing.
  - 3. Cast-in-Place Concrete.
  - 4. Structural Steel.
  - 5. Earthwork.
- B. Related Requirements:
  - 1. Specification 01 40 00 "Quality Requirements" for other independent testing agency procedures and administrative requirements.

#### 1.3 PRICE AND PAYMENT PROCEDURES

#### A. Unit Prices:

- 1. Cost Proposal: The Testing Laboratory's proposal to the Owner shall contain unit price stipulations for specified tests and inspections and on an hourly basis for personnel. A total estimated price shall also be submitted.
- B. Measurement and Payment
  - 1. Payment of the Testing Laboratory: The Owner will pay for the initial Laboratory services for inspection and testing of materials for compliance with the requirements of the Contract Documents.
  - 2. Payment for Substitution Testing: The Contractor shall arrange for and pay for any additional samples and tests above those required by the Contract Documents as requested by the Contractor for his convenience in performing the work.
  - 3. Payment for Retesting: When initial tests indicate work does not comply with the requirements of the Contract Documents, the Contractor shall be liable to the Owner for the cost for any additional inspections, sampling, testing, and retesting done by the Testing Laboratory.
  - 4. Payment by Contractor: The Contractor shall furnish and pay for the following items if required:
    - a. Soil survey of the location of borrow soil materials, samples of existing soil materials, and delivery to the Contractor's Testing Laboratory.
    - b. Samples of concrete aggregates and delivery to the Contractor's Testing Laboratory.
    - c. Concrete mix designs as prepared by his concrete supplier.
    - d. Site-situated storage boxes for concrete cylinders
    - e. Concrete coring, tests of below strength concrete, and load tests, if ordered by the Owner, Architect, or Engineer.
    - f. Certification of reinforcing steel and prestressing steel mill order.
    - g. Certification of structural steel mill order.
    - h. Certification of portland cement, lime, fly ash.
    - i. Certification of welders and preparation of Welding Procedure Specifications.
    - j. Tests, samples, and mock-ups of substitute material where the substitution is requested by the Contractor and the tests are necessary in the opinion of the Owner, Architect or Engineer to establish equality with specified items.

- k. The making and testing of concrete cylinders for the purpose of evaluating strength at time of form stripping or for post-tensioning or the time spent evaluating the in situ strength of concrete using the Maturity Method.
- I. Any other tests when such costs are required by the Contract Documents to be paid by the Contractor.
- 5. Payment for Tests of Suspected Deficient Work: If, in the opinion of the Building Official, Owner, Architect, or Engineer, any of the work of the Contractor is not satisfactory, the Contractor shall furnish and pay for all tests that the Owner, Architect, or Engineer deem advisable to determine its proper construction. The Owner shall pay all costs if the tests prove the questioned work to be satisfactory.

## 1.4 OWNER RESPONSIBILITIES

- A. The Owner shall engage a Geotechnical Engineer to provide inspection services for the foundations as outlined below in Article 12.
- B. The Owner shall provide a copy of the project plans and specifications to the Testing Laboratory prior to the start of construction and prior to any preinstallation meetings.

#### 1.5 CONTRACTOR RESPONSIBILITIES

- A. The Contractor shall not engage the same Testing Laboratory for construction services as the Owner has for Structural Testing Laboratory Services as defined herein.
- B. Furnishing Samples and Certificates: The Contractor shall provide to the laboratory certificates and representative samples of materials proposed for use in the work in quantities sufficient for accurate testing as specified.
- C. Furnishing Casual Labor, Equipment and Facilities: The Contractor shall furnish casual labor, equipment, and facilities as required for sampling and testing by the laboratory and otherwise facilitate the required inspections and tests.

### 1.6 TESTING LABORATORY RESPONSIBILITIES

- A. The Testing Laboratory shall sample and test materials as they are being installed for compliance with specified acceptance criteria. The Testing Laboratory will report and interpret the test results. The Laboratory shall monitor and report on the installation of construction work and shall perform tests on the completed construction as required to indicate Contractor's compliance with the various material specifications governing this work.
- B. The Testing Laboratory shall serve as a Special Inspector to provide Special Inspection services for the items listed below. The scope of such services for each item shall be as defined in the IBC 2018 or as defined in the local building code of the jurisdiction wherein the project is located. These inspections are mandatory for conformance to the legal requirements of the building code and shall be in addition to the inspections and tests otherwise defined in this specification.
  - 1. Special Inspector Responsibilities:
    - a. The special inspector shall observe the work assigned to ascertain that, to the best of his/her knowledge, it is in conformance with the approved design drawings and specifications.
    - b. The special inspector shall furnish inspection reports to the Building Official, the Architect/Engineer, and the Owner. All discrepancies shall be brought to the immediate attention of the Architect/Engineer, Contractor, and Owner. A report that the corrected work has been inspected shall be sent to the Building Official, the Architect/Engineer, and the Owner.
    - c. The special inspector shall create and maintain a log of all discrepancies throughout the duration of the Project. This log shall include, but is not limited to, discrepancy date, description of discrepancy, drawing and/or detail reference, description of asbuilt condition, description of any remedial work performed, and status of discrepancy. This log shall be submitted to the Architect/Engineer on a periodic basis for review and comment. Upon completion of the Project, this log shall be submitted in its entirety as an attachment to the final signed report described below.
    - d. The special inspector shall submit a final signed report stating whether the work requiring special inspection was, to the best of the inspector's knowledge, in

conformance to the approved plans and specifications and the applicable workmanship provisions of the building code.

- C. The Testing Laboratory shall provide inspections on the following items:
  - 1. Reinforcing steel placement.
    - 2. Concrete work.
    - 3. Welding of reinforcing steel.
    - 4. Bolts to be installed in concrete.
    - 5. Bolts, anchors, and reinforcing bars installed in hardened concrete (post-installed
    - 6. Inspection of structural steel, bolting, and welding material.
    - 7. Welding of structural steel.
    - 8. High-strength bolting.
    - 9. Compacted earth fill.
    - 10. Pier foundations.
- D. Inspections Required by Government Agencies: The Testing Laboratory shall perform inspections and submit reports and certifications as required by government agencies having jurisdiction over the aspects of the project covered by this specification.
- E. Notification of Deficiencies in the Work: The Testing Laboratory shall notify the Architect, Engineer, and Contractor within 24 hours of discovery of observed irregularities and deficiencies of the Work and other conditions not in compliance with the requirements of the Contract Documents. Notification shall be by telephone or e-mail and then in writing (PDF format).
- F. Accounting: The Testing Laboratory shall be responsible for separating and billing costs attributed to the Owner and costs attributed to the Contractor.
- G. Monitoring Product and Material Certifications: The Testing Laboratory shall be responsible for monitoring the submittals of product and material certifications from manufacturers and suppliers as specified in the Specifications and shall report to the Owner, Architect, and Engineer when those submittals are not made in a timely manner.
- H. Limitations of Authority: The Testing Laboratory is not authorized to revoke, alter, relax, enlarge upon, or release any requirements of the Specifications or to approve or accept any portion of the work or to perform any duties of the General Contractor and his Subcontractors.

## 1.7 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. The Testing Laboratory shall cooperate with the Architect, Engineer, and Contractor and provide qualified personnel promptly on notice.
  - 2. The Contractor shall cooperate with Testing Laboratory personnel and provide access to the work and to manufacturers' operations.
  - 3. Notification of Source Change: The Contractor shall be responsible for notifying the Owner, Architect, Engineer, and Testing Laboratory when the source of any material is changed after the original tests or inspections have been made.
- B. Preinstallation Meetings: The Testing Laboratory shall attend preinstallation meetings with the Architect, Engineer, Contractor, and material suppliers as required to coordinate materials inspection and testing requirements with the planned construction schedule and shall participate in such meetings throughout the course of the project.
- C. Scheduling:
  - 1. Advance Notice: The Contractor shall be responsible for notifying the Testing Laboratory sufficiently in advance of operations to allow for assignment of personnel and scheduling of tests. Failure to sufficiently notify may result in additional costs incurred by the Testing Laboratory that may be back-charged to the Contractor by the Owner.

## 1.8 SUBMITTALS

A. Quality Control Reports:

- 1. Information on Reports: The Testing Laboratory shall submit copies of reports (PDF format) of inspections and tests promptly. The reports shall contain at least the following information:
  - a. Project name.
  - b. Date report issued.

- c. Testing Laboratory name and address.
- d. Name and signature of inspector/technician.
- e. Date of inspection and/or sampling.
- f. Date of test.
- g. Identification of product and Specification section.
- h. Location in the project.
- i. Identification of inspection or test.
- j. Record of weather conditions and temperature (if applicable).
- k. Results of test regarding compliance with Contract Documents.
- 2. Copies: The Laboratory shall send signed electronic copies (PDF format) of test and inspection reports to the following parties:
  - a. Owner or his/her representative.
  - b. General Contractor.
  - c. Architect.
  - d. Engineer of Record.
- B. Discrepancy Log: The Testing Laboratory shall create and maintain a log of all discrepancies throughout the duration of the project.
  - 1. Information on Log: This log shall include, but is not limited to:
    - a. Discrepancy date.
    - b. Description of discrepancy.
    - c. Drawing and/or detail reference.
    - d. Description of as-built condition.
    - e. Description of any remedial work performed.
    - f. Status of discrepancy.
  - 2. Submission Schedule: This log shall be submitted to the Architect/Engineer on a periodic basis for review and comment. Upon completion of the Project, this log shall be submitted in its entirety as an attachment to the final signed report described below under Certifications.
    - a. Certification: Upon completion of the job, the Laboratory shall furnish to the Owner, Architect, and Engineer of Record, a statement signed by a licensed professional engineer that, to the best of their knowledge, required tests and inspections were made in accordance with the requirements of the Contract Documents.

## 1.9 QUALITY ASSURANCE

- A. Qualifications of Special Inspector: The special inspector shall be a qualified person who shall demonstrate competence, to the satisfaction of the Building Official, for inspection of the particular type of construction or operation being inspected. The Special Inspector shall meet the legal qualifications of the building code having jurisdiction.
- B. Qualifications of Testing Laboratory:
  - 1. The Testing Laboratory shall meet the basic requirements of ASTM E 329 and shall submit to the Owner, Architect, and Engineer evidence of current accreditation from the American Association for Laboratory Accreditation, the AASHTO Accreditation Program or the "NIST" National Voluntary Laboratory Accreditation Program.
  - 2. The Testing Laboratory shall be an Approved Agency by the Building Official to perform Special Inspections and other tests and inspections as outlined in the applicable building code.
  - 3. Tests and inspections shall be conducted in accordance with specified requirements, and if not specified, in accordance with the applicable standards of the American Society for Testing and Materials or other recognized and accepted authorities in the field.
  - 4. Qualifications of Welding Inspectors
    - a. Inspectors performing visual weld inspection shall meet the requirements of AWS D1.1 Section 6.1.4. Inspectors shall have current certification as an AWS Certified Welding Inspector (CWI). Assistant inspectors, if any, shall be supervised by an Inspector and shall be qualified by training and experience to perform the specific functions to which they are assigned.

- b. Inspectors performing nondestructive examinations of welds other than visual inspection (MT, PT, UT, and RT) shall meet the requirements of AWS D1.1, Section 6.14.6.
- 5. Qualifications for Post-Tensioning Inspector The technician for the Testing Laboratory performing the field inspections required for post-tensioned concrete shall possess a currently valid Level 2 Post-Tensioning Inspector Certification issued by the Post-Tensioning Institute. A copy of such certification for each such technician shall be submitted for Engineer review and approval.
- C. The Contractor shall not engage the same testing laboratory for construction services as the Owner has for quality assurance testing, unless agreed to by the Owner.

## PART 2 - PRODUCTS (NOT USED)

# PART 3 - EXECUTION

- 3.1 SCOPE OF WORK
  - A. The work to be performed by the Testing Laboratory shall be as specified in this Section of the Specification and as determined in meetings with the Owner, Architect, and Engineer.

## 3.2 CONCRETE FORMING AND ACCESSORIES

- A. Field Inspection:
  - 1. Shallow Foundation Elements:
    - a. Verify element width, length, depth, and elevation.
    - b. Verify that forms are plumb and straight, braced against movement, and lubricated for removal.
    - c. Verify that carton forms, if any, are dry and neatly formed around piers.

## 3.3 CONCRETE REINFORCING

- A. Quality Assurance:
  - 1. Review the Welding Procedure Specification (WPS) submitted by the contractor for any reinforcing steel other than ASTM A 706 that is proposed to be welded for consistency with acceptable welding practices and AWS.
  - 2. Review welder qualifications by certification or verify by retesting. Obtain welder certificates.
- B. Field Inspection: The scope of the work to be performed by the inspector on the jobsite shall be as follows:
  - 1. Reinforcing Steel: The Testing Laboratory or designated Special Inspector shall inspect 100% of reinforcement before each concrete pour to verify the information noted below. Inspection reports shall be prepared and distributed in accordance with the local building code and as specified in this specification.
    - a. Primary and secondary longitudinal reinforcement has correct size and number in proper layers.
    - b. Longitudinal reinforcement has correct length and lap.
    - c. Ties and stirrups are of correct size, spacing, and number and have the proper termination hook geometry.
    - d. Unscheduled face reinforcement in beams are provided and are of correct size, number and spacing and have the proper end terminations.
    - e. Proper hooks are provided at bar ends as detailed.
    - f. Reinforcement is properly supported and braced to formwork to prevent movement during concrete placement.
    - g. Reinforcement has proper cover.
    - h. Sufficient spacing between reinforcement for concrete placement.
    - i. Dowel reinforcement is of proper size, at proper spacing, and has proper lap length and embedment length.
    - j. Welded wire reinforcement is composed of flat sheets, has proper wire gage and spacing, is properly supported, and is properly lapped.

- k. Proper construction/control/expansion joint spacing and reinforcement.
- I. Reinforcement around embedded items is placed according to details.
- m. Welded reinforcement has been done according to AWS requirements.
- n. Proper installation of flat slab shear head reinforcement.
- o. Mechanical Tension Splices: The Testing Laboratory shall provide 100% visual inspection of mechanical tension splices on the project and consult with the manufacturer regarding recommendations for installation. Inspection shall verify compliance with specifications and conformance with the manufacturer's recommendations for installation after consulting with the manufacturer, who is to be present for the first installation of the splice on the project.
- p. Welded Reinforcing: Continuous inspection of the welding of reinforcing bars to ensure compliance with the requirements of AWS shall be done for the following items:
  - 1) Reinforcing steel resisting flexural and axial forces.
  - 2) Boundary elements of reinforced concrete walls.
  - 3) Shear reinforcement.

## 3.4 CAST-IN-PLACE CONCRETE

## A. Quality Assurance:

- 1. Concrete Mix Designs: The Testing Laboratory shall review the submitted mix designs for conformance to the specifications and for suitability for use in the project.
- 2. Preinstallation Meetings: The Testing Laboratory shall attend the preinstallation meetings as noted in Specification 033000 "Cast-in-Place Concrete."
- B. Source Inspection:

b.

- 1. Concrete Batch Plant Inspection: An initial batch plant inspection shall be made by the Testing Laboratory prior to the start of concrete work. The scope of batch plant inspection shall include the following:
  - a. Inspection of Batch Plant Facilities: The Testing Laboratory shall inspect batch plant facilities proposed for use in the work and report in writing inspection results to the Architect, Engineer, and Owner for approval. The inspection shall confirm the batch plant conforms to the standards set forth in ASTM C 94 and can show proof of certification by the National Concrete Ready Mix Association. Inspection shall include:
    - 1) Batch Plant operations and equipment.
    - 2) Truck mixers.
    - 3) Scales.
    - 4) Stockpile placement.
    - 5) Material storage.
    - 6) Admixture dispensers.
    - Multiple Batch Plants: The Contractor shall reimburse the Owner for the costs accrued to the Testing Laboratory for visits to more than one batch plant.
- C. Field Testing: The following tests shall be completed by the Testing Laboratory:
  - 1. During Concrete Placement:
    - a. Record the amount of water added and note if it exceeds the amount allowed to be added shown in the approved mix design.
    - b. Mold concrete test cylinders as specified below in Paragraph 3.4C.a.
    - c. Perform tests to determine slump, concrete temperature, unit weight, and air entrainment as specified below.
    - d. Record information for concrete test reports as specified below.
    - e. Pick up and transport to Laboratory cylinders cast the previous day.
  - 2. After Concrete Placement:
    - a. In-situ Concrete Strength Verification for Form Stripping: The Testing Laboratory shall perform the tests necessary to determine the concrete strength prior to form stripping:

- 1) If concrete strength for form stripping is to be determined using field-cured cylinders, the cylinder shall be broken at the time of form removal as directed by the Contractor.
- 2) If concrete strength for form stripping is to be determined using the Maturity Method, the Testing Laboratory shall verify that the requirements of ASTM C 1074 are being followed and that the proper criteria for determining concrete strength by this method has been established and is being followed.
- b. Investigation of Low Strength Concrete Test Results:
  - 1) Cost of Investigations for Low Strength Concrete: The Contractor shall reimburse the Owner for the costs of investigations of low strength concrete, as defined in Part I above.
  - Scope of Investigations: See Specification Section <033000> "Cast-In-Place Concrete" for the investigations that may be required by the Engineer. The Testing Laboratory will conduct these investigations if required.
- c. Post-Installed Anchors in Concrete:
  - 1) Verify maximum anchor tightening torque for all applicable post-installed anchors.
  - 2) Verify that all drilled holes for adhesive anchors are within 6 degrees of perpendicular to the surface of the concrete member.
  - 3) Provide pull tests on individual anchors as specified in the ICC Evaluation Services Report, on the drawings, or as directed by the Engineer-of-Record.
- d. Floor Flatness and Levelness Measuring: Perform tests as defined below.
- e. Testing of Concrete Floor Slabs for Acceptability to Receive an Adhesive-Applied, Low-Permeable Floor Covering: Perform tests as defined below.
- f. Testing of Non-Shrink Grout for Base Plates, Bearing Plates, and Precast Wall Panels:
  - Compressive Strength Tests: Compressive strength of grout shall be determined by testing grout cubes according to the requirements of ASTM C 109 - Modified. Test one set of three cubes at one day, and one set of three cubes at 28 days.
  - 2) Frequency of Testing: One set of cubes (6 cubes) shall be made for every ten base plates and bearing plates or fraction thereof but not less than one set for each day's operation. One set of cubes shall be made for each day's operation of grouting wall panels.
- 3. Standards for Concrete Tests:

a.

- Concrete Test Cylinders: Mold and test concrete cylinders as described below:
  - 1) Cylinder Molding and Testing: Cylinders for strength tests shall be molded and Laboratory cured in accordance with ASTM C 31 and tested in accordance with ASTM C 39. Cylinders may be either 6" in diameter by 12" or 4" in diameter by 8", however, the diameter of the cylinder shall be at least three times the nominal maximum size of the coarse aggregate in the mix tested. All of the cylinders for each class of concrete shall be of the same dimension for all sets of that class.
  - 2) Field Samples: Field samples for strength tests shall be taken in accordance with ASTM C 172 at the point of placement.
  - 3) Quantity of Cylinders: Each set of test cylinders shall consist of a minimum of four standard test cylinders. If concrete strength for form stripping is to be determined using field-cured cylinders, one additional cylinder per set will be required for formed slab and pan-formed beam floors for the purpose of evaluating the concrete strength at the time of form stripping. This cylinder shall be stored on the floor where form removal is to occur under the same exposure conditions as the floor concrete. The cylinder shall be cured under field conditions in accordance with ASTM C 31. Field-cured test cylinders shall be molded at the same time and from the same samples as laboratory-cured test specimens. The Contractor shall reimburse the Owner for the cost of making and testing these cylinders.

- 4) Frequency of Testing: A set of test cylinders shall be made according to the following minimum frequency guidelines:
  - a) One set for each class of concrete taken not less than once a day.
  - b) Piers, Piles, Underreamed Footings: One set for each 50 cubic yards or fraction thereof.
  - c) Spread Footings: One set for each 50 cubic yards or fraction thereof.
  - d) Pile/Pier Caps: One set for each 50 cubic yards or fraction thereof.
  - e) Basement Walls: One set for each 150 cubic yards.
  - f) Floors: One set for each 150 cubic yards or fraction thereof but not less than one set for each 5,000 square foot of floor area.
  - g) Columns: One set for each 50 cubic yards or fraction thereof with a minimum of two sets per floor.
  - h) Shear Walls: One set for each 50 cubic yards but not less than two sets per floor.
  - i) All Other Concrete: A minimum of one set for each 150 cubic yards or fraction thereof but not less than one set for each 5,000 square foot of area for walls.
  - j) No more than one set of cylinders at a time shall be made from any single truck.
  - k) If the total volume of concrete is such that the frequency of testing as specified above would provide less than five strength tests for a given class of concrete, tests shall be made from at least five randomly selected batches or from each batch if fewer than five batches are used.
  - The above frequencies assume that one batch plant will be used for each pour. If more than one batch plant is used, the frequencies cited above shall apply for each plant used.
- 5) The cylinders shall be numbered, dated, and the point of concrete placement in the building recorded.
- 6) For concrete specified on the drawings to reach the required strength at 28 days, break one cylinder of the set at seven days, two 6" by 12" cylinders or three 4" by 8" cylinders at 28 days, and keep one in reserve for testing at the Engineer's direction.
- 7) For concrete specified on the drawings to reach the required strength at 56 days, break one cylinder of the set at seven days, one cylinder at 28 days, two 6" by 12" cylinders or three 4" by 8" cylinders at 56 days, and one kept in reserve for testing at the Engineer's direction.
- 8) Cylinder Storage Box: The Contractor shall be responsible for providing a protected concrete cylinder wooden storage box at a point on the job site mutually agreeable with the Testing Laboratory for the purpose of storing concrete cylinders until they are transported to the Laboratory. The box shall be constructed and equipped to maintain the environment specified for initial curing in ASTM C 31.
- 9) Transporting Cylinders: The Testing Laboratory shall be responsible for transporting the cylinders to the Laboratory in a protected environment such that no damage or ill effect will occur to the concrete cylinders including loss of moisture, freezing temperatures or jarring.
- 10) Information on Concrete Test Reports: The Testing Laboratory shall make and distribute concrete test reports after each job cylinder is broken. Such reports shall contain the following information:
  - a) Truck number and ticket number.
  - b) Concrete Batch Plant.
  - c) Mix design number.
  - d) Accurate location of pour in the structure.
  - e) Strength requirement.
  - f) Date cylinders made and broken.

- g) Technician making cylinders.
- h) Concrete temperature at placing.
- i) Air temperature at point of placement in the structure.
- j) Amount of water added to the truck at the batch plant and at the site and whether or not it exceeds the amount allowed by the mix design.
- k) Slump.
- I) Unit weight.
- m) Air content.
- n) Cylinder compressive strengths with type of failure if concrete does not meet Specification requirements. Seven day breaks are to be flagged if they are less than 60% of the required 28 day strength. 28 day breaks are to be brought to the attention of the Architect and Engineer in writing if either cylinder fails to meet specification requirements.
- b. Slump Tests: Slump Tests (ASTM C 143) shall be completed at the beginning of concrete placement for each batch plant and for each set of test cylinders made. The slump test shall be made from concrete taken from the end of the concrete truck chute. The concrete shall be considered acceptable if the slump is within the slump tolerance noted on the mix design submittal form for that class of concrete.
- c. Air Entrainment: Air entrainment tests (ASTM C 231 or C 173, C 173 only for lightweight concrete) shall be made at the same time slump tests are made as cited above. Samples for air entrainment tests shall be taken at the point of placement.
- d. Concrete Temperature: Concrete temperature at placement shall be measured (ASTM C 1064) at the same time slump tests are made as cited above.
- e. Unit Weight Test: ASTM C 138.
- 4. Evaluation and Acceptance of Concrete:
  - a. Strength Test: A strength test shall be defined as the average strength of two six inch cylinder breaks or three four inch cylinder breaks from each set of cylinders tested at the time indicated above.
  - b. Quality Control Charts and Logs: The Testing Laboratory shall keep the following quality control logs and charts for each class of concrete containing more than 2,000 cubic yards. The records shall be kept for each batch plant and submitted on a weekly basis with cylinder test reports:
    - 1) Number of strength tests made to date.
    - 2) Strength test results containing the average of all strength tests to date, the high test result, the low test result, the standard deviation, and the coefficient of variation.
    - 3) Number of tests under specified strength.
    - 4) A histogram plotting the number of strength test cylinders versus compressive strength.
    - 5) Quality control chart plotting compressive strength test results for each test.
    - 6) Quality control chart plotting moving average for strength where each point plotted is the average strength of three previous test results.
    - 7) Quality control chart plotting moving average for range where each point plotted is the average of 10 previous ranges.
  - c. Acceptance Criteria: The strength level of an individual class of concrete shall be considered satisfactory if both of the following requirements are met:
    - 1) The average of all sets of three consecutive strength tests equal or exceed the required f'c.
    - 2) No individual strength test falls below the required f'c by more than the greater of 10% of f'c or 500 PSI.
  - d. If either of the above Acceptance Criteria requirements is not met, the Testing Laboratory shall immediately notify the Engineer by telephone. Steps shall immediately be taken to increase the average of subsequent strength tests.
- D. Field Inspection: The scope of the work to be performed by the inspector on the jobsite shall be as follows:

- 1. Before Concrete Placement:
  - a. Inspect concrete formwork per Article 3.2.
  - b. Inspect concrete reinforcing per Article 3.3.
  - c. Inspect bolts and rods to be embedded in concrete for proper grade, size, length, and embedment.
  - d. Verify that there is no standing water in pour area and that all debris has been removed from the area and from the formwork.
- 2. During Concrete Placement: Provide continuous monitoring to:
  - a. Upon arrival of concrete, inspect the concrete to verify that the proper concrete mix number, type of concrete, concrete strength is being placed at the proper location. Verify that the mix meets the project specifications and is not over 90 minutes old at the time of placement. Report concrete not meeting the specified requirements and immediately notify the Contractor, Batch Plant Inspector, Architect, Engineer, and Owner.
  - b. Inspect plastic concrete upon arrival at the jobsite to verify proper batching. Observe mix consistency and adding of water as required to achieve target slumps in mix designs. The responsibility for adding water to trucks at the job site shall rest only with the Contractor's designated representative. The Contractor is responsible that all concrete placed in the field is in conformance to the Contract Documents.
  - c. Verify that the Contractor is following appropriate Hot Weather or Cold Weather concreting practices consistent with any extreme environmental conditions at the point of placement in the structure.
  - d. Verify that concrete deposited is uniform and that vertical drop does not exceed six feet and is not permitted to drop freely over reinforcement causing segregation.
  - e. Verify that the formwork has remained stable during the concreting operation.
  - f. Verify that there are no cold joints.
  - g. Verify that the concrete is properly vibrated.
  - h. Inspect bolts embedded in concrete during concrete placement for verification that they have been properly installed to the specified embedment.
  - i. Verify that the finishing of the concrete surface is done according to specifications.
- 3. The Testing Laboratory shall report any irregularities that occur in the concrete at the job site or test results to the Contractor, Architect, Owner, and Engineer.
- 4. After Concrete Placement:
  - a. Verify that the curing process is according to Specifications and that any curing compound used is applied in accordance with the manufacturer's recommendations.
  - b. Verify that sawcut control joints in slab-on-grades are cut within 12 hours of placement.
  - c. Post-Installed Anchors in Concrete: Provide inspection of post-installed anchor installations at the frequency noted in the specifications and in accordance with the published, currently valid, Evaluation Service Report (ESR) for each anchor product. Post-installed anchors include anchors and reinforcing steel. Inspection of post-installed anchors shall include but not be limited to the following:
    - Periodic Inspection: Verify initial installation of post-installed anchors in concrete for each individual installer with each individual anchor product in accordance with the requirements stated below for each type of anchor. Periodically inspect anchor installation after the initial verification.
    - 2) Continuous Inspection: Verify each installation of post-installed anchors in concrete in accordance with the requirements stated below for each type of anchor.
    - 3) All Post-Installed Anchors: Verify that the anchor is installed in accordance with manufacturer's printed installation instructions as well as the following design requirements.
      - a) Concrete type, concrete strength and concrete thickness are in accordance with design drawings.
      - b) Anchor manufacturer and product, including material, is in accordance with design drawings or approved substitution.

- c) Anchor diameter, length and installed embedment depth.
- d) Drill bit type and diameter.
- e) Anchor edge distance and spacing.
- f) Hole diameter and depth.
- g) Hole cleaning procedure and cleanliness.
- h) Anchor maximum tightening torque.
- 4) Adhesive Anchors: In addition to the requirements for All Post-Installed Anchors, verify adhesive identification and expiration date.
  - a) The installation of all adhesive anchors shall be continuously inspected when anchors are subject to sustained tension loads, such as anchors for shelf angles, or when anchors are installed in an upwardly inclined condition.
- E. Causes for Rejection of Concrete: The Contractor shall reject concrete delivered to the site for any of the following reasons:
  - 1. Wrong class of concrete (incorrect mix design number).
  - 2. Environmental Conditions: Environmental condition limits shall be as follows unless appropriate provisions in concreting practices have been made for cold or hot weather:
    - a. Cold Weather: Air temperature must be 40°F and rising or the average daily temperature cannot have been lower than 40°F for 3 consecutive days unless the temperature rose above 50°F for at least one-half of any of those 24 hour periods.
    - b. Hot Weather: Environmental conditions must be such that cause an evaporation rate from the concrete surface of 0.2 lb./sq. ft./hr. or less as determined by Figure 2.1.5 in ACI 305R-91.
  - 3. Concrete may be placed at other environmental condition ranges only with approval of the job inspector for the Testing Laboratory or other duly appointed representative.
  - 4. Concrete with temperatures exceeding 95°F shall not be placed in the structure.
  - 5. Air contents outside the limits specified in the mix designs.
  - 6. Slumps outside the limits specified.
  - 7. Excessive Age: Concrete shall be discharged within 90 minutes of plant departure or before it begins to set if sooner than 90 minutes unless approved by the Laboratory job inspector or other duly appointed representative.
- F. Concrete Batch Trip Tickets: Concrete batch trip tickets shall be collected and retained by the Contractor. Compressive strength, slump, air, and temperature tests shall be identified by reference to a particular trip ticket. Tickets shall contain the information specified in ASTM C 94. Each ticket shall also show the amount of water that may be added in the field for the entire batch that will not exceed the specified water cement ratio for the design mix. The Contractor and Testing Laboratory shall immediately notify the Architect/Engineer and each other of tickets not meeting the criteria specified.

# 3.5 STRUCTURAL STEEL

- A. Scope of Work:
  - 1. Contract Obligations:
    - a. Owner Responsibility: The Owner shall pay for initial shop and field inspections and tests as required during the fabrication and erection of the structural steel.
    - b. Testing Laboratory Responsibility: The inspection by the Testing Laboratory of the Fabricator's work shall be in sequence, timely, and performed in such a manner so that corrections can be made without delaying the progress of the work. Inspections shall be performed by qualified technicians with a minimum of two years of experience in structural steel testing and inspection. Refer to Paragraph 4 for special requirements for welding inspectors. The Testing Laboratory shall provide test reports of inspections. All test reports shall indicate types and locations of defects found during inspection, the measures required and performed to correct such defects, statements of final approval of welding and bolting of shop and field connections. Weld inspection reports shall be signed by an inspector with current certification as an AWS Certified Welding

Inspector (CWI). In addition to the parties listed in this Specification the Fabricator and Erector shall receive copies of the test reports.

- c. Rejection of Material or Workmanship: The Owner, Architect, Engineer, and Testing Laboratory reserve the right to reject any material or workmanship not in conformance with the Contract Documents at any time during the progress of the work. However, this provision does not allow waiving the obligation for timely, in sequence inspections.
- B. Quality Assurance:
  - 1. Verify the fabrication shop's certification from AISC.
  - 2. Verify that the fabricator's fabrication and quality control procedures provide a sound basis for inspection control of workmanship and of the ability to conform to construction documents and industry standards. Review the procedures for completeness and adequacy relative to code requirements for the fabricator's finished product.
  - 3. Review field welder qualifications by certification or verify by retesting. Obtain welder certificates.
- C. Source Testing: The Testing Laboratory shall provide the following tests at the designated fabrication shops:
  - 1. Test welds completed in the shop according to Paragraph H "Weld Testing" below.
  - 2. Test bolted connections completed in the shop according to Paragraph I "High-Strength Bolt Testing."
- D. Source Inspection: The Testing Laboratory shall provide the following inspections at the designated fabrication shops:
  - 1. Shop Inspection Waiver: The requirement to perform fabricating shop inspections may be waived if the Fabricator produces evidence from the Building Official of being a registered, approved fabricating shop and if allowed by the Engineer. If these are waived, then the inspection, testing, and reporting requirements of the Owner's Testing Laboratory shall be transferred to the Fabricator.
  - 2. An initial shop inspection prior to the start of any fabricating work shall be made to accomplish the following:
    - a. Perform tasks outlined in Paragraphs 1, 2 and 3 of welding inspection duties described below in Paragraph G "Weld Inspection and Process Monitoring" when shop welding is to be performed.
    - b. Perform tasks outlined in paragraph 1 of bolt inspection duties described below in Paragraph I "High-Strength Bolt Inspection and Process Monitoring" when shop bolting involves joints that are designated on the plans as Pretensioned or Slip-Critical.
  - 3. Process Monitoring:
    - a. Provide continuous or periodic monitoring of welding as described below in Paragraph G "Weld Inspection and Process Monitoring."
    - b. Provide continuous or periodic monitoring of bolting as described below in Paragraph I "High-Strength Bolt Inspection and Process Monitoring" of high-strength bolt installation in pre-tensioned or slip-critical joints using turn-of-the-nut without matchmarking or calibrated wrench method of bolt installation.
    - c. Provide periodic verification of specified camber of steel beams.
- E. Field Testing: The Testing Laboratory shall provide the following tests in the field:
  - 1. Test welds completed in the field according to Paragraph H "Weld Testing:" below.
  - 2. Test bolted connections completed in the field according to Paragraph I "High-Strength Bolt Testing."
  - 3. Perform bend tests on completed shear connectors attached to beams as required according to procedures outlined in AWS D1.1. In addition, perform field bend tests on an additional 2% of completed shear connectors on each beam but not less than one connector per beam.
  - 4. Testing of Non-Shrink Grout for Base Plates, Bearing Plates, and Precast Wall Panels:
    - a. Compressive Strength Tests: Compressive strength of grout shall be determined by testing grout cubes according to the requirements of ASTM C 109 Modified. Test one set of three cubes at one day, and one set of three cubes at 28 days.

- b. Frequency of Testing: One set of cubes (6 cubes) shall be made for every ten base plates and bearing plates or fraction thereof but not less than one set for each day's operation. One set of cubes shall be made for each day's operation of grouting wall panels.
- F. Field Inspection: The Testing Laboratory shall provide the following inspections in the field:
  - 1. Inspect galvanized HSS and other cold-worked structural steel members for cracking or other damage resulting from galvanizing process. Endeavor to complete inspections prior to erection of these members. Immediately notify Contractor and Architect/Engineer of any irregularities discovered.
  - 2. Provide continuous or periodic monitoring of field welding as described below in Paragraph G "Weld Inspection and Process Monitoring."
  - 3. Provide continuous or periodic monitoring of field bolting as described below in Paragraph I "High-Strength Bolt Inspection and Process Monitoring" of high-strength bolt installation in pre-tensioned or slip-critical joints using turn-of-the-nut without matchmarking or calibrated wrench method of bolt installation.
  - 4. Inspect welded or bolted connections that were completed, but not inspected, in the shop. Perform inspections according to Paragraph G "Weld Inspection and Process Monitoring" and/or Paragraph I "High-Strength Bolt Inspection and Process Monitoring" as appropriate.
  - 5. Obtain the planned erection procedure, and review with the Erector's supervisory personnel.
  - 6. Check the installation of base plates for proper leveling, grout type, and grout application.
  - 7. Check structural steel as received in the field for possible shipping damage, workmanship, and identification marking to conform to AISC 360 for structural steel and specified ASTM standards for other steel.
  - 8. Verify that surveys are occurring as specified to check plumbness and frame alignment as erection progresses. Review the submitted survey report.
  - 9. Periodically inspect the steel frame for such items as bracing and stiffening details, member locations, and joint details at each connection for compliance with approved construction documents.
  - 10. Inspect 100% of the column compression and base joints for verification that gaps in contact bearing do not exceed 1/16 inch. Gaps greater than 1/16 inch but less than 1/4 inch shall be reported to the Owner and Engineer for assessment. All gaps greater than 1/4 inch shall be shimmed according to Specification 05 12 00 "Structural Steel Framing."
  - 11. Endeavor to guard the Owner against the Contractor cutting, grinding, reaming, or making any other field modification to structural steel without the prior approval of the Engineer. Report any noted unauthorized modifications to the Owner and Engineer.
- G. Weld Inspection and Process Monitoring: The Testing Laboratory shall make the following inspections of the welds and welding processes. Welds performed in the fabricating shop may be inspected in the field unless continuous monitoring of the welding process is herein specified or if access in the field due to other work or shop finishes makes field inspection impractical:
  - 1. Approve Welding Procedure Specifications submitted by the Contractor. Approve any changes submitted by the Contractor to any WPS that has already been approved. Obtain the Welding Procedure Qualification Record (WPQR) for each successful WPS qualification.
  - 2. Periodically verify welding electrodes to be used and other welding consumables as the job progresses.
  - 3. Periodically observe joint preparation, assembly practice, welding techniques including preheating and sequence, and the performance of welders with sufficient frequency to assure compliance with code and contract document requirements. Check preheating to assure conformance with AWS D1.1, Section 5.6. Verify procedure for control of distortion and shrinkage stresses.
  - 4. Continuously observe joint preparation and fit up, backing strips, and runout plates for welded moment connections and column splices.
  - 5. Periodically provide visual inspection of the root pass of partial and complete joint penetration welds.

- 6. Visually inspect 100 % of welds for proper size, length, location, and weld quality in accordance with AWS D1.1 requirements. Unless specifically noted otherwise, all welding shall be considered statically loaded nontubular connections.
- 7. Visually inspect 100% of completed shear connectors on each beam.
- 8. Visually inspect 100% of the welds of anchors to embedded plates that are to be cast into concrete elements.
- 9. In addition to the inspections above, perform the following:
  - a. Continuously monitor and observe joint preparation, assembly practice, welding techniques including preheating and sequence, and the performance of welders for 100% of complete and partial joint penetration welds, plug and slot welds, multiple-pass fillet welds, and single-pass fillet welds greater than 5/16 inch. Check preheating to assure conformance with AWS D1.1, Section 5.6. Verify procedure for control of distortion and shrinkage stresses.
  - b. Periodically monitor welding of single-pass fillet welds that are less than or equal to 5/16 inch.
  - c. Periodically monitor the welding of headed studs to floor beams.
  - d. Periodically monitor the welding of anchors to embedded plates that are to be cast into concrete elements.
- H. Weld Testing:
  - 1. Perform nondestructive examination services using a qualified technician with the necessary equipment to perform the following:
    - a. Nondestructive examination conducted in accordance with the specific requirements for the item being examined including radiographic (RT), ultrasonic (UT), magnetic particle (MT), or dye-penetrant inspection (PT). Nondestructive inspection procedures shall conform to AWS D1.1.
    - b. Interpret, record, and report results of the nondestructive tests.
    - c. Mark for repair, any area not meeting Specification requirements. Correction of rejected welds shall be made in accordance with AWS D1.1.
    - d. Re-examine repair areas and interpret, record, and report the results of examinations of repair welds.
    - e. Verify that quality of welds meet the requirements of AWS D1.1.
  - 2. Fillet Welds: Provide the following:
    - a. MT test a minimum of 10% of the length of each fillet weld exceeding 5/16".
    - b. Periodic MT testing of representative fillet welds 5/16" and less but need not exceed 10% of all such welds, except as required for high rejection rates as indicated in the following paragraph.
    - c. Increase MT testing rate for welders having a high rejection rate as required to ensure acceptable welds.
  - 3. Partial Joint Penetration (PJP) Welds, including Flare-Bevel Groove Welds: Provide the following:
    - a. MT test a minimum of 25% of the length of each PJP weld exceeding 5/16" effective throat.
    - b. Periodic MT testing of representative PJP welds 5/16" and less but need not exceed 10% of all such welds, except as required for high rejection rates as indicated in the following paragraph.
    - c. Increase MT testing rate for welders having a high rejection rate as required to ensure acceptable welds.
  - 4. Complete Joint Penetration (CJP) Welds: Provide the following:
    - a. All CJP welds equal to or exceeding 5/16" thickness shall be 100% UT tested per AWS D1.1 Clause 6 Part F. The Testing Laboratory shall review the CJP joints to determine where geometry or accessibility precludes the use of standard scanning patterns per AWS D1.1 Clause 6 Part F. At these locations the testing laboratory shall develop and submit for approval a written testing procedure in accordance with AWS D1.1 Annex S.

- b. Periodic MT testing of representative CJP welds 5/16" and less not to exceed 10% of all such welds, except as required for high rejection rates as indicated in the following paragraph.
- c. Increase MT testing rate for welders having a high rejection rate as required to ensure acceptable welds.
- 5. Acceptance Criteria:
  - a. Visual, MT, PT shall be per AWS D1.1 Table 6.1.
  - b. UT testing shall be per AWS D1.1 6.13.1 and Table 6.2.
- 6. Base metal thicker than 1.5 inches, where subjected to through-thickness weld shrinkage strains, shall be UT tested for discontinuities behind and adjacent to such welds. UT testing shall occur no sooner than 24 hours after the weld has cooled to ambient temperatures. Any material discontinuities shall be recorded on the basis of ASTM A 435 or ASTM A 898 (Level 1 criteria) and reported for Engineer disposition.
- 7. Welds of Anchors to Embedded Plates:
  - a. Headed Studs: Perform field bend tests according to AWS D1.1 on 2% of the studs welded to plates, but not less than one stud per plate.
  - b. Deformed Bar Anchors: Perform MT testing on 10% of deformed bar anchors larger than 5/8" diameter.
- 8. The costs of repairing defective welds and the costs of retesting by the Testing Laboratory providing services for the Owner shall be borne by the Contractor. If removal of a backing strip is required by the Testing Laboratory to investigate a suspected weld defect, such cost shall be borne by the Contractor.
- I. High-Strength Bolt Inspection and Process Monitoring: The Testing Laboratory shall perform the following inspections for connections joined with high-strength bolts. Bolting performed in the shop may be inspected in the field unless continuous monitoring of the bolting operation is specified herein:
  - 1. Observe preinstallation verification testing of the pretensioning method to be used in accordance with the requirements of the "Specification for Structural Joints Using High-Strength Bolts".
  - 2. Check daily the calibration of impact wrenches used in field bolted connections.
  - 3. Inspect bolt installation for 100% of high strength bolted connections according to inspection procedures outlined in the "Specification for Structural Joints Using High-Strength Bolts".
  - 4. Monitoring of Bolting Installation:
    - a. Continuous Monitoring: The Testing Laboratory shall be continuously present and monitor the bolting installation for compliance with the selected procedure for installation as specified in the "Specification for Structural Joints Using High-Strength Bolts" for joints using high-strength bolts that are designated on the plans as Pretensioned (PT) or Slip-Critical (SC) type joints and that are being installed using the calibrated wrench method or the turn-of-nut without matchmarking method of installation.
    - b. Periodic Monitoring: All other joint types and bolt installation methods shall be monitored on a periodic basis.
- J. High-Strength Bolt Testing: The Testing Laboratory shall perform the following tests for connections joined with high-strength bolts:
  - 1. Perform Arbitration Testing according to procedures outlined in the "Specification for Structural Joints using High-Strength Bolts" when a disagreement exists between the Testing Laboratory and the Fabricator as to the minimum tension of installed bolts that have been inspected according to paragraph below.

## 3.6 EARTHWORK

- A. Quality Assurance:
  - 1. Welder Qualifications: Verify welder qualifications either by certification and/or by retesting. Obtain welder certificates.
- B. Source Inspection:
  - 1. Precast Concrete Piles:

- a. Plant Inspection: Inspect forms, placement of reinforcing steel, and strands, placement and finishing of concrete, and tensioning of strands.
- C. Field Testing:
  - 1. Compacted Fill:
    - a. Verification of Fill Material: Perform classification and testing to verify that the fill material to be used complies with the project specifications.
    - b. Bearing subgrade shall be evaluated under the direction of the Geotechnical Engineer's representative.
    - c. Field Density Testing: Perform field density testing as described below:
      - 1) Field density tests shall be run according to ASTM D 2937 or ASTM D 6938 as applicable.
      - 2) Acceptance Criteria: The results of field density tests by the Laboratory will be considered satisfactory if the average of any three consecutive tests has a value not less than the required density with no single test falling more than 2 percent below the required density and the moisture content conforms to the requirements of the specification.
      - 3) Test Frequency for Paved Areas and Building Mudslab Subgrade:
      - 4) A minimum of three tests per lift shall be performed.
        - a) Make at least one field density test of the natural subgrade for every 2500 square feet of paved area or building slab but in no case less than three tests.
        - b) In each compacted fill layer or lift, make one field density test for every 2500 square feet of building slab or paved area but in no case less than three tests.
      - 5) Test Frequency for Foundation Wall Backfill: Make at least one field density test for each 200 lineal feet of wall with a minimum of 4 tests for the basement walls around the perimeter of each building and a minimum of one test for every other type of foundation wall on the site. Tests shall be performed in random lifts along each wall.
      - 6) Test Frequency for Compacted Fill beneath Column and Wall Footings and Mat Foundations: Make at least one field density test in each compacted fill layer or lift for each column footing, one for each twenty-five lineal feet of wall and one for each 2,500 square feet of mat foundation area or fraction thereof.
      - 7) Test Frequency at Utility Trench Backfill: Make at least one test for every 50 linear foot of compacted utility trench backfill.
    - d. Report Copies: Moisture-density curves and results of field density tests shall be submitted to the parties specified earlier in this section.
    - e. Additional Testing: If reports by the Laboratory indicate field densities lower than specified, additional tests will be run by the Laboratory with at least the frequencies scheduled above on recompacted fill and/or natural subgrade. The Testing Laboratory shall notify the Contractor on a timely basis for any required retesting so as not to delay the work. The costs of such tests shall be liable to the Owner for repayment by the Contractor.
  - 2. Drilled Piers and Underreamed Footings:
    - a. Concrete Cylinders: Make and test concrete cylinders as specified for Cast-in-Place Concrete.
  - 3. Spread (Excavated) Footings
    - a. Concrete Cylinders: Make and test concrete cylinders as specified for Cast-in-Place Concrete.
- D. Field Inspection by the Testing Laboratory:
  - 1. The Testing Laboratory shall provide inspection of materials used in foundation elements as described below.
  - 2. Compacted Fill:
    - a. Subgrade below Compacted Fill: Observe and verify that the subgrade below compacted fill has been properly prepared before compact fill construction begins.

- b. During placement and compaction of fill, determine that the material being used and the maximum lift thickness comply with the specifications.
- 3. Drilled Piers and Underreamed Footings:
  - a. Reinforcing Steel: Inspect reinforcing steel for proper number and size of bars and confirm dowel or anchor rod placement into top of pier.
- 4. Spread (Excavated) Footings:
  - a. Reinforcing Steel: Inspect reinforcing steel size, number of bars, and placement and confirm dowel or anchor rod placement into footing.
- E. Foundation Inspection by the Geotechnical Engineer: The Geotechnical Engineer of Record shall provide inspection service for the following items before and during foundation installation as appropriate for the foundation type. The Geotechnical Engineer shall submit written field inspection reports promptly after inspection to the parties listed above and report his findings after each inspection by telephone or e-mail to the Engineer.
  - 1. Spread (Excavated) Footing:
    - a. Subgrade: Verify that foundation bearing conditions are consistent with soil report tests and that the footing is being installed in the proper soil strata at the proper elevation. Make recommendations regarding adjustment to subgrade or bearing elevation if subgrade is not adequate to support footing.
  - 2. Drilled Piers and Underreamed Footings:
    - a. Bearing Elevation: Observe that piers are founded in proper bearing strata as defined in the Geotechnical Report and that bottom of hole is clean and properly formed. Recommend appropriate action if specified bearing elevation does not provide proper strength.
    - b. Bell and Shaft Sizes: Verify that the shaft and bell diameters are within specified tolerances.
    - c. Shaft Stability: Observe the shaft sides as drilling proceeds and recommend appropriate action if sloughing becomes excessive.
    - d. Concrete Quantities: Record quantity of concrete placed in each pier and compare against theoretical quantity required. Report discrepancies to Engineer.
    - e. Placement Method: Observe that piers are placed by approved methods as defined in the Geotechnical Report and in the Specifications. Confirm that casings are being used as recommended in the Geotechnical Report. Confirm that concrete is not being contaminated by soil encroachment into pier.
    - f. Report: For each drilled shaft installed, prepare and submit a report indicating the following information:
      - 1) Name of the Project.
      - 2) Name of the drilling contractor
      - 3) Name of the field superintendent.
      - 4) Pier number and location.
      - 5) Pier shaft diameter.
      - 6) Pier underream diameter (if applicable).
      - 7) Bottom elevation.
      - 8) Top elevation.
      - 9) Pier length.
      - 10) Theoretical volume of concrete in pier.
      - 11) Estimate of actual volume of concrete placed.
      - 12) Reinforcing steel size and depth actually placed.
      - 13) Drilling start and finish time.
      - 14) Concreting start and finish time.
      - 15) Variation from specified tolerances including surveyed location and plumbness.
      - 16) Construction method (dry method, casing method, or slurry displacement method).
      - 17) Groundwater conditions (rate of water infiltration and depth of water in hole prior to concreting for dry piers; water elevation in hole for wet piers).
      - 18) Elevation of top and bottom of any casing left in place.

- 19) Description of temporary or permanent casing (including purpose, diameter, wall thickness and length).
- 20) Description and elevation of any obstructions encountered and whether removal was obtained
- 21) Description of pier bottom including amount and extent of loose material.
- 22) Method of concrete placement.
- 23) Any difficulties encountered in drilling or concreting operations.
- 24) Any deviations from specifications.
- 3. The report shall be signed by a licensed engineer in the state where the project is located.

## END OF SECTION

### **SECTION 03 20 00**

#### CONCRETE REINFORCING

#### 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 work of this section.

#### 1.2 SUMMARY

- A. Section includes labor, materials, hardware, equipment, transportation and services required to fabricate and place all reinforcement for cast-in-place concrete including bars, welded wire reinforcement, ties and supports shown on the drawings and as specified. Prestressing reinforcement is specified in Post-Tensioned Concrete and/or Precast Concrete sections of the specifications.
- B. Related Requirements:
  - 1. Specification 01 45 29 "Structural Testing and Inspections" for testing and inspection requirements associated with concrete reinforcing.
  - 2. Specification 03 10 00 "Concrete Forming and Accessories" for forming associated with cast-in-place concrete.
  - 3. Specification 03 30 00 "Cast-in-Place Concrete" for cast-in-place concrete and related products.

#### 1.3 REFERENCES

- A. Reference Standards:
  - 1. Comply with all provisions of the following codes, specifications, and standards except where more stringent requirements are shown or specified:
    - a. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
    - b. ACI 301, "Specifications for Structural Concrete for Buildings."
    - c. ANSI/AWS D1.4, "Structural Welding Code Reinforcing Steel."
    - d. CRSI, "Manual of Standard Practice."

# 1.4 ADMINISTRATIVE REQUIREMENTS

#### A. Coordination:

- 1. Quality Control: The Contractor is responsible for quality control, including workmanship and materials furnished by subcontractors and suppliers.
- 2. Document Conflict and Precedence: In case of conflict among documents, including architectural and structural drawings and specifications, notify the Architect/Engineer prior to submitting proposal. In case of conflict between and/or among the structural drawings and specifications, the strictest interpretation shall govern, unless specified otherwise in writing by the Architect/Engineer.
- B. Preinstallation Meetings: The Reinforcing-Placing subcontractor and Fiber Reinforcement Representative shall attend the Pre-Concrete Conference conducted by the Concrete Contractor as described in Specification 03 30 00 "Cast-in-Place Concrete."

## 1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's product data with application and installation instructions for proprietary materials and items including mechanical splices, hooked anchorage systems, large-headed stud punching shear reinforcement, dowel bar replacement systems, and dowel bar sleeves. For fiber reinforcement, submit manufacturer's product data, including application rate and mixing instructions.
- B. Shop Drawings:
  - 1. Submit shop drawings for all reinforcing steel and related accessories for the Engineer's approval. Shop drawings shall show arrangement and layout, bending and assembly

diagrams, bar schedules, stirrup spacing, splicing and laps of bars and shall be prepared in accordance with CRSI Standards.

- C. Certificates:
  - 1. Submit, for record, mill certificates and/or test results signed by Producer, for all reinforcement.
  - 2. Provide certification from fiber reinforcement manufacturer that fiber reinforcement complies with specified requirements.
- D. Test and Evaluation Reports:
  - 1. Submit International Code Council (ICC) Evaluation Service Reports indicating approval from ICC Evaluation Service, Inc. for mechanical splices, hooked anchorage systems, large-headed stud punching shear reinforcement and dowel bar replacement systems.
- E. Qualification Statements: Submit welding certificates.
- 1.6 QUALITY ASSURANCE
  - A. Welder Qualifications: Qualify procedures and personnel according to ANSI/AWS D1.4.

## PART 2 - PRODUCTS

## 2.1 MATERIALS

- A. Steel Reinforcement:
  - 1. Reinforcing materials shall be delivered from the mill in bundles that are identified as to heat number and manufacturer and accompanied with mill and analysis test reports and an affidavit from the supplier stating that the material conforms to the requirements of the governing ASTM specification listed herein.
  - 2. Reinforcing Bars: Reinforcing bars shall conform to ASTM A 615, Grade 60 or Grade 80 as noted on the drawings.
  - 3. Weldable Reinforcing Bars: All reinforcing bars noted on the drawings as being required to be welded shall conform to ASTM A 706.
  - 4. Deformed Bar Anchors: 3/8" to 5/8" diameter AWS Type C studs manufactured in conformance with ASTM A 1064 with a minimum yield strength of 70,000 psi and a tensile strength of 80,000 PSI. 3/4" or larger diameter, ASTM A 706 bars of equal size with welds to steel substrate that develop the full strength of the anchor. ASTM A 615 reinforcing bars may not be substituted for deformed bar anchors. Reinforcement shall be approved by the ICC-Evaluation Service, Inc and shall have the Evaluation Service Report submitted for Engineer review. The following are acceptable products, provided that their Evaluation Service Reports are still valid at the time of intended use on the project:
    - a. Nelson Stud Welding, Inc.; Nelson D2L Deformed Bar Anchor Studs (ESR-2907).
    - b. Tru-Weld Division, TFP Corporation; Deformed Bar Anchors (ESR-2823).
  - 5. Wire: Smooth wire for spiral reinforcement shall conform to ASTM A 82 with a minimum yield strength of 70,000 PSI.
- B. Fiber Reinforcement:
  - Synthetic Micro Fiber Reinforcement: Collated, fibrillated, or monofilament polypropylene, cellulose, or multi-filament nylon fibers conforming to ASTM C 1116, Type III or Type IV. Reinforcement shall be approved by the ICC-Evaluation Service, Inc and shall have the Evaluation Service Report submitted for Engineer review. The following are acceptable products, provided that their Evaluation Service Reports are still valid at the time of intended use on the project:
    - a. The Euclid Chemical Company; Fiberstrand Series.
    - b. Forta Corporation; Econo-Mono or Econo-Net (ESR-2720).
    - c. Propex Concrete Systems Corp.; Fibermesh 300 (ESR-1165).
    - d. W.R. Grace & Company; Grace Microfibers (ESR-1506).
    - e. Nycon, Inc.; Nycon RC.
    - f. Buckeye Technologies; UltraFiber 500 (ESR-1032).
    - g. BASF Construction Chemicals; MasterFiber M or F series.
    - h. Maccaferri; Fibromac.

- 2. Synthetic Macro Fiber Reinforcement: Monofilament polypropylene/polyethylene fibers conforming to ASTM C 1116, Type III having an aspect ratio between 50 and 90 and a minimum tensile strength of 90 KSI. The fiber lengths shall be between 1.5 and 2 inches long. Reinforcement shall be approved by the ICC-Evaluation Service, Inc. and shall have the Evaluation Service Report submitted for Engineer review. The following are acceptable products, provided that their Evaluation Service Reports are still valid at the time of intended use on the project:
  - a. The Euclid Chemical Company; Tuf-Strand SF.
  - b. Forta Corp.; Forta-Ferro.
  - c. W.R. Grace; Strux 90/40.
  - d. Propex Concrete Systems, Corp.; Fibermesh 650.
  - e. Bekaert Corp.; Synmix.
  - f. BASF Construction Chemicals; MasterFiber MAC.
- 3. Steel Fibers: Provide deformed cold-drawn wire or modified cold-drawn steel fibers meeting the requirements of ASTM A 820, Types I or V, and that are listed as an acceptable product for use in the D900 series of UL Fire Rating Assemblies. The fibers shall have a minimum tensile strength of 145,000 PSI when tested in accordance with ASTM A 370. The fibers shall have a minimum aspect ratio of 50 and maximum aspect ratio of 100. Acceptable products include:
  - a. Bekaert Corp; Dramix 3D 65/60 BG (Type 1), or Dramix 3D 80/60 BG (Type 1).
  - b. Propex Concrete Systems, Corp.; Novocon 1050 (Type I), Novocon 1050 HE (Type I), or Novomesh 850 (Type I).
  - c. BASF Construction Chemicals; MasterFiber FF or FS series.
  - d. Maccaferri; Wirand series.

# 2.2 SPLICES

Α.

- 1. Mechanical splices shall conform to Type 1 and Type 2 splices.
  - a. Type 1 splice shall develop, in tension and compression, 1.25 times the specified yield strength of the splice bar.
  - b. Type 2 splice shall meet the requirements of Type 1 splice and, in addition, develop the full tensile strength of the splice bar.
- 2. Splices shall be approved by the ICC-Evaluation Service, Inc and shall have the Evaluation Service Report submitted for Engineer review.
- 3. The bar ends that are to attach to the splice shall be prepared and installed in accordance with the manufacturer's requirements.
- 4. The following are acceptable mechanical tension splices (splices qualified for use with grade 80 bars are parenthetically noted), provided that their Evaluation Service Reports are still valid at the time of intended use on the project:
  - a. BarSplice Products, Inc.; BPI-Grip XL System (ESR-2299). (Type 1 or Type 2)
  - b. BarSplice Products, Inc.; Taper Threaded Grip-Twist System (ESR-2299). (Type 1 or Type 2)
  - c. BarŚplice Products, Inc.; Position Taper Threaded Grip-Twist System (ESR-2299). (Type 1 or Type 2)
  - d. Headed Reinforcement Corporation; HRC 500/510 Xtender Mechanical Coupler System (ESR-2764). (Type 1 or Type 2)
  - e. Dayton Superior Corporation; DBDI Reinforcing Bar Mechanical Splice System (ESR-2649). (Type 1 or Type 2).
  - f. Dayton Superior Corporation; Bar-Lock Coupler Systems for Splicing Reinforcement Bars, S-Series (ESR-2495). (Type 1)
  - g. Dayton Superior Corporation; Bar-Lock Coupler Systems for Splicing Reinforcement Bars, L-Series (ESR-2495). (Type 1 or Type 2)
  - h. Dayton Superior Corporation; Taperlok Reinforcing Bar Mechanical Splice Couplers (ESR-2481). (Type 1 or Type 2)
  - i. Dextra Manufacturing Co., Ltd.; Bartec Mechanical Splice System for Steel Reinforcing Bars in Concrete (ESR-1705). (Type 1 or Type 2)

Mechanical Tension Splices:
- j. nVent Electric, plc.; Lenton Standard Coupler (IAPMO-UES 0129). (Type 1 or Type 2)
- k. nVent Électric, plc.; Lenton Ultimate Standard Coupler (IAPMO-UES 0129). (Type 1 or Type 2)
- I. nVent Electric, plc.; Lenton Ultimate Position Coupler (IAPMO-UES 0129). (Type 1 or Type 2)
- m. BarSplice Products, Inc.; ZAP Screwlok (qualified for use with grade 80 bars) (ER-5461). (Type 1 and Type 2)
- n. Splice Sleeve North America; NMB Splice-Sleeve (ER-5645). (Type 1 or Type 2).
- B. Dowel Bar Replacement: All grade 60 reinforcing steel dowel bars shown on the drawings crossing concrete construction joint surfaces with inserts cast flush against the form and having reinforcing bars connected to the insert in a subsequent concrete pour shall conform to the following:
  - 1. Splice connection to the insert shall develop the 1.25 times the specified yield strength and the full tensile strength of the spliced bar.
  - 2. Splices shall be approved by the ICC Evaluation Service, Inc. as expressed in an ICC Evaluation Service Report which shall be submitted for review.
  - 3. The following are acceptable products (for use only with grade 60 bars), provided that their Evaluation Service Reports are still valid at the time of intended use on the project:
    - a. Dextra Manufacturing Co., Ltd.; Bartec Mechanical Splice System for Steel Reinforcing Bars in Concrete (ESR-1705).
    - b. nVent Electric, plc.; Lenton Form Saver SA (IAPMO-UES 0129).
- C. Hooked Anchorage Replacement: Reinforcing bar terminations shall be manufactured out of ASTM A 576, ASTM A 615, or A 706 material and shall develop the full tensile strength of the bar when installed at the manufacturer's recommended depth.
  - 1. The anchorage shall be approved by the ICC Evaluation Service Inc. as expressed in an ICC Evaluation Service Report which shall be submitted for review.
  - 2. The following are acceptable products (for use only with grade 60 bars), provided that their Evaluation Service Reports are still valid at the time of intended use on the project:
    - a. Dextra Manufacturing Co., Ltd; Bartec Mechanical Anchorages for Steel Reinforcing Bars in Concrete (ESR-2166).
    - b. Headed Reinforcement Corporation; HRC 555 Headed Reinforcing Bars (ESR-2935).
    - c. Headed Reinforcement Corporation; HRC 670 HeadLock (IAPMO-UES 0177).
    - d. nVent Electric plc.; Lenton Terminator (IAPMO-UES 0188).
    - e. nVent Electric plc.; Lenton Ultimate (IAPMO-UES 0188)
- 2.3 REINFORCEMENT ACCESSORIES
  - A. Joint Dowel Bars: Smooth bars used to dowel across slab-on-grade construction joints shall conform to ASTM A 615, Grade 40 or ASTM A 36, plain-steel bars. Cut bars true to length with ends square and free of burrs.
  - B. Epoxy-Coated Joint Dowel Bars: Smooth epoxy-coated bars used to dowel across slab-on-grade construction joints shall conform to ASTM A 775 with ASTM A 615, Grade 40 or ASTM A 36 plain-steel bars. Cut bars true to length with ends square and free of burrs.
  - C. Dowel Bar Sleeves: Plastic or gage metal (26 gauge minimum) sleeves with an inside diameter of 1/16 inch greater than the dowel bar that it encases, that have the strength, durability, and design to provide free movement of the dowel relative to the concrete slab and that are specifically manufactured for this purpose.
  - D. Alternate Slab-on-Grade Joint Load Transfer Systems: A system that consists of flat, ASTM A 36 plate that is saw cut into a square or rectangular shape and is embedded into or encased by a plastic sleeve that allows movement in both lateral directions but not in the vertical direction. Acceptable systems are manufactured by PNA Construction Technologies with products known by the names "Diamond Dowel System" and "PD<sup>3</sup> Basket" and Greenstreak Group Inc. with products known as "Speed Plate' and "Double-Tapered Basket".
  - E. Tie Wire: Tie wire shall be annealed steel tie wire, minimum 16 gauge.

- a. Tie wire in architecturally exposed concrete shall be plastic coated or stainless steel.
- b. Tie wire for epoxy-coated reinforcement shall be epoxy-coated.
- c. Tie wire for galvanized reinforcement shall be galvanized.
- Holding Wire: Holding wire shall conform to ASTM A 82 or ASTM A 1064.
- G. Coating Repair Materials: Repair damaged areas of epoxy-coated or galvanized reinforcement using the following products.
  - 1. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating compatible with epoxy coating on reinforcement and complying with ASTM A 775.
  - 2. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc shall be used to repair damaged areas of galvanized reinforcement.
- H. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Use wire bar type supports complying with CRSI recommendations.
  - 1. Slabs-on-Grade: Use precast concrete bar supports (dobies) or supports with sand plates or horizontal runners designed for use on ground.
  - 2. Spread Footing Bottom Reinforcement: Use precast concrete bar supports (dobies) or chairs designed for soil-supported slabs.
  - 3. Mat Foundation: Use precast concrete bar supports (dobies), chairs designed for soilsupported slabs, or cast-in-place concrete curbs.
  - 4. Exposed to View Concrete: Provide supports with legs which are plastic protected (CRSI, Class 1) or stainless steel protected (CRSI, Class 2).
  - 5. Support of Epoxy-Coated Reinforcement: Provide epoxy-coated or other dielectricpolymer-coated wire bar supports to support epoxy-coated reinforcement.
  - 6. Support of Galvanized Reinforcement: Provide galvanized wire bar supports to support galvanized reinforcement.
- 2.4 ALTERNATES:

F.

- 1. Products Requiring International Code Council (ICC) Evaluation Service Reports:
  - a. For those products listed in Part 2 as requiring Evaluation Service Reports (ESRs), alternate products that do not have ESRs will be considered by the Engineer only if valid research reports or test data from an independent and approved agency is provided and use of the product receives prior approval from the Building Official.

## PART 3 - EXECUTION

## 3.1 FABRICATION AND DELIVERY

- A. Bending and Forming: Fabricate bars of indicated sizes and accurately form to shapes and lengths indicated and required, by methods not injurious to materials. Do <u>not</u> heat reinforcement for bending. Bars shall be free from injurious defects, have a workman-like finish with no excessive rust and/or pitting, and have no unusual kinks or bends.
- B. Marking and Shipping: Bundle reinforcement and tag in accordance with Section 7.4.5 of the CRSI "Manual of Standard Practice." Transport and store at site so as not to damage material. Keep sufficient supply of tested, approved, and proper reinforcement at the site to avoid delays. Maintain reinforcing bars free of mud, dirt, grease, or other coating.
- C. Repair of Epoxy-Coated Reinforcing: Repair cut and damaged epoxy coatings on fabricated reinforcing before delivery with epoxy repair coating according to ASTM D 3963

## 3.2 PLACING REINFORCEMENT

- A. Comply with CRSI recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports and as herein specified.
- B. Before placing reinforcement and again before concrete is placed, clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.
- C. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by chairs,

runners, bolsters, spacers, and hangers as required. Exercise particular care to maintain proper distance and clearance between parallel bars and between bars and forms. Provide spreaders and spacers to hold steel in position. Support steel at proper height upon approved chairs.

- D. Place reinforcement to obtain at least minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set tie wires so ends are directed into concrete, not toward exposed concrete surfaces.
- E. Support of Column and Wall Reinforcing Steel:
  - 1. It is the responsibility of the contractor to ensure that all reinforcing assemblies have adequate strength and stability to resist loads imposed during construction.
- F. Support of Spread Footing Reinforcing Steel:
  - 1. Bottom Steel: Support bottom reinforcing mat to provide the specified clearance to the bars. Spacing between supports shall not exceed 4'-0" centers each way.
  - 2. Top Steel: Support top reinforcing on steel angle frames braced in both directions or on special standee support bars. Spacing between supports shall not exceed 4'-0" centers each way. The depth of the supports shall provide the specified clearance from the bars to the top of the concrete. The design of the support steel shall be the responsibility of the Contractor.
- G. Install welded wire reinforcement in as long lengths as practicable. Provide lap splice for wires of adjoining pieces per ACI 318 Chapter 25.5.3 or 25.5.4 and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.
- H. Coordinate with other trades and expedite materials and labor to avoid omissions and delay.
- I. Install waterproof membrane or vapor retarder as specified prior to placing steel for concrete slabs-on-grade.
- J. Extend reinforcement continuous through construction joints unless otherwise shown on the drawings.
- K. Slab-on-Grade Joint Dowel Bars: Support slab-on-grade joint dowel bars independently of support for slab reinforcement on soil supported slab bolsters or specially manufactured cradles such that dowel bar remains parallel to slab surface and at right angles to joint during concreting operations. Lightly coat the exposed end of the dowel with a paraffin-base lubricant, asphalt emulsion, form oil, or grease or use a dowel bar sleeve.
- L. Alternate Slab-on-Grade Joint Load Transfer Systems: Install the alternate load transfer system in accordance with the manufacturer's instructions such that the largest plane of the flat plate is parallel to the plane of the subgrade on which the slab is bearing.
- M. Provide and place additional reinforcing steel at all sleeves and openings in beams, slabs, and walls as specified on the drawings. Where sleeves or openings not shown on the drawings interrupt the reinforcement, consult with Engineer for instructions for placing and splicing of bars. Provide required additional reinforcing steel at no additional cost to the Owner.
- N. Epoxy-Coated Reinforcement: Use epoxy-coated steel tie wires to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963.
- O. Galvanized Reinforcement: Use galvanized steel tie wires to fasten galvanized reinforcement. Repair cut and damaged zinc coatings with zinc repair material.
- P. Do not bend reinforcement that is embedded partially in concrete except in locations noted on the drawings or approved by the Engineer.

## 3.3 SPLICING REINFORCING STEEL

- A. Provide splices as indicated on the drawings. Splice reinforcing bars only at locations shown on the structural drawings and approved shop drawings. Unauthorized or unscheduled splices not approved by the Engineer in writing will not be accepted.
- B. All lap splices in reinforcing steel shall be contact lap splices unless detailed otherwise on the drawings.
- C. Maintain proper cover and spacing between reinforcing bars at splices.
- D. Lap unscheduled reinforcing bars not otherwise specified with a Class B lap splice. Lap welded wire reinforcement per ACI 318 Chapter 25.5.3 or 25.5.4.
- E. Manufacturer of mechanical tension splice shall be present for first day's installation.

- 3.4 WELDING REINFORCING STEEL
  - A. Welding reinforcing steel is permitted only where specifically shown on the drawings. All welding shall conform to AWS D1.4. Only weldable reinforcing steel conforming to ASTM A 706 or deformed bar anchors conforming to ASTM A 1064 shall be permitted. ASTM A 615 bars may not be welded for structural use.
  - B. Tack welding of reinforcement shall not be permitted.
  - C. Fusion welding of preassembled cages shall be permitted only under the following conditions:
    - 1. Written approval is received from the Building Official and the Engineer.
      - 2. Fusion welding of holding wires to ties, stirrups, and hoops in beams, columns and grade beams to preassemble reinforcing cages is permissible. The holding wire area shall not exceed five percent of the beam, column, or grade beam cross sectional longitudinal steel area. Fusion welding is not allowed to longitudinal reinforcing steel in any beam, column, or grade beam.
      - 3. Fusion welding of holding wires to the ends of the reinforcing steel placed in spread footings or mats is permitted if the fusion weld occurs within six bar diameters of the free end of the bar. Fusion welding is not allowed at the end of coupled, T-headed, or weld spliced bars.
      - 4. Fusion welding of holding wires shall not occur on a bent portion of a reinforcing bar. Bars shall not be bent where a fusion weld occurs.

## 3.5 SHRINKAGE AND TEMPERATURE REINFORCEMENT

A. Provide shrinkage and temperature reinforcement as indicated on the drawings at right angles to main top and bottom bars for all structural slabs unless detailed otherwise on the drawings.

## 3.6 PLACEMENT OF WELDED WIRE REINFORCEMENT

A. Wherever welded wire reinforcement is specified as reinforcement in pan-formed beams or slabs, it shall be continuous and properly lapped per ACI 318 Chapter 25.5.3 or 25.5.4 across the entire concrete surface and not interrupted by beam or girders.

## 3.7 REINFORCEMENT IN GRADE BEAMS

- A. Provide reinforcing in grade beams as shown on the drawings.
- B. Bar Support for Grade Beam Cages: Grade beam bottom steel shall be supported at 5'-0" maximum centers using beam bolsters that provide bottom cover to the reinforcing steel as noted on the drawings. Beam bolsters used shall be designed and manufactured for support on soil.

#### 3.8 REINFORCEMENT IN HOUSEKEEPING PADS

- A. Provide welded smooth wire reinforcement 6 x 6 W2.9 x W2.9 minimum in all housekeeping pads supporting mechanical equipment unless detailed otherwise on the drawings.
- B. Provide reinforcing in housekeeping pads as shown on the drawings.

### 3.9 MECHANICAL AND PLUMBING REQUIREMENTS

A. Refer to Mechanical and Plumbing Drawings for concrete requiring reinforcing steel. Such reinforcement shall be furnished as part of the work of this section.

## 3.10 FIELD QUALITY CONTROL

A. Field Testing and Inspection: Refer to Specification 01 45 29 "Structural Testing and Inspections""] for testing and inspection requirements associated with concrete reinforcing.

#### END OF SECTION

#### **SECTION 033000**

#### CAST-IN-PLACE CONCRETE

#### 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 work of this section.

#### 1.2 SUMMARY

- A. Section includes all labor, materials, services, equipment, and hardware required in conjunction with or related to the forming, delivery, and pouring of all cast-in-place concrete work. Concrete paving and walks are specified in Division 32. Architectural Concrete, Precast Concrete, Post-Tensioned Concrete and special requirements for Tilt-Up Concrete are specified in other Division 03 sections.
- B. Related Requirements:
  - 1. Specification 01 45 29 "Structural Testing and Inspections" for inspection requirements associated with cast-in-place concrete.
  - 2. Specification 03 10 00 "Concrete Forming and Accessories" for forming associated with cast-in-place concrete.
  - 3. Specification 03 20 00 "Concrete Reinforcing" for reinforcement for cast-in-place concrete.

#### 1.3 REFERENCES

A. Reference Standards:

- 1. Codes and Standards: Comply with provisions of following codes, specifications and standards, except where more stringent requirements are shown or specified:
  - a. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
  - b. ACI 301, "Specifications for Structural Concrete."
  - c. ACI 305.1, "Specification for Hot Weather Concreting."
  - d. ACI 318, "Building Code Requirements for Structural Concrete."
  - e. ACI 355.4, "Qualification of Post-Installed Adhesive Anchors in Concrete."
  - f. CRSI, "Manual of Standard Practice."

## 1.4 ADMINISTRATIVE REQUIREMENTS

#### Coordination:

Α.

- 1. Quality Control: The Contractor is responsible for quality control, including workmanship and materials furnished by subcontractors and suppliers.
- 2. Document Conflict and Precedence: In case of conflict among documents, including architectural and structural drawings and specifications, notify the Architect/Engineer prior to submitting proposal. In case of conflict between and/or among the structural drawings and specifications, the strictest interpretation shall govern, unless specified otherwise in writing by the Architect/Engineer.
- 3. Materials and installed work may require testing and retesting, as directed by the governing building code or the Architect/Engineer, at any time during progress of work.
  - a. The Contractor shall provide adequate notification to the Owner's Testing Agency of construction operations including the project schedule to allow the Testing Agency to schedule inspections. Failure to notify sufficiently may result in additional costs incurred by the Testing Laboratory that may be back-charged to the Contractor by the Owner.
  - b. The Contractor shall cooperate with laboratory personnel, provide access to the work, and provide access to manufacturer's operations.
  - c. The Contractor shall make adequate arrangement with the Owner's Testing Agency for inspection of material stockpiles and facilities.

- d. The Contractor shall provide to the laboratory certificates and representative samples of materials proposed for use in the work in quantities sufficient for accurate testing as specified.
- e. The Contractor shall furnish casual labor, equipment, and facilities as required for sampling and testing by the laboratory and otherwise facilitate the required inspections and tests.
- f. Inspection or testing by the Owner does not relieve the Contractor of his responsibility to perform the Work in accordance with the Contract Documents. Tests not specifically indicated to be done at the Owner's expense, including retesting of rejected materials and installed work, shall be done at the Contractor's expense. See Structural Testing section of the Specifications.
- 4. Responsibility for Selection and Use of Concrete Admixtures and Chemical Treatments: The Contractor shall be responsible for selecting admixtures and surface treatments that are compatible with the intended use of the concrete including all final surface treatments called for within this or other specifications or on the structural or architectural drawings. The Contractor is responsible for following the manufacturer's instructions for the use of their product including abiding by any limitations placed by the manufacturer on the use of any of its products.
- B. Preinstallation Meetings:
  - 1. Pre-Concrete Conference:
    - a. At least seven days prior to beginning concrete work, the Contractor shall conduct a meeting to review the proposed design mixtures and to discuss required methods and procedures to produce concrete construction of the required quality. Also, review requirements for submittals, status of coordinating work and availability of materials. Establish work progress schedule and procedures for materials inspection, testing, and certifications. The contractor shall send a pre-concrete conference agenda to all attendees seven days prior to the scheduled date of the conference.
    - b. The Contractor shall require responsible representatives of every party who is concerned with the concrete work to attend the conference, including but not limited to the following:
      - 1) Contractor's Superintendent.
      - 2) Laboratory responsible for the concrete design mix.
      - 3) Laboratory responsible for field quality control.
      - 4) Concrete Subcontractor.
      - 5) Post-Tensioning Contractor
      - 6) Ready-Mix Concrete Producer.
      - 7) Admixture Supplier.
      - 8) Concrete Pumping Contractor.
      - 9) Fiber Reinforcement Representative.
      - 10) Owner's and Architect's/Engineer's Representative.
    - c. Minutes of the meeting shall be recorded, typed and printed by the Contractor and distributed to all parties concerned within five days of the meeting. One copy of the minutes shall be transmitted to the following for information purposes:
      - 1) Owner's Representative.
      - 2) Architect.
      - 3) Engineer-of-Record.
    - d. The Engineer shall be present at the conference. The Contractor shall notify the Engineer at least seven days prior to the scheduled date of the conference.
- C. Sequencing:
  - 1. Provide for installation of inserts, hangers, metal ties, anchors, bolts, angle guards, dowels, thimbles, slots, nailing strips, blocking, grounds, and other fastening devices required for attachment of work. Properly locate in cooperation with other trades and secure in position before concrete is poured. Do not install sleeves in any concrete slabs, beams, or columns except where shown on the drawings or upon written approval of the Architect/Engineer.

## 1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's product data with application and installation instructions for proprietary materials and items, including patching compounds, epoxies, grouts, waterstops, joint systems, curing compounds, dry-shake finish materials, hardeners, sealers, joint fillers, and others as requested by Architect/Engineer.
- B. Shop Drawings:
  - 1. Construction Joints: Submit drawings of proposed construction joint locations in concrete for slab-on-grade, mat foundations, structural floors, roofs and walls. Submit any additional or changed reinforcing that is required at construction joints that differs from that shown on the drawings.
  - 2. Openings, Sleeves, and Cores: Submit drawings of all openings to be formed, sleeved, cored, or sawcut in cast-in-place elements. Drawings shall indicate size and location of openings, sleeves, or cores.
  - 3. Embedded Items: Submit drawings showing all items to be embedded in concrete elements, including plates, angles, bolts, and any non-structural items, such as conduit. Drawings shall indicate location, size, orientation, and type of embedded item.
- C. Samples: Submit samples of materials specified if requested by Architect/Engineer, including names, sources, and descriptions.
- D. Certificates:
  - 1. Material and Mill Certificates:
    - a. Provide material and mill certificates as specified herein and in the Testing Laboratory section of the Specifications. The Manufacturer and Contractor shall sign the material and mill certificates certifying that each material item complies with specified requirements.
- E. Concrete Materials:
  - 1. Cementitious Materials:
    - a. Provide cementitious material types and certificates showing compliance with the respective ASTMs.
  - 2. Aggregates:
    - a. Provide types, sizes, pit or quarry locations, producers' names, aggregate supplier statement of compliance with ASTM C33/C33M.
    - b. Provide expansion data from ASTM C1260 or ASTM C1293 for all concrete designated C1, C2 or W1.
  - 3. Admixtures:
    - a. Provide types, brand names, producers' names, manufacturer's technical data sheets, compatibility with other admixtures, and certificates showing compliance with the respective ASTMs.
    - b. Provide certification from admixture manufacturers that chloride ion content complies with specified requirements.
  - 4. Design Mixtures:
    - a. Submit for each concrete mixture as specified in Section 2.7.
    - b. Submit shrinkage test results for all concrete identified on the drawings requiring shrinkage limits.
- F. Field Quality Control Submittals:
  - 1. Surveys: Submit report certifying that all anchor rods and reinforcing dowels into columns above are in their proper location prior to placing of concrete.
- G. Qualification Statements: Submit certifications for adhesive anchor installers.
- H. Environmental Product Declarations:
  - 1. To encourage the use of building products that are working to minimize their environmental and health impacts, consideration will be given to products with publicly available Environmental Product Declarations. For all concrete mixtures submit one of the following that applies to the product:
    - a. Product-specific Type III EPD with internal or external review that conform to ISO 14025, and EN 15804 or ISO 21930 and has at least a cradle to gate scope.

- b. Industry Wide Type III EPD. A letter from the product manufacturer, on manufacturer's letterhead, stating that the manufacturer, and proposed batch plants, participated in the NRMCA Industry-Wide Environmental Product Declaration.
- c. A letter from the product manufacturer, on manufacturer's letterhead, stating that the product does not have a product specific EPD nor was a participant in an industry wide EPD.
- 2. Submit required EPDs at time of bid.
- 3. Concrete mixes will be evaluated with consideration to their EPDs. Reference maximum cement content, where listed, per the "Classes of Concrete Matrix" in the structural drawings.
- I. Minutes of Preinstallation Meetings: Submit for review.

## 1.6 QUALITY ASSURANCE

## A. Qualifications:

- 1. Concrete Supplier: The concrete supplier shall have a minimum of five years of experience in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment. The supplier must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.
- 2. Concrete Contractor: The concrete contractor shall have a minimum of five years of experience with installation of concrete similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful service performance.
- 3. Adhesive Anchor Installers: The individuals performing the installation of adhesive anchors that are horizontally or upwardly inclined shall be certified in accordance with the ACI/CRSI Adhesive Anchor Installer Certification program.
- B. Survey for Anchor Rods and Reinforcing Steel Dowels: The Contractor shall use a qualified licensed professional engineer or licensed land surveyor to lay out the proper location of all embedded anchor rods and reinforcing steel dowels for columns above before they are encased in concrete. The surveyed locations of such elements shall be submitted to the Architect/Engineer for record, if requested.
- C. Manufacturer Representative Presence:
  - 1. Post-installed anchors: The manufacturer's representative for each post-installed anchor product (adhesive, expansion, undercut, screw, or insert anchor) shall be present during the first day's installation of the product to provide instruction for the correct installation of each type of any to be installed in accordance with the manufacturer's recommendation and the current ICC-ES Evaluation Report.
  - 2. Fiber-reinforced concrete: The manufacturer's representative for each fiber type shall be present during the first pour in which the fiber is used to verify whether the dosage rate, placing, and finishing method is in accordance with the specifications and the manufacturer's instruction.
- D. Mockups: Provide mock-ups as required.

## PART 2 - PRODUCTS

## 2.1 CONCRETE MATERIALS

- A. Refer to the drawings for classes and strengths of concrete required.
- B. Hydraulic Cement:
  - 1. Use ASTM C 150, ASTM C 1157, or ASTM C 595 (excluding Type IS) unless otherwise specified. Do not use Type III cement in slabs-on-grade unless approved in advance by the Engineer.
  - 2. Concrete Exposed to Sulfates in Soil or Water:
    - a. Exposure Class S1: For concrete designated on the drawings as Exposure Class S1, use ASTM C 150, Type II or ASTM C 1157, Type MS.

- b. Exposure Class S2: For concrete designated on the drawings as Exposure Class S2, use ASTM C 150, Type V or ASTM C 1157, Type HS.
- c. Alternate Cement Types for Exposure Classes S1 and S2: ASTM C 150, Type I or III cement may be used for concrete designated as Exposure Class S1 or S2 if the tricalcium aluminate (C<sub>3</sub>A) content is less than eight percent for Exposure Class S1 or five percent for Exposure Class S2. ASTM C 150, Type I or III cement may be used for exposure to seawater if the tricalcium aluminate content does not exceed 10 percent and the water/cementitious material ratio of the concrete mix does not exceed 0.40.
- d. Exposure Class S3: For concrete designated on the drawings as Exposure Class S3, use ASTM C 150, Type V plus pozzolan or slag or ASTM C 1157, Type HS plus pozzolan or slag or ASTM C 595, Type IP (HS) or Type IS (HS). The amount of pozzolan or slag added or in a blended mix shall be such that has been determined by service record to improve sulfate resistance when used with Type V cement or the amount that when tested according to ASTM C 1012 meets the criteria of Table 26.4.2.2(c) in ACI 318-14.
- 3. Use one brand of cement, for each class of concrete, throughout the project, unless approved otherwise by the Architect/Engineer and the Owner's Testing Laboratory. Submit mill certificates certifying conformance to this specification for each brand and type of cement.
- 4. Testing of cement in lieu of mill certificate submittal will be required if:
  - a. The cement has been in storage at the mixing site for over 30 days.
  - b. It is suspected by the Owner, Architect, Engineer, or Owner's Testing Laboratory that the cement has been damaged in storage or in transit or is in any way defective.
- C. Low-alkali cement: Cement that has the additional requirement that equivalent alkalis (Na<sub>2</sub>O + 0.658K<sub>2</sub>O) do not exceed 0.60% according to ASTM C 150-00, Table 2.
- D. Fly Ash: ASTM C 618, Class C or F.
- E. Silica Fume: ASTM C 1240, Amorphous Silica.
- F. Slag Cement: ASTM C 989, Grade 100 or 120 or ASTM C 595, Type IS or Type S.
- G. Normalweight Aggregates: ASTM C 33, and as herein specified. Submit material certificates from aggregate supplier or test results from an independent testing agency certifying conformance to this specification for each source of aggregate.
  - 1. Concrete identified on the drawings as Exposure Class C1, C2 or W1 must meet the Durability Requirements outlined in Section 2.7E.
- H. Water: Comply with the requirements of ASTM C 1602.

## 2.2 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
  - 1. Subject to compliance with requirements, provide one of the following products and manufacturers:
    - a. GCP Applied Technologies; Darex or Daravair series.
    - b. Master Builder Solutions; MasterAir VR 10, MasterAir AE 90, MasterAir AE 200.
    - c. Sika Corporation; Sika AER.
    - d. The Euclid Chemical Company; Air Mix, AEA-92, Eucon Air 30 or Eucon Air 40.
- B. Water-Reducing Admixture: ASTM C 494, Type A. See maximum permissible chloride ion content in concrete specified below.
  - 1. Subject to compliance with requirements, provide one of the following products and manufacturers:
    - a. Master Builder Solutions; MasterPozzolith Series or MasterGlenium Series.
    - b. Sika Corporation; Plastocrete 161.
    - c. The Euclid Chemical Company; Eucon WR-75, Eucon WR-91, Eucon NW or Eucon LW.
    - d. GCP Applied Technologies; WRDA series, Zyla Series.
- C. Mid-Range Water-Reducing Admixture: ASTM C 494, Type A and Type F. See maximum permissible chloride ion content in concrete specified below.

- 1. Subject to compliance with requirements, provide one of the following products and manufacturers:
  - a. Master Builders Solutions: MasterPolyheed Series or MasterGlenium Series.
  - The Euclid Chemical Company; Eucon MR, Eucon X-15 or Eucon X-20. b.
  - Sika Corporation: SikaPlast-300 GP. C.
  - GCP Applied Technologies; Daracem or Mira series. d.
- High-Range Water-Reducing Admixture (Superplasticizer): ASTM C 494, Type F or Type G. See D. maximum permissible chloride ion content in concrete specified below.
  - 1. Subject to compliance with requirements, provide one of the following products and manufacturers:
    - GCP Applied Technologies; ADVA or Daracem Series. a.
    - Master Builders Solutions; MasterRheobuild 1000 or MasterGlenium Series. b.
    - Sika Corporation; Sikament. C.
    - The Euclid Chemical Company; Eucon 37/1037, Plastol series, Eucon SP or Eucon d. RD2.
- E. Water-Reducing, Accelerator Admixture (Non-Corrosive, Non-Chloride): ASTM C 494, Type C or E. See maximum permissible chloride ion content in concrete specified below.
  - 1 Subject to compliance with requirements, provide one of the following products and manufacturers:
    - GCP Applied Technologies; Polarset, Lubricon NCA, Daraset 400, or DCI. a.
    - b. Master Builders Solutions; MasterSet FP 20 or MasterSet AC 534.
    - The Euclid Chemical Company; Accelguard 80/90, Accelguard NCA, or Accelguard C. AcN.
    - d. Sika Corporation; Plastocrete 161FL.
- Water-Reducing, Retarding Admixture: ASTM C 494, Type D. See maximum permissible F. chloride ion content in concrete specified below.
  - Subject to compliance with requirements, provide one of the following products and 1. manufacturers:
    - GCP Applied Technologies; Daratard series, or Zyla R. a.
    - Master Builders Solutions; MasterPozzolith R series, or MasterSet DELVO series. b.
    - Sika Corporation; Plastiment. C.
    - d. The Euclid Chemical Company; Eucon Retarder series.
- G. Shrinkage Reducing Admixture.
  - Subject to compliance with requirements, provide one of the following products and 1 manufacturers:
    - For Air-Entrained Concrete: a.
      - GCP Applied Technologies; Eclipse 4500. 1)
      - The Euclid Chemical Company; Eucon SRA. 2)
      - Master Builders Solutions: MasterLife CRA 007. 3)
    - b. For Non Air-Entrained Concrete
      - GCP Applied Technologies; Eclipse Floor 200. 1) 2)
        - Master Builders Solutions; MasterLife SRA 20
- Η. Corrosion Inhibitor: 30% calcium nitrite:
  - Products: Subject to compliance with requirements, provide the following at dosage rates 1. per Engineer from manufacturer's recommendation based on design life, application, clear cover and other products in concrete mix:
    - a. The Euclid Chemical Company; Eucon CIA or Eucon BcN.
    - b. GCP Applied Technologies; DCI or DCI-S.
    - BASF Corporation; MasterLife CI 30. C.
    - Sika Corporation; Sika CNI. d.
- Corrosion Inhibitor: Amine-Ester type: L.
  - Products: Subject to compliance with requirements, provide the following at dosage rates 1. per manufacturer's recommendation:
    - BASF Corporation; MasterLife CI 222. a.

- J. Crystalline-Forming Waterproofing Admixture: A powder admixture capable of producing concrete that is water tight under hydrostatic pressure up to seven atmospheres when tested in accordance with Corps of Engineers test CRD-C48 and capable of sealing cracks up to 0.4 mm.
  - 1. Products: Subject to compliance with requirements, provide the following at dosage rates per manufacturer's recommendation:
    - a. ICS/Penetron International/Ltd; Penetron Admix.
    - b. Kryton International, Inc.; Krystol Internal Membrane (ESR-1515).
    - c. Xypex Chemical Corporation; Xypex Admix C1000 or C500.
    - d. Sika Corporation; Sika WT-215P
    - e. Master Builders Solutions; MasterLife 300C
    - f. The Euclid Chemical Company; Eucon Vandex AM-10
- K. Moisture Vapor Reduction Admixture: Acceptable products include:
  - 1. Barrier One, Inc.; Barrier-1.
  - 2. USC Technologies, Inc.; Aridus.
  - 3. GCP Applied Technologies; Eclipse Floor 200.
  - 4. Concure Systems; Concure Systems Admixture.
  - 5. Specialty Products Group; Vapor Lock VL 20/20.
  - 6. ISE Logik Industries; MVRA 900.
- L. Calcium Chloride: Calcium chloride is not permitted.
- M. Certification: Written conformance to all the above-mentioned requirements and the chloride ion content of the admixture as tested by an accredited laboratory will be required from the admixture manufacturer at the time of design mixture review by the Engineer.

## 2.3 WATERSTOPS

- A. Provide waterstops at all construction joints and other joints in all foundation walls below grade and where shown on the drawings. Size to suit joints and factory fabricate corners, intersections, and directional changes. The selected waterstop products shall be appropriate for the specific joint condition as specified by the manufacturer, including number of layers of reinforcement, minimum concrete thickness and minimum concrete cover.
  - 1. Products:
    - a. Swell Hydrophilic Waterstops:
      - 1) Manufacturers: GCP Applied Technologies; ADCOR ES or ADCOR 500S.
    - b. Polyvinyl Chloride (PVC) Waterstops: Comply with Corps of Engineers CRD-C 572. Provide flat, dumbbell type or centerbulb type as noted on the drawings.
    - c. Rubber Waterstops: Comply with Corps of Engineers CRD-C 513. Provide flat, dumbbell type or centerbulb type as noted on the drawings.
    - d. Preformed Plastic Waterstops: Comply with Federal Specifications SS-S-210A "Sealing Compound for Expansion Joints".
      - 1) Manufacturers: Henry Corporation; Synko-Flex Waterstop
    - e. Bentonite Waterstops:
      - 1) Manufacturers: CETCO; Bentonite Waterstop-RX.

## 2.4 CURING MATERIALS

A. Liquid Membrane-Forming Curing and Curing and Sealing Compounds:

- 1. Water-Based Dissipating Resin Type Curing Compound: Curing Compound shall be a dissipating resin type, which chemically breaks down after approximately four weeks. Membrane forming compound shall meet ASTM C 309, Types 1 or 1D, Class B with a VOC content less than 350 grams per liter.
  - a. Products: Subject to compliance with requirements, provide one of the following:
    - 1) The Euclid Chemical Company; Kurez DR VOX.
    - 2) L&M Construction Chemicals; L&M Cure R.
    - 3) Dayton-Superior Company; Clear Resin Cure J11W.
    - 4) W.R. Meadows, Inc; 1100-Clear.
    - 5) US Mix Co.; US Spec Maxcure Resin Clear.
    - 6) SpecChem LLC; SpecRez.

- b. Submit manufacturer's certification that product conforms to the requirements specified and is compatible with any covering or surface treatments to be applied. Submit any instructions that must be followed prior to any subsequent surface treatments and floor coverings.
- 2. High Solids, Water-Based Acrylic Curing and Sealing Compound with Moderate Yellowing Characteristics: Water-Based membrane-forming curing and sealing compound conforming to ASTM C 1315, Type 1, Class B, classified as low odor with a VOC content less than 350 grams per liter. Do not apply to surfaces that are to receive subsequent cementitious toppings, sealers, hardeners, ceramic tile, resilient flooring, vinyl-backed carpet, wood, terrazzo, epoxy overlays or adhesives, or other coating or finishing products.
  - a. Products: Subject to compliance with above requirements, provide one of the following products or equivalent products:
    - 1) Dayton-Superior; Cure & Seal 1315 J22WB.
    - 2) The Euclid Chemical Company; Super Aqua-Cure VOX.
    - 3) L&M Construction Chemicals; Dress & Seal, 30 WB.
    - 4) Master Builders Solutions; Masterkure CC 1315.
    - 5) SpecChem LLC; Cure & Seal WB 25.
  - b. Submit manufacturer's certification that product conforms to the requirements specified and is compatible with any covering or surface treatments to be applied. Submit any instructions that must be followed prior to any subsequent surface treatments.
- 3. High Solids, Water-Based, Non-Yellowing Curing and Sealing Compound: Water based membrane-forming curing and sealing compound, acrylic type, complying with ASTM C 1315, Type 1, Class A classified as low odor with a VOC content less than 350 grams per liter. Do not apply to surfaces that are to receive subsequent cementitious toppings, sealers, hardeners, ceramic tile resilient flooring, vinyl-backed carpet, wood, terrazzo, epoxy overlays or adhesives, or other coating or finishing products.
  - a. Products: Subject to compliance with requirements, provide one of the following:
    - 1) The Euclid Chemical Company; Super Diamond Clear VOX.
    - 2) L&M Construction Chemicals; Lumiseal WB Plus.
    - 3) Master Builders Solutions; MasterKure CC 1315.
    - 4) Dayton-Superior Corporation; Cure & Seal 1315EF
    - 5) W.R. Meadows, Inc; Vocomp 30.
    - 6) SpecChem LLC; Cure & Seal WB 30.
  - b. Submit manufacturer's certification that product conforms to the requirements specified and is compatible with any covering or surface treatments to be applied. Submit any instructions that must be followed prior to any subsequent surface treatments.
- B. Evaporation Control: Monomolecular film forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss in hot, dry, or windy weather conditions.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. The Euclid Chemical Company; Eucobar.
    - b. L&M Construction Chemicals; E-Con.
    - c. Master Builders SolutionsBASF Corporation; MasterKure ER 50.
    - d. Dayton-Superior Corporation; Aqua Film (J74).
    - e. Sika Corporation; SikaFilm.
    - f. W.R. Meadows. Inc: Sealtight Evapre.
    - g. US Mix Co.; US Spec Monofilm ER.
    - h. SpecChem LLC; SpecFilm RTU.
  - 2. Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all coverings and surface treatments to be applied. Submit any instructions that must be followed prior to any subsequent surface treatments.
- C. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately nine ounces per square yard, complying with AASHTO M 182, Class 2.
- D. Moisture-Retaining Cover: One of the following, complying with ANSI/ASTM C 171:

- 1. Waterproof paper.
- 2. Polyethylene film.
- 3. Polyethylene-coated burlap.
- 4. Polyethylene-coated natural cellulose fabric such as Greenstreak Group, Inc.; Aquacure.
- 5. Cover for Industrial Slab: Provide a low permeance moisture-retaining cover that allows a moisture loss of no more than one pound per square yard in 72 hours when tested in accordance with ATSM C 156 for industrial slabs. The material shall be non-staining and meet with requirements of ASTM C 171.

## 2.5 RELATED MATERIALS

- A. Post-Installed Anchors:
  - 1. Qualified Products:
    - a. Mechanical Anchors: Only anchors having passed Acceptance Criteria 193 for use in cracked concrete and resisting wind and seismic loads shall be approved for use. Reports from the following organizations are acceptable:
      - 1) ICC Evaluation Service Report.
      - 2) IAPMO Uniform Evaluation Services.
    - b. Adhesive Anchoring Systems: Only adhesive anchor systems that comply with the latest revision of ICC-ES Acceptance Criteria 308 for use in cracked concrete and resisting wind and seismic loads shall be approved for use. Reports from the following organizations are acceptable:
      - 1) ICC Evaluation Service Report.
      - 2) IAPMO Uniform Evaluation Services.
  - 2. Alternate Anchor Approval: Install only anchors identified on the drawings by manufacturer and product. Substitutions using products approved by this Specification may be permitted provided complete design calculations are signed and sealed by a registered professional engineer licensed in the state where the project is located and furnished to the Engineer for review and approval prior to commencement of work. The Contractor shall request design criteria for all conditions where a product substitution is considered. Failure to obtain approval for an anchor substitution may result in the request by the Engineer to remove installed anchors and replace with the product specified on the drawings at the Contractor's expense.
  - 3. Installation: All installation of post-installed anchors shall be in accordance with the Manufacturer's Printed Installation Instructions (MPII).
  - 4. Interior Use: All anchors for use in interior conditioned environments free of potential moisture shall be manufactured from carbon steel zinc plated in accordance with Federal Specification QQ-Z-325C, Type II, Class 3.
  - 5. Exterior or Exposed Use: All anchors for use in exposed or potentially wet environments or for attachment of exterior cladding materials shall be galvanized or stainless steel. Galvanized anchors shall conform to ASTM A 153. Stainless steel anchors shall be manufactured from 300 series stainless steel.
  - 6. Nuts and Washers: Nuts and washers shall be furnished from the manufacturer and used with the anchors.
  - 7. Anchor Types:
    - a. Expansion and Undercut Anchors in Concrete:
      - 1) Type: All expansion and undercut anchors in concrete shall be wedge type expansion, sleeve type expansion, or undercut type anchors.
      - 2) Acceptable Products and Manufacturers Normalweight and Sand-Lightweight Concrete Not on Corrugated Steel Deck:
        - a) Hilti, Inc.; Kwik Bolt TZ2 (ESR-4266).
        - b) Hilti, Inc.; HDA Undercut Anchor (ESR-1546).
        - c) Hilti, Inc.; HSL-4 Heavy Duty Sleeve Anchor (ESR-4386).
        - d) Simpson Strong-Tie Co., Inc.; Strong-Bolt 2 Wedge Anchor (ESR-3037).
        - e) USP Structural Connectors; DUC Undercut Anchor (ESR-1970).

- f) Dewalt; Power Stud+ SD1 Expansion Anchor (ESR-2818).
- g) Dewalt; Power Stud+ SD2 Anchor (ESR-2502).
- h) Dewalt; Atomic+ Undercut Anchor (ESR-3067).
- i) Dewalt; Power-Bolt+ Sleeve Anchor (ESR-3260)
- j) MKT Metall-Kunststoff-Technik; SRS TZ Anchor (ESR-2461).
- Acceptable Products and Manufacturers Normalweight and Sand-Lightweight Concrete on Corrugated Steel Deck:
- b. Screw and Insert Anchors in Concrete:
  - 1) Acceptable Products and Manufacturers:
    - a) Hilti, Inc.; KWIK HUS-EZ Anchor (ESR-3027).
    - b) Simpson Strong-Tie Co., Inc.; Titen HD (ESR-2713).
    - c) Dewalt; Snake+ Anchor (ESR-2272).
    - d) Dewalt; Screw-Bolt+ (ESR-3889).
- c. Adhesive Anchoring Systems in Concrete:
  - 1) Chemical anchoring of anchors, rods, or reinforcing steel is not allowed for fire-rated assemblies, unless specified provided for in the drawings.
  - 2) Consult with the manufacturer for the minimum temperature of the concrete substrate allowed.
  - Only personnel trained to install adhesive anchors and certified in accordance with the ACI/CRSI Adhesive Anchor Installer Certification Program shall install adhesive anchors, including reinforcing steel.
  - 4) All anchors installed horizontally or upwardly inclined require continuous inspection.
  - 5) All adhesive anchors shall be installed in concrete having a minimum age of 21 days at the time of anchor installation.
  - 6) Acceptable Products and Manufacturers:
    - a) Hilti, Inc.; HIT-HY 200 (ESR-3187).
    - b) Hilti, Inc.: HIT-RE 500 V3 (ESR-3814)
    - c) ITW Red Head; EPCON G5 (ESR-1137).
    - d) ITW Red Head; EPCON S7 (ESR-2308).
    - e) Dewalt; PE 1000+ (ESR-2583).
    - f) Dewalt; Pure110+ (ESR-3298).
    - g) Dewalt; AC200+ (ESR-4027).
    - h) Simpson Strong-Tie; SET-XP Adhesive (ESR-2508).
    - i) Simpson Strong-Tie; SET-3G Adhesive (ESR-4057).
    - j) Simpson Strong-Tie; AT-XP (IAPMO ER-263).
  - 7) These products may not be used in concrete cast over corrugated deck.
  - 8) Threaded Rods Chemically Anchored in Concrete:
    - a) Type: Threaded rods installed in holes using a chemical anchoring process shall have a 45° chiseled end on the embedded end.
    - b) Interior Application: Meet the requirements of ASTM A 307, A 36 or A 193, grade B7.
    - c) Exterior Application: Meet the requirements of ASTM A 153 galvanized steel, or F 593, Group 1 or 2, condition CW stainless steel.
  - 9) Steel Reinforcing Bars:
    - Reinforcing steel installed shall comply with ASTM A 615 or ASTM A706 unless noted otherwise in the structural drawings. The embedded portions of reinforcing bars must be straight, and free of mill scale, rust, mud, oil and other coatings that may impair the bond with the adhesive.
    - b) Reinforcing bars must not be bent after installation except as permitted in the structural drawings. Heating of reinforcing bars to facilitate field bending is not permitted.
- B. Bonding Compound: Polyvinyl acetate or acrylic base, for use in cosmetic and/or nonstructural repairs.
  - 1. Products: Subject to compliance with requirements, provide one of the following:

- a. Acrylic or Styrene Butadiene:
  - 1) Dayton-Superior Corporation; Acrylic Bonding Agent J40.
  - 2) The Euclid Chemical Company; SBR Latex, Akkro-7T.
  - 3) GCP Applied Technologies; Daraweld C.
  - 4) BASF Corporation: MasterEmaco A 400
  - 5) Sika Corporation; SikaLatex.
  - 6) W.R. Meadows, Inc; Acry-Lok.
  - 7) US Mix Co.; US Spec Acrylcoat.
  - 8) SpecChem, LLC; Strong Bond Acrylic Bonder.
- b. Polyvinyl Acetate (Interior Use Only):
  - 1) The Euclid Chemical Company; Tammsweld.
  - 2) L&M Construction Chemicals; Primer One.
  - 3) Dayton-Superior Corporation; PVA Bonding Agent J41.
  - 4) SpecChem, LLC; SpecWeld.
  - 5) W.R. Meadows, Inc; Intralok.
- C. Epoxy Products: Two-component material suitable for use on dry or damp surface, complying with ASTM C 881.
  - 1. Products for Crack Repair:
    - a. Sika Corporation; Sikadur 35 Hi Mod LV injection type.
    - b. Sika Corporation; Sikadur 52 injection type.
    - c. Sika Corporation; Sikadur 55 SLV gravity feed.
    - d. The Euclid Chemical Company; Dural Injection Gel.
    - e. Dayton-Superior Corporation, Inc; Sure-Inject (J56 or J56SLV).
    - f. BASF Corporation; MasterInject 1000.
    - g. Simpson Strong-Tie Co., Inc.; ETI-LV or ETI-GV injection type.
    - h. Unitex; Pro-Poxy 100 or Pro-Poxy 50.
    - i. Adhesives Technology; Crackbond LR 321 or Crackbond LR 321 LPL.
    - j. W.R. Meadows, Inc; Rezi-Weld LV.
    - k. SpecChem LLC; SpecPoxy 1000.
  - 2. Products for Epoxy Mortar Patches:
    - a. Sika Corporation; Sikadur Lo-Mod LV.
    - b. Dayton-Superior Corporation; Sure Patch.
    - c. BASF Corporation; MasterInject 1500.
    - d. Unitex; Pro-Poxy 2500.
    - e. W.R. Meadows, Inc; Rezi-Weld 1000.
    - f. SpecChem, LLC; SpecPoxy Binder.
  - 3. Products for Epoxying Steel Plates to Concrete: Conform to ASTM C 881-13, Type IV, Grade 3, Class A, B, & C except gel times.
    - a. Sika Corporation; Sikadur 31 Hi-Mod Gel.
    - b. Dayton-Superior Corporation, Inc; Sure Anchor J50 or Sure Bond J58
    - c. BASF Corporation; MasterEmaco ADH 1420.
    - d. Unitex; Pro-Poxy 300.
    - e. The Euclid Chemical Company; Duralcrete Gel.
    - f. SpecChem, LLC; SpecPoxy 3000.

## 2.6 REPAIR MATERIALS

- A. Self-Leveling Mortars, Underlayment Compound: Freeflowing, self-leveling, pumpable cementitious base compound. Follow manufacturer's instruction regarding the use of a bonding agent.
  - 1. Products: Unless specified otherwise, provide one of the following:
    - a. BASF Corporation; MasterTop 110 SL.
    - b. The Euclid Chemical Company; Flo-Top, Super Flo-Top.
    - c. Dayton-Superior Corporation, Inc; Levelayer.
    - d. US Mix Co.; US Spec Self-Leveling Underlayment.
    - e. The Euclid Chemical Company; Level Magic Lightweight.

- f. SpecChem, LLC; SpecFlow.
- B. Polymer Patching Mortar: Polymer and microsilica modified cementitious-based compounds.
  1. Products:
  - a. Horizontal Application:
    - 1) The Euclid Chemical Company; Thin Top Supreme, Concrete Top Supreme.
    - 2) Sika Corporation; Sikatop 121 Plus or Sikatop 122 Plus.
    - 3) BASF Corporation; MasterEmaco T 310CI.
    - 4) BASF Corporation; MasterEmaco N424 or N423 RS.
    - 5) US Mix Co.; US Spec H2 or NuTop.
    - 6) The Euclid Chemical Company; Speed Crete PM.
    - 7) SpecChem, LLC; RepCon H.
    - 8) Dayton-Superior Corporation; Thin Resurfacer or Special Patch.
  - b. Upwardly Inclined Application:
    - 1) The Euclid Chemical Company; Verticoat or Verticoat Supreme.
    - 2) Sika Corporation; Sikatop 123 Plus.
    - 3) BASF Corporation; MasterEmaco N 350CI.
    - 4) BASF Corporation; MasterEmaco N423 RS.
    - 5) US Mix Co.; US Spec V/O Patch CI.
    - 6) The Euclid Chemical Company; Speed Crete PM.
    - 7) SpecChem, LLC; RepCon V/O.
    - 8) Dayton-Superior Corporation; Civil/Structural VO.
- C. High Strength Flowing Repair Mortar: For forming and pouring structural members, or large horizontal repairs, provide flowable one-part, high strength microsilica polymer modified repair mortar with 3/8" aggregate. The product shall achieve 9,000 PSI at 28-days at a nine inch slump.
  - 1. Products:
    - a. BASF Corporation; MasterEmaco T 1060.
    - b. US Mix Co.; US Spec STR Mortar.
    - c. The Euclid Chemical Company; Eucocrete.
    - d. The Euclid Chemical Company; Tamms Form and Pour.
    - e. SpecChem, LLC; RepCon 928.
    - f. Dayton-Superior Corporation; Civil/Structural FPX.
- D. Anti-Corrosive Époxy/Cementitious Adhesive: Water-based epoxy/cementitious compound for adhesion and corrosion protection of reinforcing members (20 hour maximum open time).
  - 1. Products:
    - a. The Euclid Chemical Company; Duralprep A.C.
    - b. Sika Corporation; Sika Armatec 110 Epocem.
    - c. BASF Corporation: MasterEmaco P 124.
    - d. Dayton-Superior Corporation; Perma Prime 3C.

## 2.7 PROPORTIONING AND DESIGN OF CONCRETE MIXTURES

- A. The Contractor shall submit design concrete mixtures for each class of concrete indicated on the structural drawings and in the Specifications for approval by the Engineer and Owner's Testing Laboratory at least 15 working days prior to the start of construction. If required, the Contractor shall engage the services of an independent Testing Laboratory to assist in preparing the design mixtures. The Contractor shall not begin work with a particular mixture until that design mixture has been approved.
  - B. The Contractor, acting in conjunction with his Concrete Supplier and his Testing Laboratory, shall submit in writing, with his design mixtures, the method used to select mixture proportions. Either of the following methods, as outlined in ACI 301, may be used:
    - 1. Field Experience Method.
    - 2. Laboratory Trial Mixture Method.
  - C. Required types of concrete and compressive strengths shall be as indicated on the Structural Drawings.
  - D. All design mixtures shall state the following information:

- 1. Design mixture number or code designation by which the Contractor shall order the concrete from the Supplier.
- 2. Identify design mixture usage (i.e., columns, shear walls, footings, slab-on-grade, etc.).
- 3. Wet and dry unit weights.
- 4. Compressive strength and associated age (28-day, 56-day, etc.).
- 5. Aggregate type, source, size, gradation, fineness modulus.
- 6. Cement type and brand.
- 7. Fly ash or other pozzolan type and brand (if any).
- 8. Admixtures including air entrainment, water reducers, high-range water reducers, accelerators, and retarders.
- 9. Design slump or slump/flow.
- 10. Proportions of each material used.
- 11. Water/cementitious ratio and maximum allowable water content.
- 12. Method by which the concrete is intended to be placed (bucket, chute, or pump).
- 13. Required average strength qualification calculations per ACI 301 4.2.3.3a and 4.2.3.3b. Submit separate qualification calculations for each production facility that will supply concrete to the project.
- 14. Documentation of Average Strength (Trial Mixture Data or Field Test Data) per ACI 301: When field test data is used to qualify average strength, submit separate documentation for each production facility that will supply concrete to the project.
- 15. Field test data submitted for qualification of average strength under ACI 301 shall include copies of the Concrete Testing Agency's reports from which the data was compiled.
- E. Durability Requirements:
  - 1. For concrete identified on the drawings as Exposure Classes C1, C2, or W1, use one of the following options to qualify the concrete mixtures to reduce the potential of alkali-silica reaction.
    - a. Use aggregate with an expansion of not more than 0.04% at one-year when tested in accordance with ASTM C1293.
    - b. Limit the total alkali content in concrete to 4.0 pounds per cubic yard of concrete for aggregate with an expansion value greater than or equal to 0.04% and less than 0.12% when test in accordance with ASTM C1293.
    - c. Limit the total alkali content in concrete to 3.0 pounds per cubic yard of concrete for aggregate with an expansion value greater than or equal to 0.12% and less than 0.24% per ASTM C1293
    - d. Limit the expansion for each aggregate to 0.10% at 16 days when tested in accordance with ASTM C1567.
- F. Supplementary Cementitious Materials: Fly ash and/or ground granulated blast-furnace slag replacement of Portland cement shall be within percentage replacement levels listed on the drawings unless noted otherwise. Every effort should be made to reduce the amount of cement to the minimum practical amount, and still achieve performance requirements contained in the Contract Documents.
  - 1. Cement replacement shall not exceed a percentage level that has been shown by experience on other projects to exhibit satisfactory performance using materials from identical sources as proposed for this project. As an alternate, trial concrete batches can be performed to identify design mixtures that maximize cement replacement while meeting strength requirements per ACI 301 and finishability criteria.
  - 2. The use of fly ash or slag in architecturally exposed structural concrete shall be coordinated with the Architect, Engineer, and Contractor.
  - 3. Overall replacement percentages with combined fly ash and slag shall not exceed the maximum identified with slag or be less than the minimum identified with fly ash for each type of element. In addition, the replacement percentage of fly ash within the combined mixture shall not exceed the maximum identified with fly ash alone.
  - 4. Replacement percentages exceeding the maximum may be permitted at the discretion of the Architect, Engineer of Record, and Contractor.
  - 5. For concrete identified on the drawings as being subject to Exposure Class F3, the maximum amount of supplementary cementitious materials shall not exceed the limits

noted in Table 4.2.2.7.b.2 "Maximum cementitious materials requirements for concrete exposed to deicing chemicals" of ACI 301.

- 6. Except for Mass Concrete, the Contractor may submit for approval a revised design mixture with lower supplementary cementitious material percentages than herein specified should finishability or other issues arise due to changing weather conditions.
- G. Aggregate: Comply with the following special requirements:
  - 1. For exposed concrete, provide aggregates from a single source.
  - 2. For exposed surfaces subject to Exposure Class C1 or C2, do not use aggregates containing spalling-causing deleterious substances unless the conditions outlined in the Durability Requirements are met.
  - 3. For slabs and other designated concrete, combined aggregate gradation shall be 8% 18% for large top size aggregates (1 1/2 inches) or 8% 22% for smaller top size aggregates (1 inch or 3/4 inch) retained on each sieve below the top size and above the No. 100. Deviations from this gradation may be allowed upon the approval of the Engineer subject to the following limitations:
    - a. The percent retained on two adjacent sieves shall be not less than 5%.
    - b. The percent retained on three adjacent sieves shall be not less than 8%.
    - c. If the percent retained on two adjacent sieves is less than 8%, the total percent retained on either of those sieves and the adjacent outside sieve shall be not less than 13%.
- H. Admixtures:
  - 1. Admixtures to be used in concrete shall be subject to the approval of the Engineer and Owner's Testing Laboratory and shall be used for the purpose intended by the manufacturer to produce concrete to meet the specified requirements.
  - 2. Quantities of admixtures to be used shall be in strict accordance with the manufacturer's instructions.
  - 3. Air Content Requirements: For concrete subject to Exposure Class F1, F2 or F3 as noted on the drawings, use air-entrainment admixtures to provide concrete such that the air content at the point of placement shall conform to the requirements of ACI 301 Table 4.2.2.7.b "For Exposure Category F: Freezing and thawing exposures" within plus or minus 1.5%. Required air content levels may be reduced by 1.0 percent for concrete strengths above 5,000 PSI.
    - a. Interior steel troweled surfaces shall not have more than 3% total air content.
    - b. Surfaces scheduled to receive hardeners shall not have more than 3% total air content.
    - c. Air-entraining admixtures are not permitted in industrial slabs.
- I. Adjustments of Concrete Mixtures: Design mixture adjustments may be requested by the Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant. Such adjustments shall be provided at no additional cost to the Owner. Any adjustments in approved design mixtures including changes in admixtures shall be submitted in writing to the Engineer and Owner's Testing Laboratory for approval prior to field use.
- J. Shrinkage: Concrete so identified on the drawings shall be proportioned for a maximum allowable unit shrinkage as noted on the drawings, measured at 28 days after curing in lime water as determined by ASTM C 157 (using air storage).Submit results of test for each class of applicable concrete after every 500 cubic yards placed.
- K. Chloride Ion Content:
  - 1. Unless noted otherwise, the maximum water soluble chloride ion concentration in hardened concrete measured at ages from 28 to 42 days contributed from all ingredients including water, aggregates, cementitious materials, and admixtures shall not exceed the limits specified in ACI 318-14 Table 19.3.2.1 "Requirements for concrete by exposure class" depending on to which Corrosion Exposure Class (C0, C1 or C2) the concrete is subject as noted on the drawings. Water-soluble chloride ion tests shall conform to ASTM C 1218. One test shall be run for each class of concrete before the design mixture submittal and each time a change is made to the design mixture (such as change in aggregate type or source).

- 2. The chloride ion content in all concrete used for prestressed or post-tensioned concrete shall not exceed 0.06 percent by mass of cementitious materials. For the purpose of determining chloride ion content in all concrete used for prestressed or post-tensioned concrete, mass of supplementary cementitious material shall not exceed the mass of the portland cement.
- 3. The Concrete Supplier shall certify that the chloride ion content in all concrete design mixtures used on the project does not exceed the limits stated above.

## 2.8 CONCRETE MIXING

A. Ready-Mix Concrete: Comply with requirements of ANSI/ASTM C 94 and the Structural Testing and Inspections section of the specifications.

## 2.9 SOURCE QUALITY CONTROL

A. Source Inspection: Refer to Specification 01 45 29 "Structural Testing and Inspections" for inspection requirements associated with cast-in-place concrete.

## PART 3 - EXECUTION

## 3.1 SLUMP LIMIT

A. The slump, as measured in the field where concrete cylinders are taken, shall be within plus or minus 1-1/2 inches of the design slump noted in the approved Design Mixture submittal. Self-Consolidating Concrete shall have a slump/flow of plus or minus two inches of the design slump/flow noted on the approved Design Mixture submittal. Water may be added to the concrete in the field only to the extent that the prescribed water/cementitious ratio noted in the approved Design Mixture submittal is not exceeded. The responsibility for adding water to trucks at the job site shall rest only with the Contractor's designated representative. The Contractor is responsible that all concrete placed in the field is in conformance with the Contract Documents.

#### 3.2 JOINTS IN CONCRETE

- A. Construction Joints: Locate and install construction joints as indicated on the drawings or if not shown on drawings, located so as not to impair strength and appearance of the structure, as acceptable to Architect/Engineer.
  - 4. Joint Construction: Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise shown on the drawings. Dowels that cross construction joints shall be supported during concreting operations so as to remain parallel with the slab or wall surface and at right angles to the joint. Submit all construction joint locations as a shop drawing submittal.
  - 5. Formed Joints: Form contraction joints by inserting premolded plastic hardboard or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. The depth is to be one quarter of the slab thickness, but not less than one inch. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.

## 3.3 INSTALLATION OF EMBEDDED ITEMS

- A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of items to be attached thereto unless directed otherwise by these specifications. Install reglets to receive top edge of foundation sheet waterproofing where specified by the Architect, and to receive thru-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, relieving angles and other conditions.
  - B. Do not install sleeves in any concrete member except where shown on the structural drawings or approved by the Architect and Engineer.

C. Securely fasten embedded plates, angles, anchor rods and other items to be built into the concrete to the formwork or hold in place with templates. Insertion of these items into concrete after concrete placement is prohibited.

## 3.4 CONCRETE PLACEMENT

- A. Pre-placement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.
- B. Concrete Batch Trip Tickets: The Contractor shall collect and retain concrete batch trip tickets. Compressive strength, slump, air content, and temperature tests shall be identified by reference to a particular trip ticket. Tickets shall contain the information specified in ASTM C 94. Each ticket shall also show the amount of water that may be added in the field for the entire batch that will not exceed the specified water cement ratio for the design mixture. The Contractor and Testing Laboratory shall immediately notify the Architect/Engineer and each other of tickets not meeting the criteria specified.
- C. Causes for Rejection of Concrete: The Contractor shall reject concrete delivered to the site for any of the following reasons:
  - 1. Wrong class of concrete (incorrect design mixture number).
  - 2. Environmental condition limits shall be as follows unless appropriate provisions in concrete practices have been made for cold or hot weather:
    - a. Cold Weather: Air temperature must be 40°F and rising or the average daily temperature cannot have been lower than 40°F for three consecutive days unless the temperature rose about 50°F for at least one-half of any of those 24 hour periods.
    - b. Hot Weather: Environmental conditions must be such that cause an evaporation rate from the concrete surface of 0.2 pounds per square foot per hour or less as determined by the figure "NRMCA Nomograph for Estimating Evaporation Rate on the Basis of Menzel Formula" in Appendix A of ACI 305.1.
    - c. Concrete may be placed at other environmental condition ranges only with the approval of the job inspector for the Testing Laboratory or other duly appointed representative.
  - 3. Concrete with temperatures exceeding 95°F.
  - 4. Air contents outside the limits specified in the design mixtures.
  - 5. Slumps outside the limits specified.
  - 6. Water added to the mix that exceeds the maximum allowed water-to-cementitious material ratio.
  - 7. Excessive Age: Concrete shall be discharged within 90 minutes of plant departure or before it begins to set if sooner than 90 minutes and it shall be discharged before the drum has revolved 300 revolutions, unless approved by the Testing Laboratory job inspector or other duly appointed representative.
- D. Coordinate the installation of joint materials and vapor retarders with placement of forms and reinforcing steel.
- E. Comply with ACI 301 and as herein specified:
  - 1. Concrete Temperature: The maximum acceptable concrete temperature at the truck discharge point shall be 95°F.
  - 2. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete that has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation. Spread concrete using short-handled, square-ended shovels, or comealongs.
  - 3. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

- 4. Consolidate placed concrete by mechanical vibrating equipment supplemented by handspading, rodding or tamping. Use internal vibrators of the largest size and power that can properly be used in the work.
- 5. Do not vibrate Self-Consolidating Concrete.
- 6. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to penetrate rapidly placed layer and at least 6" into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.
- 7. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed. Place concrete for beams, girders, brackets, column capitals, haunches, and drop panels at the same time as concrete for slabs. Do not place concrete over columns and walls until concrete in columns and walls is no longer plastic and has been in place at least one hour.
- 8. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners of forms, eliminating air and stone pockets that may cause honeycombing, pitting, or planes of weakness.
- 9. Bring slab surfaces to correct level with straightedge and strikeoff. Use highway straightedges, bull floats, or darbies to smooth surface free of humps or hollows before excess moisture or bleedwater appears on the surface. Do not disturb slab surfaces prior to beginning finishing operations.
- 10. Maintain reinforcing in proper position during concrete placement operations.
- 11. Protect adjacent finish materials against damage and spatter during concrete placement.
- 12. Placing Concrete by Pump: If concrete is placed by using a pump, the grout used for pump priming must not become a part of the completed structure unless an engineered grout design mix and grout location are approved in advance by the Engineer.

# 3.5 FINISH OF FORMED SURFACES

- A. General: Formed surfaces shall have the finishes as described below and as shown on the drawings after formwork is removed and repairs made.
- B. Matching Mockup Finish: In all areas where a special finish is required or a mock-up is required below, Contractor shall prepare a 100 square foot mock-up to match the required finish. The mock-up should match the finish on a sample panel furnished to the Contractor. If a sample is not furnished, provide finish to match SF2.0 or any other finish specified for the project. Protect mock-up from damage for the duration of project. Approval of mock-up by Architect is required before proceeding with application of finish in project.
- C. Classifications and Finish Requirements:
  - 1. Surface Finish 1.0 (SF-1.0):
    - a. No formwork facing material is specified.
    - b. Patch voids larger than 1-1/2 inch wide or 1/2 inch deep.
    - c. Remove projections larger than 1.0 inch.
    - d. Provide surface tolerance Class D as specified in ACI 117.
    - e. Tie holes need not be patched.
  - 2. Surface Finish 1.1 (SF-1.1):
    - a. No formwork facing material is specified.
    - b. Patch voids larger than 1 inch wide or 1/2 inch deep.
    - c. Remove projections larger than 1/2 inch.
    - d. Provide surface tolerance Class C as specified in ACI 117.
    - e. Tie holes need not be patched.
  - 3. Surface Finish 2.0 (SF-2.0):
    - a. Provide specified formwork-facing material.
    - b. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
    - c. Patch tie holes.

- d. Remove projections larger than 1/4 inch.
- e. Provide surface tolerance Class B as specified in ACI 117.
- f. Provide mock-up of concrete surface appearance.
- 4. Surface Finish 2.1 (SF-2.1):
  - a. Provide specified formwork-facing material.
  - b. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
  - c. Patch tie holes.
  - d. Remove projections larger than 1/4 inch.
  - e. Provide surface tolerance Class B as specified in ACI 117.
  - f. Provide specified rubbed finish after formwork removal.
  - g. Provide mock-up of concrete surface appearance.
- 5. Surface Finish 2.2 (SF-2.2):
  - a. Provide specified formwork-facing material.
  - b. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
  - c. Patch tie holes.
  - d. Remove projections larger than 1/4 inch.
  - e. Provide surface tolerance Class B as specified in ACI 117.
- 6. Surface Finish 2.3 (SF-2.3):
  - a. No formwork-facing material is specified.
  - b. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
  - c. Patch tie holes.
  - d. Remove projections larger than 1/4 inch.
  - e. Provide surface tolerance Class B as specified in ACI 117.
- 7. Surface Finish 3.0 (SF-3.0):
  - a. Provide specified formwork facing material.
  - b. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
  - c. Remove projections larger than 1/8 inch.
  - d. Patch tie holes.
  - e. Provide surface tolerance Class A as specified in ACI 117.
  - f. Provide mock-up of concrete surface appearance.
- 8. Surface Finish 3.1 (SF-3.1):
  - a. Provide specified formwork-facing material.
  - b. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
  - c. Patch tie holes.
  - d. Remove projections larger than 1/8 inch.
  - e. Provide surface tolerance Class A as specified in ACI 117.
  - f. Provide specified rubbed finish after formwork removal.
  - g. Provide mock-up of concrete surface appearance.
- 9. Surface Finish 3.2 (SF-3.2):
  - a. Provide specified formwork-facing material.
  - b. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
  - c. Patch tie holes.
  - d. Remove projections larger than 1/8 inch.
  - e. Provide surface tolerance Class A as specified in ACI 117.
- 10. Surface Finish 3.3 (SF-3.3):
  - a. No formwork-facing material is specified.
  - b. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
  - c. Patch tie holes.
  - d. Remove projections larger than 1/8 inch.
  - e. Provide surface tolerance Class A as specified in ACI 117.
- D. Standard Finish: Provide SF-1.0 on all concrete surfaces not exposed to view in the final condition unless otherwise specified.
- E. Exposed Finishes: Provide SF-2.0 on all concrete surfaces exposed to view in final condition unless otherwise specified.

- F. Rubbed Finishes: Remove forms as early as permitted by these specifications and perform any necessary repairs and patches. Unless otherwise specified, provide one of following finishes where rubbed concrete finish is specified or scheduled:
  - 1. Smooth Rubbed Finish: Provide smooth rubbed finish to scheduled or specified concrete surfaces where indicated, not later than one day after form removal. Moisten concrete surfaces and rub with carborundum brick or other abrasive until a uniform color and texture is produced. Do not apply cement grout other than that created by the rubbing process.
  - 2. Grout Cleaned Finish: Provide grout cleaned finish to scheduled or specified concrete surfaces that have received smooth-form finish treatment.
    - a. Combine one part portland cement to 1-1/2 parts sand meeting the requirements of ASTM C 144 and ASTM C 404 by volume, and 50:50 mixture of acrylic or styrene butadiene based bonding admixture and water to consistency of thick paint. Proprietary additives may be used at Contractor's option. Blend standard portland cement and white portland cement, amounts determined by trial patches, so that final color of dry grout will closely match adjacent surfaces.
    - b. Thoroughly wet concrete surfaces and apply grout to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.
- G. Related Unformed Surfaces: At tops of walls, horizontal offsets and similar unformed surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

## 3.6 MONOLITHIC SLAB FINISHES

- A. Place, consolidate, strike off, and level concrete, eliminating high spots and low spots, before proceeding with any other finish operation. Do not add water to the surface of the concrete during finishing operation.
- B. Scratch Finish: Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo and other bonded applied cementitious finish flooring material, and as otherwise indicated. After placing slabs, plane surface to tolerance specified below. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set, with stiff brushes, brooms, or rakes.
- C. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo, and as otherwise indicated. After screeding, consolidating and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using a hand float, a bladed power float equipped with float shoes, or a powered disk float, when the bleed water sheen has disappeared and the concrete surface has stiffened sufficiently to permit the operation. Check and level surface plane to a tolerance as specified below. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.
- D. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint or other thin film finish coating system. After floating, begin first trowel finish operation by hand or power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with a level surface to a tolerance as specified below. Grind smooth surface defects that would telegraph through applied floor covering system. Do not hard trowel concrete with air entrainment.
- E. Penetrating Sealer Finish: Apply a chloride-and-water-repelling-penetrating-sealer finish to surfaces as described below and where indicated on the drawings. Apply liquid penetrating sealer after complete curing and drying of the concrete surface. Apply proprietary sealers in strict accordance with manufacturer's printed instructions. The Contractor shall verify the compatibility of the sealer product with the paint used to stripe parking decks and coordinate the sequencing of the sealing and striping operations. Apply to the following surfaces:

- 1. Sloping and horizontal surfaces of parking garages.
- 2. Top surfaces of exposed exterior balconies.
- F. Finish of Top of Spread Footings and/or Mat Foundations:
  - 1. Top Surface below Finished Slab: The top of the footing or mat shall be screeded level and smooth with a flatness F-number,  $F_F15$  (overall),  $F_F10$  (minimum local) and a levelness F-number,  $F_L12$  (overall),  $F_L10$  (minimum local).
  - 2. Top Surface as Finished Slab: The top surface of a footing or mat that is to serve as the finished slab in the building shall be leveled, cured, and surface prepared as specified for the finished floor construction appropriate to the space usage as defined in the Architectural Drawings.

## 3.7 CONCRETE CURING AND PROTECTION

## A. General:

- 1. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Maintain concrete with minimal moisture loss at a relatively constant temperature for the period necessary for hydration of the cement and hardening of concrete. Limit moisture loss to a maximum of 0.05 pounds per square foot per hour for concrete containing silica fume and 0.2 pounds per square foot per hour for all other concrete before and during finishing operations. If using an evaporation retarder, apply in accordance with manufacturer's instructions after screeding and bull floating, but before power floating and troweling.
- 2. Curing shall commence as soon as free water has disappeared from the concrete surface after placing and finishing. The curing period shall be seven days for all concrete except high early strength concrete that shall be cured for three days minimum.
- 3. Alternatively, curing times may be reduced if either of the following provisions is complied with:
  - a. If tests are made of cylinders kept adjacent to the structure and cured by the same methods, curing measures may be terminated when the average compressive strength has reached 70% of the specified compressive strength.
  - b. If the temperature of the concrete is maintained at a minimum of 50°F for the same length of time required for laboratory cured cylinders of the same concrete to reach 85% of the specified compressive strength, then curing may be terminated thereafter.
- 4. Curing shall be in accordance with ACI 301 procedures. Avoid rapid drying at the end of the curing period.
- B. Curing Formed Surfaces: Where wooden forms are used, cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. When forms are removed, continue curing by one or a combination of the methods specified below, as applicable:
  - 1. Columns and Shear Walls Not Exposed to View: Moist cure in forms or by one or a combination of Methods 1, 2, or 3 specified below. Use a high–solids, liquid membrane-forming curing and sealing compound conforming to ASTM C 1315, Type I, Class A or B for Method 3.
  - 2. Columns and Shear Walls Exposed to View: Moist cure in forms or by one or a combination of Methods 1, 2, or 3 specified below. Use a high-solids, non-yellowing, liquid membrane-forming curing and sealing compound conforming to ASTM C 1315, Type 1, class A for Method 3.
  - 3. Sides and Soffits of Beams and Pan-Joist Ribs, Soffits of Slabs: Moist cure in forms or by one or a combination of Methods 1, 2, or 3 specified below. Use a liquid membrane-forming dissipating resin curing compound conforming to ASTM C 309, Type 1, class A or B for Method 3.
  - 4. Basement Walls, Sides of Exterior Retaining Walls: Moist cure in forms or by one or a combination of Methods 1, 2, or 3 specified below. Use a liquid membrane-forming dissipating resin curing compound conforming to ASTM C 309, Type 1, class A or B for Method 3.

- C. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by one or a combination of the methods specified below, as applicable. The Contractor shall choose a curing method that is compatible with the requirements for subsequent material usage on the concrete surface.
  - 1. Ramps and Horizontal Surfaces of Parking Areas, Exposed Exterior Balconies: Cure using only Methods 1 or 2 as specified below.
  - 2. Floors Directly Exposed to Vehicular or Foot Traffic [Not in Parking Areas] and Not Otherwise Receiving a Chemical Hardener or Penetrating Sealer Finish: Apply two coats of a high-solids, water-based, non-yellowing, liquid membrane-forming curing and sealing compound conforming to ASTM C 1315, Type 1, Class A in accordance with Method 3 as specified below.
  - 3. Floors in Non-Public Spaces that are Left Exposed to View and Not Receiving Sealers or Hardeners, Floors Involved in Under-Floor Air Distribution Systems: Apply one coat of a high-solids, water-based, non-yellowing, liquid membrane-forming curing and sealing compound conforming to ASTM C 1315, Type 1, Class A or B in accordance with Method 3 as specified below.
  - 4. Floors that are to Receive Subsequent Cementitious Toppings, Sealers, Hardeners, Ceramic Tile, Acrylic Terrazzo, Vinyl Composition Tile, Sheet Vinyl, Linoleum, Vinyl-Backed Carpet, Rubber, Athletic Flooring, Synthetic Turf, Wood, Epoxy Overlay or Adhesive, or Other Coating or Finishing Products: Cure using Methods 2 or 3 as specified below. Use a water-based dissipating resin type curing compound conforming to ASTM C 309, Type 1, class A or B for Method 3.
  - 5. All Other Surfaces: Cure using Methods 1, 2, or 3 as specified below. Use a water-based dissipating resin type curing compound conforming to ASTM C 309, Type 1, class A or B for Method 3.
- D. Curing Methods:
  - 1. Method 1 Moisture Curing: Provide moisture curing by one of the following methods:
    - a. Keep concrete surface continuously wet by covering with water.
    - b. Continuous water-fog spray.
    - c. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water, and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.
  - 2. Method 2 Moisture-Retaining Cover Curing: Provide moisture-retaining cover curing as follows:
    - a. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape. Water may be added to concrete surface to prevent drying before the cover is installed, but the surface shall not be flooded with water if a non-absorptive cover is used.
  - 3. Method 3 Curing or Curing and Sealing Compound: Provide curing, liquid membraneforming curing, or curing and sealing compound as follows:
    - a. Apply specified compound to concrete slabs as soon as final finishing operations are complete (within two hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Do not allow to puddle. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period. Apply second coat for sealing two to three hours after the first coat was applied.
    - b. Do not use membrane-forming curing and sealing compounds on surfaces which are to be covered with coating material applied directly to concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring (such as ceramic or quarry tile, glued-down carpet, vinyl composition tile, linoleum, sheet vinyl, rubber, athletic flooring, synthetic turf, or wood), paint, or other coatings and finish materials. Dissipating resin type cures are acceptable in these locations.

## 3.8 HOT WEATHER CONCRETING

- A. Definition:
  - 1. Conditions warranting hot weather concreting practices are defined as any combination of high air temperature, low relative humidity, and wind velocity tending to impair the quality of fresh or hardened concrete or otherwise result in abnormal properties. If conditions cause an evaporation rate of 0.2 pounds per square foot per hour or greater as calculated by the figure "NRMCA Nomograph for Estimating Evaporation Rate on the Basis of Menzel Formula" in Appendix A of ACI 305.1, then precautions shall be taken to prevent plastic shrinkage cracks from occurring.
- B. Specification: Follow hot weather concreting practices specified below when required to limit the concrete temperature at the truck discharge point to the stated maximum acceptable temperature.
- C. Records: Under hot weather conditions, the Contractor shall keep records of outside air temperature, concrete temperature at truck discharge and general weather conditions.
- D. Hot Weather Concreting Requirements: The following items, all or in part as required, shall be followed to limit the concrete temperature to the stated maximum acceptable temperature and to minimize the possibility of plastic shrinkage cracks from developing.
  - 1. Design the concrete mixtures specifically for hot weather conditions replacing some cement with fly ash or other pozzolan and using a water reducing retarding admixture (ASTM C 494 Type D).
  - 2. Use the largest size and amount of coarse aggregate compatible with the job.
  - 3. Use sunshades and/or windbreaks.
  - 4. Delay construction of indoor slabs-on-grade until the walls and roof are constructed.
  - 5. Cool and shade aggregate stockpiles.
  - 6. Use ice as part of the mixing water or cool the water with liquid nitrogen. Do not place concrete that contains unmelted ice.
  - 7. Limit the number of revolutions at mixing speed to 125 maximum.
  - 8. Reduce time between mixing and placing as much as possible.
  - 9. Do not add water to ready-mixed concrete at the job site unless it is part of the amount required initially for the specified water-cement ratio and the specified slump.
  - 10. Schedule concrete placement for early morning, late afternoon, or night.
  - 11. Have all forms, equipment, and workers ready to receive and handle concrete.
  - 12. Maintain one standby vibrator for every three vibrators used.
  - 13. Keep all equipment and material cool by spraying with water including exteriors of forms, reinforcing steel, subgrade, chutes, conveyors, pump lines, tremies, and buggies.
  - 14. Protect slab concrete at all stages against undue evaporation by applying a fog spray or mist above the surface or applying a monomolecular film. Where high temperatures and/or placing conditions dictate, use water-reducing retarding admixture (Type D) in lieu of the water-reducing admixture (Type A) as directed by the Owner's Testing Laboratory.
  - 15. Provide continuous curing, preferably with water, during the first 24 hours using wet burlap, cotton mats, continuous spray mist, or by applying a curing compound meeting ASTM C 1315. Continue curing for three days minimum.
  - 16. Cover reinforcing steel with water soaked burlap so that steel temperature will not exceed ambient air temperature immediately before placement of concrete.
  - 17. As soon as possible, loosen forms and run water down the inside. When forms are removed, provide a wet cover to newly exposed surfaces.

## 3.9 COLD WEATHER CONCRETING

- A. Definition:
  - 1. Concrete shall not be placed when the outside air temperature is 40°F or less unless cold weather concreting practices are followed as specified below.
  - 2. Cold weather concreting practices should also be followed whenever the average daily air temperature is expected to be less than 40°F for more than three successive days. The average daily air temperature is the average of the highest and lowest temperature occurring during the period from midnight to midnight. The requirement for adhering to

these cold-weather concreting practices may be terminated when the air temperature is above 50° F for more than half of any 24 hour duration.

- 3. Cold-weather concreting practices invoked shall keep the temperature of the concrete immediately after placing within the following temperature ranges:
  - a. 55° to 75° F for sections less than 12 inches in the least dimension.
  - b.  $50^{\circ}$  to  $70^{\circ}$  F for sections 12 to 36 inches in the least dimension.
  - c. 45° to 65° F for sections 36 to 72 inches in the least dimension.
  - d. 40° to 60° F for sections greater than 72 inches in the least dimension.
- 4. Concrete Protection: Protect the concrete immediately after placing and during the defined protection period such that the concrete does not freeze nor fall below the temperature levels stated in the above paragraph. For concrete not loaded during construction, the protection period shall be for a minimum of three days if cold-weather conditions persist. The time may be reduced to a minimum of two days if Type III cement or an accelerating admixture is used or if an additional 100 pounds of cement per cubic yard is added to the concrete mix. Concrete fully loaded during construction shall be protected during cold weather conditions for whatever time is required to obtain the required strength as determined by nondestructive strength tests (Windsor probe, Swiss Hammer Test) on the in-place concrete. Protect concrete surfaces from freezing for the first 24 hours even if cold-weather conditions do not officially exist due to high volatility in ambient temperatures.
- 5. Protection Deficiency: If the temperature requirements during any portion of the protection period are not met but the concrete surface did not freeze, the protection period shall be extended until twice the deficiency expressed in degree-hours is made up. Deficiency degree-hours are defined as the average deficiency in temperature below the required value times the number of hours the deficiency persisted. Make-up degree hours are the average increase in temperature above the minimum value times the hours required to make up twice the deficiency degree-hours. Contact the Architect/Engineer if the concrete surface was allowed to freeze during the protection period.
- 6. Protection Removal: As the protection is being removed the decrease in temperature measured at the surface of the concrete in a 24 hour period shall not exceed the following:
  - a.  $50^{\circ}$  F for sections less than 12 inches in the least dimension.
  - b. 40° F for sections 12 to 36 inches in the least dimension.
  - c. 30° F for sections 36 to 72 inches in the least dimension.
  - d. 20° F for sections greater than 72 inches in the least dimension.
- 7. The maximum concrete temperature heated by artificial means at point of placement shall not exceed 90°F.
- B. Records: Under cold weather conditions, the Contractor shall keep records of outside air temperature, concrete temperature as placed and general weather conditions. The temperature record shall be taken no less than two times per 24 hour duration.
- C. Cold Weather Concreting Requirements: The following items, all or in part as required, should be followed to assure acceptable concrete in cold weather conditions:
  - 1. Design the concrete mixture to obtain high early strength by using higher cement content, a high early strength cement (Type III), or a specified non-chloride accelerator (ASTM C 494 Type C or E).
  - 2. Protect the concrete during curing period using insulating blankets, insulated forms, enclosures, and/or heaters.
  - 3. Concrete cured in heated enclosures shall have heaters vented to prevent exposure of concrete and workmen to noxious gases.
  - 4. Frozen subgrade shall be thawed prior to concrete placement and snow and ice shall be removed from forms.
  - 5. Temperature of embedments in concrete must be heated to above 32°F prior to placing concrete
  - 6. Heat the mixing water and then blend hot and cold water to obtain concrete no more than 10°F above the required temperature.
  - 7. Heat the aggregates by circulating steam in pipes placed in the storage bins for air temperatures consistently below 32°F. When either water or aggregate is heated to over

140°F, combine them in the mixer first to obtain a maximum temperature of the mixture not to exceed 140°F in order to prevent flash set of the concrete.

- 8. Uniformly thaw aggregates far in advance of batching to prevent moisture variations in the stockpile.
- 9. Cover warmed stockpiles with tarps to retain heat.
- 10. Place air entraining admixture in the batch after the water temperature has been reduced by mixing with cooler solid materials.
- 11. Use wind screens to protect concrete from rapid cooling.
- 12. Place vertical pump lines inside the building, if possible, for concrete being pumped.
- 13. Maintain artificial heat as low as possible to reduce temperature stresses during cooling.
- 14. Avoid water curing of concrete except for parking garage structures. Apply the required curing compound to unformed surfaces as soon as possible to prevent drying of concrete from heated enclosures.
- 15. Delay form stripping as long as possible to help prevent drying from heated enclosures and to reduce damage to formed surfaces caused by premature stripping.
- 16. Provide triple thickness of insulating materials at corners and edges vulnerable to freezing.
- 17. Wrap protruding reinforcing bars with insulation to avoid heat drain from the warm concrete.
- 18. Gradually reduce the heat at the end of the heating period to reduce likelihood of thermal shock.

### 3.10 MISCELLANEOUS CONCRETE ITEMS

- A. Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.
- B. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor rods for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.
- C. Adhesive Anchors: All drilled holes for adhesive anchors shall be within six degrees of perpendicular to the surface of the concrete member.

## 3.11 INVESTIGATION OF LOW CONCRETE STRENGTH TEST RESULTS

- A. Contractor Responsibility for Low Strength Concrete:
  - 1. If the average of any three consecutive strength tests falls below the required f'c for a class of concrete but no individual strength test is more than 500 PSI below the required f'c, the Contractor shall immediately notify the Engineer by telephone or email and take immediate steps to increase the average of subsequent strength tests.
  - 2. If any individual strength test falls more than 500 PSI below the required f'c, the Contractor shall immediately notify the Engineer by telephone or e-mail and take immediate steps to assure that the load-carrying capacity of the structure is not jeopardized.
- B. Additional Field Tests to Confirm Low Concrete Strengths:
  - 1. The cost of all investigations of low-strength concrete, as defined by any individual strength test being more than 500 PSI below the required f'c, shall be borne by the Contractor.
  - 2. Code-Prescribed Acceptance: The only accepted field-test methods of determining actual in-situ concrete strength is by the way of core tests as prescribed by ACI 318.
  - 3. Non-Destructive Tests: If any individual strength test falls more than 500 PSI below the required f'c, the Engineer may request that non-destructive field tests be performed on the concrete in question using Swiss Hammer, Windsor Probe, or other appropriate methods as approved by the Engineer. Report the comparative test results of the suspect concrete under consideration with identical tests done on concrete of known strength and of the same class. The Engineer considers these test results as only approximate indicators of strength and may not necessarily, by themselves, resolve the low concrete strength issue. These test results will be considered as additional information by which to make an informed judgment. The Engineer reserves the right to accept the concrete based on the

results of these approximate tests or order that core tests be taken as prescribed below. At the Contractor's option, the approximate non-destructive field-tests may be waived and core tests immediately initiated.

- 4. Core Tests: If, in the opinion of the Engineer, the likelihood of low-strength concrete is confirmed and it has been determined that the load-carrying capacity of the structure is significantly reduced as a result, the Engineer may request that core tests be taken from the area in question as directed by the Engineer. There shall be a minimum of three cores taken for each strength test more than 500 PSI below the required fc in accordance with ASTM C 42. If concrete in the structure will be dry under service conditions, cores shall be air dried (temperature 60° to 80°F, relative humidity less than 60 percent) for seven days before test and shall be tested dry. If concrete in the structure will be immersed in water for at least 40 hours and tested wet. The Contractor shall fill all holes made by drilling cores with an approved drypack concrete.
- 5. Acceptance Criteria for Core Test: Concrete in an area represented by core tests shall be considered adequate if the average of three cores is equal to at least 85% of the required f'c and no single core is less than 75% of the required f'c. If approved by the Engineer, locations of erratic core strengths may be retested to check testing accuracy.
- 6. Load Test: If the concrete strength is not considered adequate based on core tests and the structural adequacy remains in doubt, the Engineer may order a load test as specified in ACI 318 be conducted for the questionable portion of the structure.
- 7. Strengthening or Demolition of the Structure: If the structural adequacy of the affected portion of the structure remains in doubt following the load test, the Engineer may order the structure to be strengthened by an appropriate means or demolished and rebuilt at the Contractor's expense.

## 3.12 CONCRETE SURFACE REPAIRS

- A. Defective Areas:
  - 1. Formed Surfaces: Concrete surfaces requiring repairs shall include all cracks in excess of 1/64" in width and any other defects that affect the durability or structural integrity of the concrete. Voids, including honeycombing and rock pockets, and tie holes shall be repaired as required by the specified Surface Finish.
  - 2. Unformed Surfaces: Concrete surfaces requiring repair shall include all surface defects such as crazing, cracks in excess of <1/64"><1/32"> in width or cracks that penetrate to reinforcement or through the member, popouts, spalling, and honeycombs.
  - B. Classification:
    - 1. Structural Concrete Repair: Major defective areas in concrete members that are load carrying (such as shear walls, beams, joists and slabs), are highly stressed, and are vital to the structural integrity of the structure shall require structural repairs. Structural concrete repairs shall be made using a two-part epoxy bonder, epoxy mortar, or specified polymer repair mortar. The Engineer shall determine the locations of required structural concrete repairs.
    - 2. Cosmetic Concrete Repair: Defective areas in concrete members that are non-load carrying and minor defective areas in load carrying concrete members shall require cosmetic concrete repair when exposed to view and not covered up by architectural finishes. Cosmetic concrete repairs may be made using a polymer repair mortar and compatible bonding agent. The Architect/Engineer shall determine the locations of required cosmetic concrete repairs. Stains and other discolorations that cannot be removed by cleaning and are exposed to view will require cosmetic repair. Cosmetic concrete repairs in exposed-to-view surfaces will require Architect's approval prior to patching operation.
    - 3. Slab Repairs: High and low areas in concrete slabs shall be repaired by removing and replacing defective slab areas unless an alternate method, such as grinding and/or filling with self-leveling underlayment compound or repair mortar is approved by the Architect/Engineer. Repair of slab spalls and other surface defects shall be made using

epoxy products as specified above and as determined by the Engineer. The high strength flowing repair mortar may be used for areas greater than one inch in depth.

## 3.13 FIELD QUALITY CONTROL

A. Field Testing and Inspection: Refer to Specification 01 45 29 "Structural Testing and Inspections" for testing and inspection requirements associated with cast-in-place concrete.

## END OF SECTION

#### **SECTION 051200**

### STRUCTURAL STEEL FRAMING

### 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 work of this section.

#### 1.2 SUMMARY

- A. Section includes labor, materials, services, equipment, and appliances required in conjunction with or related to the furnishing, fabrication, delivery, and erection of all structural steel, as defined below. Include all supplementary parts, members, and connections necessary to complete the structural steel work, regardless of whether all such items specifically are shown or specified on the drawings. Miscellaneous metal fabrications, architecturally exposed structural steel, metal stairs and ladders, cold-formed metal framing, and steel deck are specified in other Division 05 sections.
- B. Related Requirements:
  - 1. Specification 014529 "Structural Testing and Inspections for testing and inspection requirements associated with structural steel.

### 1.3 PRICE AND PAYMENT PROCEDURES

- A. Alternates: Substitutions for the member sizes, type(s) of steel connection details, or any other modifications proposed will be considered by the Architect/Engineer only under the following conditions:
  - 1. The request has been made and accepted prior to the submission of shop drawings. All substitutions shall be marked clearly and indicated on the shop drawings as a substitute.
  - 2. There is a substantial cost advantage or time advantage to the Owner or that the proposed revision is necessary to obtain the required materials or methods at the proper times to accomplish the work in the time scheduled.
  - 3. Sufficient sketches, engineering calculations, and other data have been submitted to facilitate checking by the Architect/Engineer, including cost reductions or savings in time to complete the work.
  - 4. In no case shall such substitutions result in additional cost to the Owner.

#### 1.4 REFERENCES

## A. Definitions:

- 1. Erection Drawings: Field installation or member-placement drawings that are prepared by the Fabricator to show the location and attachment of the individual shipping pieces.
- 2. Erection-Bracing Drawings: Drawings that are prepared by the Erector to illustrate the sequence of erection, any requirements for temporary supports, and the requirements for raising, bolting, and or/welding. These drawings are in addition to and separate from the Erection Drawings.
- 3. Professional Engineer: A professional engineer who is licensed to practice engineering in the state where the project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for projects with structural steel framing that are similar to that indicated for this Project in material.
- 4. Shop Drawings: Drawings of the individual structural steel shipping pieces that are to be produced in the fabrication shop.
- 5. Structural Steel: Structural steel shall be defined as that work prescribed in Section 2.1 of AISC 303 and all steel support for elevator guide rails and catwalks (including support members and attached structural steel shapes and plates such as hangers, toe plates, and the grating walking surface).

B. Reference Standards:

d.

- 1. Codes and Standards: Comply with provisions of following codes, specifications, and standards, except where more stringent requirements are shown or specified.
  - a. All federal (OSHA), state, and local laws that govern safety requirements for steel erection and other requirements if more stringent than the codes and standards enumerated below. OSHA requirements include regulation 29 CFG 1926, Part R, "Safety Standard for Steel Erection".
  - b. AISC, "Steel Construction Manual."
  - c. AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," except as noted herein.
    - 1) Certain sections in this specification contain requirements that are more restrictive and/or different than contained in this standard. In such cases, the requirements of this specification shall control.
    - ANSI/AISC 360, "Specification for Structural Steel Buildings."
  - e. ANSI/AWS D1.1, "Structural Welding Code Steel."
  - f. ANSI/AWS D1.3, "Structural Welding Code Sheet Steel."
  - g. ANSI/AWS D1.4, "Structural Welding Code Reinforcing Steel."
  - h. Research Council on Structural Connections (RCSC), "Specification for Structural Joints using High-Strength Bolts."
  - i. The Society of Protective Coatings, "SSPC Painting Manual", Volumes 1 and 2.

## 1.5 ADMINISTRATIVE REQUIREMENTS

## A. Coordination:

1.

- Quality Control:
  - a. The Contractor is responsible for quality control, including workmanship and materials furnished by his subcontractors and suppliers.
  - b. The Contractor shall coordinate the fabrication and erection of all structural steel work with the work of other trades.
  - c. The Fabricator alone shall be responsible for all errors of detailing, fabrication, and for the correct fitting of the structural members.
  - d. The Fabricator shall coordinate connection details, joint fit-up procedures, and field adjustment requirements with Erector. The Contractor shall coordinate provision of all erection bolts, lifting lugs, or other devices required for erection with the Fabricator and the Erector and for interference with architectural finishes and constraints.
- 2. Document Conflict and Precedence:
  - a. In case of conflict among documents, including architectural and structural drawings and specifications, notify Architect/Engineer prior to submitting proposal. In case of conflict between and/or among the structural drawings and specifications, the strictest interpretation shall govern, unless specified otherwise in writing by the Architect/Engineer.
  - b. Questions about Contract Documents: The Contractor shall notify promptly the Architect/Engineer whenever design of members and connections for any portion of the structure are not indicated clearly or when other questions exist about the Contract Documents. Such questions shall be resolved prior to the submission of shop drawings.
- 3. Materials and installed work may require testing and retesting, as directed by the governing building code or the Architect/Engineer, at any time during progress of work.
  - a. The Contractor shall provide adequate notification to the Owner's Testing Agency of construction operation including the project schedule to allow the Testing Agency to schedule inspections. Failure to notify sufficiently may result in additional costs incurred by the Testing Laboratory that may be back-charge to the Contractor by the Owner.
  - b. The Contractor shall cooperate with laboratory personnel, provide access to the work, and provide access to manufacturer's operations.

- c. The Contractor shall cooperate with the Owner's Testing Laboratory when Arbitration Testing and Inspection is called for due to a disagreement regarding the tension in installed bolts that have been inspected according to the Structural Testing and Inspections specification.
- d. The Contractor shall make adequate arrangement with the Owner's Testing Agency for inspection of material stockpiles and facilities.
- e. The Contractor shall provide to the laboratory certificates and representative samples of materials proposed for use in the work in quantities sufficient for accurate testing as specified.
- f. The Contractor shall furnish labor, equipment, and facilities as required for sampling and testing by the laboratory and other facilitate the required inspections and test.
- g. Inspection or testing by the Owner does not relieve the Contractor of his responsibility to perform the Work in accordance with the Contract Documents. Test not specifically indicated to be done at the Owner's expense, including retesting of rejected materials and installed work, shall be done at the Contractor's expense. See the Structural Testing and Inspections Specification.
- B. Preinstallation Meetings:
  - 1. At least 14 days prior to beginning structural steel erection, the Contractor shall hold a meeting to review the detailed quality control and construction requirements and to determine the procedures for producing proper structural steel construction. Also, review requirements for submittals, status of coordinated work, and availability of materials. Establish work progress schedule and procedures for materials inspection, testing, and certification.
  - 2. The Contractor shall require responsible representatives of every party who is concerned with the structural steel work to attend the conference, including, but not limited to, the following:
    - a. Contractor's Superintendent.
    - b. Laboratory responsible for field quality control.
    - c. Special Inspector or Laboratory responsible for shop inspection or testing.
    - d. Structural steel detailer.
    - e. Structural steel fabricator.
    - f. Structural steel erector.
    - g. Owner's and Architect's/Engineer's Representative.
    - h. Engineer.
  - 3. Minutes of the meeting shall be record, typed, and printed by the contractor and distributed to all parties concerned within five days of the meeting. One copy of the minutes shall be transmitted to the following for information purposes:
    - a. Owner's Representative.
    - b. Architect.
    - c. Engineer.
  - 4. The Engineer shall be present at the conference. The Contractor shall notify the Engineer at least seven days prior to the scheduled date of the conference.

#### 1.6 SUBMITTALS

A. Product Data: Submit producer's or manufacturer's specifications and installation instructions for following products to show compliance with specifications, including the specified standards):

- 1. Welding Electrodes.
- 2. Structural Steel Primer Paint.
- 3. Inorganic or Other Protective Paint.
- B. Shop Drawings:
  - Preliminary Connection Review: Submit preliminary details of proposed connections not less than 14 days in advance of the start of preparation of detailed shop drawings. Proposed variations from the details shown on the drawings will be considered and such variations must have preliminary approval from the Engineer prior to the preparation of detailed shop drawings. Failure to adhere to the requirements of this paragraph obligates

the Contractor to take responsibility for any and all resulting delays in the detailing and fabrication of structural steel.

- 2. Detailed Shop Drawings: Submit drawings showing complete details and schedules for fabrication and assembly of structural steel members. Drawings shall include the following minimum information:
  - a. Details of cuts, connections, camber, holes, and other pertinent data.
  - b. Indication of welds by standard AWS symbols, and show size, length, and type of each weld.
  - c. Indication of type, size, and length of bolts, distinguishing between shop and field bolts. Identify the type of high-strength bolted connection (slip-critical, direct-tension, or bearing connections). Indicate locations of pretensioned bolts.
  - d. Connection material specification and sizes.
  - e. Joints or groups of joints in which a specific assembly order, welding sequence, welding technique, or other special precautions are required.
  - f. Holes, flange cuts, slots, and openings shall be made as required by the structural drawings, all of which shall be properly located by means of templates.
  - g. Setting drawings, templates, and directions for installation of anchor rods and other anchorages to be installed by others.
  - h. Non-Destructive Testing (NDT) to be performed by the Fabricator, if any.
  - i. A letter sealed by the Fabricator's Professional Engineer responsible for the design of any of the connections shown on the shop drawings attesting that the engineer has reviewed the shop drawings and that the connections detailed and shown on the shop drawings conform to the engineer's design.
- 3. Erection Drawings: Submit complete erection drawings showing field installation and member-placing instructions for locating and attaching the individual shipping pieces.
- 4. All drawings submitted for review shall have blank space for a 2" high and 3.5" wide shop drawing stamp of the Engineer as part of the title block
- C. Certificates:
  - 1. Structural Steel: Submit for each type.
- D. Delegated Design Submittals:
  - 1. Preliminary Connection Design Review: In conjunction with the Preliminary Connection Review submittal, the Fabricator's licensed professional engineer shall submit example design calculations for each connection type not less than 14 days in advance of the start of preparation of detailed shop drawings.
  - 2. Connection Design Submittals: The Fabricator's licensed professional engineer shall submit complete design calculations show all information as specified in the "Connections" section under Part 2. The Engineer reserves the right to reject all shop drawings submitted without complete design calculations.
  - 3. Connection Design Validation Letter: The Fabricator's licensed professional engineer responsible for the design of any of the connections shown on the shop drawings shall submit a letter that is sealed attesting that the connection design engineer has reviewed the shop drawings and that the connections detailed and shown on the shop drawings conform to the engineer's design.
- E. Test and Evaluations Reports: Submit certified reports of tests required by this Specification. Include data on type(s) of tests conducted and test results.
- F. Field Quality Control Submittals:
  - 1. Surveys: Submit for each survey required.
- G. Qualification Statements:
  - 1. Submit qualification data, including required certifications, for firms and persons specified in the "Qualifications" section under Part 1, to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
  - 2. Submit a resume from the structural steel detailer showing a minimum of two years of experience selecting or completing structural steel connection details using information found in tables in the AISC "Steel Construction Manual".

- 3. Submit Welding Procedure Specifications (WPS) in accordance with ANSI/AWS D1.1 for all welded joints. Submit test reports showing successful passage of qualification tests for all non-prequalified WPSs.
- 4. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests as specified in the "Qualifications" section under Part 1. If recertification of welders is required, retesting will be at Contractor's responsibility.
- 5. A fabricator that is registered with the local building official and is approved to perform fabrication without special inspection shall submit a certificate of compliance stating that the work was performed in accordance with the approved construction documents.
- H. Record Documentation:
- I. Minutes of Preinstallation Meeting: Submit for review.

## 1.7 QUALITY ASSURANCE

- A. Qualifications:
  - 1. Fabricator:
    - a. The structural steel fabricator shall have not less than five years of experience in the successful fabrication of structural steel similar to this project.
  - 2. Detailer:
    - a. The structural steel detailer shall have not less than two years of experience in the successful detailing of structural steel similar to this project including experience in selecting or completing structural steel connection details using information found in tables in the AISC "Steel Construction Manual.
  - 3. Erector:
    - a. The structural steel erector shall have not less than two years of successful experience in the erection of structural steel of a similar nature to this project.
  - 4. Welding Qualifications: Qualify welding processes and welding operators in accordance with AWS "Structural Welding Code Steel". Retain the section below if the fabricator is required to design the connections or when a professional engineer is required to be involved in designing the temporary shoring and bracing of the structure.
  - 5. Professional Engineer:
    - a. The Professional Engineer employed by the Fabricator for connection design shall be experienced in the specific area of structural steel connection design with demonstrated experience of not less than three projects of similar scope and complexity.
  - 6. Independent Testing Laboratory:
    - a. Any testing laboratory retained to perform tests that are required by this specification shall meet the basic requirements of ASTM E 329 and shall submit to the Owner, Architect, and Engineer evidence of current accreditation from the American Association for Laboratory Accreditation, the AASTHO Accreditation Program or the "NIST" National Voluntary Laboratory Accreditation Program.
    - b. The Testing Laboratory shall be an Approved Agency by the Building Official to perform Special Inspections and other tests and inspections as outlined in the applicable building code.
    - c. Tests and inspections shall be conducted in accordance with specified requirements, and if not specified, in accordance with the applicable standards of the American Society for Testing and Materials or other recognized and accepted authorities in the field.
    - d. Qualification of Welding Inspectors:
      - Inspectors performing visual weld inspection shall meet the requirements of AWS D1.1 Section 6.1.4. Inspectors shall have current certification as an AWS Certified Welding Inspector (CWI). Assistant inspectors, if any, shall be supervised by an Inspector and shall be qualified by training and experience to perform the specific functions to which they are assigned.

- 2) Inspectors performing nondestructive examinations of welds other than visual inspection (MT, PT, UT, and RT) shall meet the requirements of AWS D1.1, Section 6.14.6.
- 1.8 DELIVERY, STORAGE, AND HANDLING
  - A. Deliver materials to site at such intervals to ensure uninterrupted progress of work.
  - B. Deliver anchor rods and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time so as not to delay work.
  - C. Store materials to permit easy access for inspection and identification. Keep steel members off ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration. Do not store materials on structure in a manner that might exceed allowable loads on or cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed by Architect/Engineer.

# PART 2 - PRODUCTS

## 2.1 MATERIALS

- A. Structural Steel:
  - 1. All hot rolled steel plates, shapes, sheet piling, and bars shall be new steel conforming to ASTM A 6.
  - 2. Comply with the provisions of the following ASTM Specifications as appropriate for the grades and types, and at the locations as specified on the drawings:
    - a. Structural Steel Wide Flange and WT Shapes: High Strength Steel, ASTM A 992.
    - b. Structural Steel Wide Flange and WT Shapes: High Strength Steel, ASTM A 572, Grade 60.
    - c. M-Shapes, S-Shapes, and Channels: Carbon Steel, ASTM A 36.
    - d. Angle Shapes: Carbon Steel, ASTM A 36.
    - e. Structural Steel Plates and Bars: Carbon Steel, ASTM A 36.
    - f. Structural Steel Plates and Bars: High Strength Steel, ASTM A 572, Grade 50.
    - g. Steel Pipe: ASTM A 53 (Type E or S) Grade B (Fy = 35 ksi).
    - h. Round HSS: ASTM A 500 Grade B (Fy = 42 ksi) or ASTM A 501 with written approval from the Engineer.
    - i. Square and Rectangular HSS: ASTM A 500, Grade B (Fy = 46 ksi).
  - 3. Connection Material: Unless noted otherwise on the drawings, column stiffener plates and doubler plates at moment connections shall be the same grade of steel as the beam connecting the column (highest grade if more than one grade is used). All other connection material except as noted otherwise on the drawings including bearing plates, gusset plates, stiffener plates, filler plates, angles, etc. shall be A36 steel unless a higher or matching grade of steel with the members connected is required by strength or stiffness calculations and provided the resulting sizes are compatible with the members connected.
  - 4. Structural Steel Surfaces: For fabrication of work which will be exposed to view in the completed structure, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating and application of surface finishes.
  - 5. Potential Non-conforming Material: For structural steel for which evidence exists that the steel may not conform to ASTM requirements, the Contractor, where permitted by the Engineer, shall engage the services of an independent testing laboratory to test the material according to ASTM A 6 and submit certified test reports that verify conformity to ASTM standards. Tests shall be made for each 10 tons of affected material unless otherwise directed by the Engineer.
- B. Structural Bolts and Threaded Fasteners: Structural bolts and threaded fasteners shall comply with the following ASTM Specifications as appropriate for the types and at the locations as specified on the drawings:
  - 1. ASTM A 325 Type 1.
- 2. ASTM A 490 Type 1.
- 3. Twist-Off-Type Tension-Control Bolt Assemblies:
  - a. Bolts that are manufactured to conform to ASTM A 325 shall additionally conform to ASTM F 1852.
  - b. Bolts that are manufactured to conform to ASTM A 490 shall additionally conform to ASTM F 2280.
  - c. Subject to conformance with specified requirements, acceptable manufacturers include but are not limited to:
    - 1) Nucor Fastener, A Division of Nucor Corporation.
    - 2) Lake Erie Screw Corp.
    - 3) Vermont Fasteners Manufacturing.
    - 4) Lohr Structural Fasteners.
- 4. Threaded Round Stock:
  - a. ASTM A 36.
  - b. ASTM A 572 Grade 50 (to 2 inches in diameter).
- 5. Bolts and Nuts, High Strength Bolts: Bolts and nuts for all high strength bolts shall be heavy hex head conforming to ANSI Standards B18.2.1 and B18.2.2 respectively. Nuts shall conform to ASTM A 563.
- 6. Washers: All washers shall be circular, flat and smooth and shall conform to the requirements of Type A washers in ANSI Standard B23.1. Washers for high strength bolts shall be hardened and conform to ASTM F 436. Beveled washers for American Standard Beams and channels shall be square or rectangular, shall taper in thickness (16 2/3% slope) with an average thickness of 5/16". When an outer face of a bolted part has a slope greater than 1:20 with respect to a plane normal to the bolt axis, a beveled washer shall be used. Washers to be used with A490 bolts larger than 1 inch in diameter and installed over oversized or short-slotted holes and other similar situations shall conform to ASTM F 436 except with 5/16 inch minimum thickness.
- 7. Zinc-Coated Bolts: ASTM A 325 bolts, with their nuts and washers, that are used to connect steel called for on the drawings or in the specifications as hot-dip galvanized after fabrication shall be zinc-coated either by the hot-dip process in accordance with ASTM A 153, Class C or by the mechanical deposition process in accordance with ASTM B 695, Class 50, Type 1. The bolts, nuts, and washers shall all be zinc-coated using the same process and they shall be considered together as an assembly and shall be tested and shipped together as such. Comply with all the requirements of ASTM A 325 and ASTM A 563 as they relate to zinc-coated materials. ASTM F 1852 bolts with their nuts, and washers shall be zinc-coated only by the mechanical deposition process in accordance with ASTM B 695, Class 50, Type 1. Do not zinc-coat ASTM A 490 bolts.
- 8. Direct Tension Indicators: Compressible washer-type direct-tension indicators conforming to ASTM F 959.
  - a. Subject to conformance with specified requirements, acceptable manufacturers include but are not limited to:
    - 1) Applied Bolting Technology.
    - 2) Turnasure, LLC.
- 9. Bolt Lubrication: All bolts shall be well lubricated at time of installation. Dry, rusty bolts will not be allowed.
- 10. New Bolts: All bolts shall be new and shall not be reused.
- C. Electrodes for Welding:
  - 1. Provide electrodes that comply with AWS D1.1, "Structural Welding Code Steel" and that can produce welds that have a minimum Charpy V-notch toughness of 20 ft-lbs at 40° F, unless noted otherwise in these specifications or on the drawings.
  - 2. Electrodes for various welding processes shall be as specified below:
    - a. SMAW:
      - 1) E70XX low hydrogen.
    - b. SAW:
      - 1) F7X-EXXX.

- c. GMAW:
  - 1) ER70S-X.
- d. FCAW:
  - 1) E7XT-X.
- 3. Electrodes shall be compatible with parent metal joined.
- D. Structural Steel Primer Paint:
  - 1. Unless noted otherwise, primer paint shall be one of the following types with the indicated surface preparation:
    - a. SSPC-Paint 25.1, Type II; zinc oxide, raw linseed oil and alkyd primer, surface prepared according to SSPC-SP-2 (Hand Tool Cleaning) unless noted otherwise in this specification.
    - b. Hyrdrophobic Acrylic Polymer with dry film thickness of not less than 2.0 mils: Tnemec Series 30, Spra-Saf EN or Sherwin Williams, Spraylastic Exterior Waterborn Dryfall (SSPC-SP6 Commercial Blast Cleaning).
  - 2. Match Apogee Stadium for final paint finish requirements of structural steel. Final paint finish color should be black. Primer paint shall be compatible with final paint requirements.
- E. Non-Shrink Grout: Provide grout type(s) as specified on the drawings:
  - 1. Non-Metallic Non-Shrink Grout: Premixed, non-corrosive, non-staining product containing Portland cement, silica sands, shrinkage compensating agents, and fluidity improving compounds. Conform to ASTM C 1107. Provide the minimum strength as shown below as determined by grout cube test at 28 days:
    - a. 6,000 PSI for supporting concrete 3,000 PSI and less.
    - b. 8,000 PSI for supporting concrete greater than 3,000 PSI and less than or equal to 4,000 psi.
    - c. Unless noted otherwise on the drawings, grout strength for supporting concrete greater than 4,000 PSI shall be 8,000 PSI.

Subject to conformance with specified requirements, acceptable non-shrink grouts include:

- a. L&M Construction Chemicals, Inc.; Crystex and Duragrout.
- b. Dayton-Superior Corporation; Sure Grip High Performance Grout and 1107 Advantage Grout.
- c. BASF Construction Chemicals; Masterflow 555 and Set Grout.
- d. U.S. Grout Corp.; Five Star Grout.
- e. The Euclid Chemical Company; NS Grout.
- f. Hilti, Inc.; CG 200 PC.
- F. Grating: Welded steel bar grating of the type, depth, and finish noted on the drawings capable of carrying not less than the stated live load and deflecting not more than span/360 under that load.
- G. Hot-Dip Galvanizing:
  - 1. Scope: All structural steel items and their connections permanently exposed to exterior conditions or that are within areas of unconditioned airspace, whether specified on the drawings or not, shall be hot-dip galvanized after fabrication unless indicated on the drawings or in Specification 099100 to receive a primer and/or finish coat. Such items include, but are not limited to:
    - a. Base plates and anchor rods supporting galvanized members.
    - b. Embedded plates in concrete exposed to unconditioned airspace.
    - c. Examine the architectural and structural drawings for other items required to be hotdip galvanized.
  - 2. Zinc-coat all ASTM A 325 bolts nuts, and washers used in the connection of such steel. Field welded connections shall have welds protected and the exposed portions of ASTM A 490 bolts, nuts, and washers shall be protected with galvanizing repair paint.
  - 3. Surface Preparation: All steel to be hot-dip galvanized shall undergo the following surface preparation as specified by the Society for Protective Coatings (SSPC), Volume 2.
    - a. Remove all grease, oil, grime and foreign contaminants by thorough cleaning with an alkaline or organic solvent followed by thorough rinsing in cold water.
    - b. Remove scale by pickling in diluted sulfuric or hydrochloric acid. Pickling shall be followed by a rinse in warm water and a second rinse in cold water. As an alternative to pickling, the steel may be white metal blast cleaned according to SSPC-SP-5.

- c. Dip in a flux solution of zinc ammonia chloride followed by drying at room temperature.
- 4. Zinc Coating: The zinc coating for steel shapes and plates shall conform to ASTM A 123. Weight of zinc coating per square foot of surface for 1/8 inch and 3/16 inch thick steels shall average not less than 3.0 mils with no individual thickness less than 2.6 mils. The coating weight shall average not less than 3.9 mils for 1/4" thick and heavier steel with no individual thickness less than 3.3 mils.
- H. Galvanizing Repair Paint: Galvanizing repair paint shall be "ZRC Cold Galvanizing Compound" as manufactured by ZRC Chemical Products or a paint complying with SSPC-Paint 20, Level 1.

# 2.2 FABRICATION

- A. Structural steel members for which shop drawings have not been reviewed shall not be fabricated. Any steel detailed or fabricated prior to the Initial Survey from Part 3 below is at contractor's risk.
- B. All fabricated material and connections shall fit within architectural constraints.
- C. The omission from the shop drawings of any materials required by the Contract Documents shall not relieve the Contractor of the responsibility of furnishing and installing such materials, even though the shop drawings may have been reviewed.
- D. Shop Fabrication and Assembly:
  - 1. Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specification and as indicated on approved final shop drawings. Provide camber in structural members where indicated.
  - 2. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.
  - 3. Milled surfaces of built-up sections shall be completely assembled or welded before milling.
  - 4. Fitted stiffeners shall be fabricated neatly between flanges, and the ends of stiffeners shall be milled or ground to secure an even bearing against abutting surfaces. All milled or ground joints shall bear throughout their contact length.
- E. Dimensional Tolerances: Dimensional tolerances of fabricated structural steel shall conform to Section 6.4 of the AISC Code of Standard Practice.
- F. Cutting: Manual oxygen cutting shall be done only with a mechanically guided torch. An unguided torch may be used provided the cut is not within 1/8 inch of the finished dimension and final removal is completed by means such as chipping or grinding to produce a smooth surface quality free of notches or jagged edges. All corners shall be smooth and rounded to a minimum 1/2" radius.
- G. Anchor Rods: Furnish anchor rods and other connectors required for securing structural steel to foundations and other in-place work. Furnish 1/8" minimum steel templates for presetting bolts and other anchors to accurate locations.
- H. Lifting and Erection Devices: The Fabricator shall be responsible for designing, detailing, and furnishing all lifting devices and erection aids required for erection. Such devices shall be removed after erection if they interfere with architectural finish requirements.
  - Edge Preparations: Comply with the requirements of AISC Specification Section J1.6 and M2.2 for beam copes and weld access holes. Use of weld access hole geometry meeting the requirements of AWS D1.1 is acceptable. <Unless noted otherwise weld access holes in beam to column connections of the Seismic Load Resisting System (SLRS) as designated shall conform to the requirements of AWS D1.8, Section 6.9.>
- I. Drainage Holes: Provide 1 inch diameter drainage (weep) holes in all members (trusses, girders, beams, etc.) exposed to weather where rain water could collect (at low points and/or behind dams caused by connections, stiffener plates, etc.). Show all holes on shop drawings for review by the Engineer.

#### 2.3 WELDING

A. Code: All shop and field welding shall conform to all requirements in the "Structural Welding Code – Steel", ANSI/AWS D1.1, as published by the American Welding Society (AWSWelder certifications never expire unless the welder has not welded for more than 6 months or there is a

specific reason to question a welder's ability. For complicated welding jobs, consider requiring requalification if certification is over two years old. Requalification testing should be at contractor's expense.

- B. Welder Certification: All shop and field welders shall be certified according to all the applicable AWS procedures for the welding process and welding position used. Each welder shall be assigned an identifying symbol or mark and all shop and field welded connections containing complete or partial joint penetration welds, multi-pass fillet welds, and fillet welds greater than 5/16" shall be identified by the symbol or mark of the welder responsible for the connection.
- C. Minimum Size and Strength:
  - 1. Fillet Welds: Minimum size of fillet welds shall be as specified in Table J2.4 in AISC Specification, Chapter J.
  - 2. Partial-Penetration Groove Welds: The minimum effective throat thickness of partialpenetration groove welds shall be as specified in Table J2.1 in AISC Specification, Chapter J.
  - 3. Minimum Strength of Welded Connections: Except as specified below in "Connections" or noted otherwise on the drawings, all shop and field welds shall develop the full tensile strength of the member or element joined. All members with moment connections as indicated on the drawings shall be welded to develop the full flexural capacity of the member, unless noted otherwise on the drawings.
- D. Filler Metal Requirements: Weld metal shall be as specified in Table J2.5 in AISC Specification, Chapter J and other requirements of this specification.
- E. Welding Procedure Specification:
  - 1. All welding shall be performed in accordance with a Welding Procedure Specification (WPS) as required in AWS D1.1 and reviewed by the Owner's Testing Laboratory and by the Architect/Engineer. The WPS variables shall be within the parameters established by the filler-metal manufacturer. Engage the services of an independent Testing Laboratory to provide the qualification testing required by AWS D 1.1, Chapter 4, part B to qualify any non-prequalified WPS needed for the project. The independent Testing Laboratory shall prepare Welding Procedure Qualification Records (WPQR) documenting the successful qualification of each Welding Procedure Specification.
- F. Welding Procedures:
  - 1. All welding processes shall comply with the requirements of ANSI/AWS D1.1 unless noted otherwise.
  - 2. Built-up sections assembled by welding shall be free of warpage and all axes shall have true alignment.
  - 3. Welds not specified shall, if possible, be continuous fillet welds developing the minimum strength, as specified above, using not less than the minimum fillet welds as specified by AISC.
  - 4. The toughness and notch sensitivity of the steel shall be considered in the formation of all welding procedures to prevent brittle and premature fracture during fabrication and erection.
  - 5. The Welding Procedure Specification shall be followed without deviation unless specific approval for change is obtained from the Owner's Testing Laboratory and the Architect/Engineer.
  - 6. Before welding, particular attention shall be paid to surface preparation, fit up, and cleanliness of surfaces to be welded.
  - 7. Minimum preheat and interpass temperatures for structural steel welding shall be as specified in ANSI/AWS D1.1, except that no welding shall be performed when the ambient temperature is lower than 0 degrees F. The temperature shall be measured from the side opposite that upon which the preheat is applied.
  - 8. The heat, input, length of weld, and sequence of weld shall be controlled to prevent distortions. The surfaces to be welded and the filler metals to be used shall be subject to inspection before any welding is performed.
  - 9. Welds shall be sound throughout. There shall be no crack in any weld or weld pass. Welds shall be considered sound if they conform to AWS requirements, as confirmed by non-destructive testing.

- 10. Welds shall be free from overlap.
- 11. Craters shall be filled to the full cross section of the welds.
- 12. For high-strength low-alloy steels, follow welding procedures as recommended by steel producer for exposed and concealed connections.
- 13. Fabricator and Erector shall coordinate welding responsibility at all welded joints.
- G. Stress Relieving: All welding sequences shall be such as to reduce the residual stresses due to welding to a minimum value. If high residual stresses are present, stress relieving of joints shall be required. Welded connections shall be detailed and designed to minimize the accumulation and concentration of through-thickness strains due to weld shrinkage.

#### 2.4 BOLTING

- A. Bolt Diameter: Minimum bolt diameter shall be 3/4 inch. The difference in diameter between bolts of differing sizes used on the project shall be not less than 1/4".
- B. Connection Type: Unless noted otherwise on the drawings, all bolted connections shall be snugtightened using high-strength bolts in standard holes (hole diameter nominally 1/16 inch greater than the nominal bolt diameter) with threads included in the shear planes. Notwithstanding, the contractor shall be responsible to adhere to provisions of ANSI/AISC 360 Section J1.10, which lists circumstances under which certain connections require pretensioned high strength bolts.
- C. Oversize, Short-Slotted and Long-Slotted Holes: The dimensions and washer requirements of oversize, short-slotted, and long-slotted holes shall conform to ANSI/AISC 360 Table J3.3.
- D. Fastener Tension:
  - 1. High strength bolts in snug-tightened joints shall be tightened to a snug tight condition only. Do not pretension bolts in snug-tightened joints the same as if they were in slip-critical joints. The snug-tightened condition is defined as the tightness that exists when all plies are in firm contact. This may usually be attained by a few impacts of an impact wrench or the full effort of an ironworker using an ordinary spud wrench. If Twist-Off-Type Tension-Control Bolt Assemblies are used in snug-tightened joints, do not fully tension bolts and leave the splines intact.
    - 2. High-strength Bolts in Slip-critical and Pretensioned Joints:
      - a. High-strength bolts in slip-critical and pretensioned joints shall be tightened to achieve the minimum bolt tension as specified in the RCSC's "Specification for Structural Joints using High-Strength Bolts" when all the fasteners of a joint are tight.
      - b. Any of the four methods to tighten bolts specified in the RCSC Specification may be used to achieve the minimum bolt tension. The tightening procedure that uses direct tension indicator washers shall conform to the requirements of ASTM F 959. Conform to the requirements of ASTM F 1852 for a Twist-Off-Type Tension-Control bolt pretensioning.
- E. Washers: Washers under the bolt head and/or nut shall be used as required by the RCSC Specification.
- F. Bolt Lubrication: All bolts shall be well lubricated at time of installation. Dry, rusty bolts are not be allowed.
- G. Impact Wrenches: Properly sized and lubricated air impact wrenches with adequate air pressure shall be utilized for all bolt installation.
- H. New Bolts: All bolts shall be new and shall not be reused.

#### 2.5 CONNECTIONS

A. Conceptual connection details with the required member design forces are shown on the drawings for bidding purposes and are applicable to all connections not designed and completely detailed on the drawings. The conceptual details are provided only to indicate the connection type required and may not fully represent the complexity of the connection as required by the final connection design for the forces they must resist. Except as noted below, the Fabricator is responsible for engaging the services of a professional engineer to prepare a final connection design for submission that meets the requirements of the conceptual connection details and resists the indicated design forces. Refer to the drawings and specifications for complete requirements.

- B. Typical connection details are indicated on the drawings.
- C. Design and Detailing Procedure:
  - 1. Unless noted otherwise or specifically detailed on the drawings, end connections of beams, girders, and trusses shall be designed as flexible and the connection shall accommodate end rotations of the unrestrained beams. Restrained end connections, as indicated on the drawings, shall be designed for the combined effect of bending moment and shears induced by the rigidity of the connection. Forces to be used in the design are described below.
  - 2. The Fabricator's licensed professional engineer shall design and submit sealed calculations documenting the design and showing details of the assembled joint with the bolts and welds required for the conditions noted below:
    - a. For each connection not otherwise completely detailed on the drawings.
    - b. Where connections are encountered on the project that do not match those assumed in the AISC Manual.
  - 3. Where connections are of the type than can be selected or completed using information found in tables in the AISC "Steel Construction Manual", sealed calculations need not be submitted provided the project design conditions precisely match those assumed in the referenced publications. For conditions encountered on the project that do not conform to the AISC Manual, a complete design shall be prepared and submitted for Engineer's review.
  - 4. The Fabricator's licensed professional engineer shall seal all design calculations.
  - 5. The Engineer reserves the right to reject all shop drawings submitted without complete design calculations if required. Failure to adhere to the requirements of this section obligates the Contractor to take responsibility for any and all resulting delays in the detailing and fabrication of structural steel.
  - 6. The Fabricator, his detailer, and professional engineer shall coordinate all connection requirements with the Erector. The Fabricator is responsible to detail connections that contain the adjustability and all other requirements that allow the Erector to erect the structural steel in conformance to all specified tolerances. The Fabricator shall be responsible for providing adjustability in all connections between exterior-cladding systems, skylights, and other architectural features and the supporting structural steel as required in achieving the specified tolerances for the architectural feature as specified in the contract documents or per the manufacturer's requirements.
- D. Design Intent: It is the intention of the plans and specifications that shop connections be welded or bolted and that field connections be bolted, unless detailed otherwise on the drawings.
- E. Preliminary Connection Review: Proposed variations from the details shown on the drawings will be considered and such variations must obtain preliminary approval from the Engineer prior to preparation of detailed shop drawings.
- F. Flexible (Simple) Beam Connections:
  - 1. All typical beam simple connections shall conform to requirements of the AISC specifications. Refer to the drawings for typical connection types.
- G. Restrained (Moment) Connections:
  - 1. Refer to the drawings for moment connection details.
  - 2. Design Reactions for Moment Connected Beams: Shear connections for momentconnected beams shall be designed for the factored reactions shown on the drawings.
  - 3. Design and Furnishing of Reinforcement in Moment Connected Joints: As part of the design responsibility outlined above, the fabricator shall design and furnish all additional reinforcement in moment connected joints to resist the specified design forces unless otherwise specifically detailed on the drawings. Column sections shall be investigated for web shear, web yielding, web buckling, and tension. Stiffeners and/or doubler plates shall be furnished as required by the AISC Specification Section J10.
- H. Tightening of Bolts in Welded Moment Connections: At moment connections where beams are complete-joint penetration welded directly to columns or girders in the field, welds shall be made after installation of erection bolts to draw the pieces together and before the final shear connection bolts are tightened. Where loose moment plates are used, such plates shall be groove welded to columns prior to connecting these plates to the beams.

- I. Base Plates and Bearing Plates:
  - 1. Finish: All baseplates and bearing plates shall be finished in accordance with AISC Specification M2.8.
  - 2. A complete-joint penetration weld that joins a column that is a part of the Seismic Load Resisting System to a base is a Demand Critical Weld.
  - 3. Anchor Rod Holes in Baseplates: Hole sizes in baseplates for anchor rods shall be per\_the AISC "Steel Construction Manual", Table 14-2.
- J. Stiffeners: Provide stiffeners finished to bear under load concentrations where shown on the drawings.
- K. Limitations on Use of A307 Bolts: ASTM A 307 bolts shall not be used in any permanent steelto-steel or concrete-to-steel connection.
- L. Bolts in Combination with Welds: Bolts shall not be considered as sharing the load in combination with welds, except as allowed in AISC Specification Section J1.8.

#### 2.6 SURFACE PREPARATION AND SHOP PRIME PAINTING

- A. Specification: Surface preparation, paint, and painting practices shall conform to the "SSPC Painting Manual", Volumes 1 and 2.
- B. Scope: All steel shall receive a primer coat unless shown to be fire-proofed or as noted below:
  - 1. Shop paint surfaces that are to remain exposed to view in the final construction.
  - 2. Shop paint any steel other than weathering steel that, in the final construction, will not be in a controlled environment and is therefore subject to moisture or high humidity infiltration and that has not been specified to be galvanized.
  - 3. Shop paint any steel that is shown on the drawings to receive a finished paint system as defined in Specification 099100.
  - 4. Coordinate all shop painting of structural steel with Architect's painting requirements as specified on the architectural drawings and in the specifications. The Fabricator shall be responsible for determining all painting requirements (which surfaces are to be painted or left unpainted) on the project prior to fabrication.
- C. Additional Painting Requirements:
  - 1. Extend shop paint to 2" from location of welds on surfaces that are to be field welded.
  - 2. All unpainted mating surfaces of all elements that are welded together into an assembly that is permanently exposed to the exterior shall be seal welded in addition to structural welding requirements.
  - 3. If individual elements (including the mating surfaces) of an assembly that is required to be painted are painted prior to welding into an assembly, then all painted surfaces affected by welding shall be touched-up and repaired (according to manufacturer's instructions, if any) to prevent corrosion bleeding.
  - 4. The fabricator shall be responsible to ensure that all elements of all assemblies that are to be painted are fabricated so that no exposed surface shall be subject to stains due to corrosion bleeding during the warranty period of the paint.
  - 5. Structural steel elements that are bolted with slip-critical joints and are required on the drawings to be painted shall have all faying surfaces (including all surfaces of filler plates, member end supplement plates, and welds) painted to comply with the specified slip-critical coating requirement.
- D. Surface Preparation Unpainted Steel: All structural steel that is not specified to receive a shop coat of primer paint shall be prepared in accordance with Society for Protective Coatings specifications as follows:
  - 1. SSPC-SP 2, "Hand Tool Cleaning" or SSPC-SP 3, "Power Tool Cleaning" unless otherwise specified.
- E. Surface Preparation and Primer Paint Shop Painted Steel:
  - 1. Surface Preparation: Prepare the surface of all structural steel specified to be shop painted as required by the paint manufacturer or the Society for Protective Coatings specifications, but not less than the following:
    - a. SSPC-SP 2, "Hand Tool Cleaning" or SSPC-SP 3, "Power Tool Cleaning" unless otherwise specified.

- b. SSPC-SP 6, "Commercial Blast Cleaning" shall be applied to the faying surfaces (including filler and member-end supplement plates, if any) of connections that are noted on the drawings as requiring a slip-critical coating. At a minimum, apply this surface preparation to the area between and surrounding all bolt holes including the area up to 2" outside the outer-most holes.
- 2. Priming: Immediately after surface preparation, apply primer to all structural steel specified to be shop primed in strict accordance with manufacturer's instructions and the Society for Protective Coatings specifications. Apply paint at a rate to conform to the manufacturer's written instructions and to provide a dry film thickness of not less the 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, welds, and all exposed surfaces. Apply two coats to surfaces that are inaccessible after assembly or erection. Change the color of the second coat to distinguish it from the first coat.
- 3. Finish Coat: Coordinate shop primer paint requirements with architectural drawings and specifications. The primer selected must be compatible with any specified finish coat.
- F. Shop Touch-Up Painting: The Fabricator shall provide for cleaning and touch-up painting of welds, bolted connections (including nuts, bolts, washers, filler plates, member end supplement plates and welds, if any), and abraded areas. Prior to shipment, apply paint to exposed areas using same materials and surface preparation as used for shop painting. Paint shall be applied by brush or spray with minimum dry film thickness of 1.5 mils.

# 2.7 SOURCE QUALITY CONTROL

A. Source Testing and Inspection: Refer to Specification 014529 "Structural Testing and Inspections" for testing and inspection requirements associated with structural steel.

# PART 3 - EXECUTION

#### 3.1 EXAMINATION

A. Inspection Prior to Erection: Erector shall examine areas and conditions under which structural steel work is to be installed and notify the Contractor and the Architect/Engineer in writing of conditions detrimental to proper and timely completion of the work.

#### 3.2 PREPARATION

- A. Temporary Shoring and Bracing:
  - 1. The lateral-load resisting or stability-providing system and connecting diaphragms are identified on the drawings. Comply with the provisions of the Code of Standard Practice regarding stability of the structure during the erection process, except where stricter requirements are noted herein.
  - 2. Where architectural or MEP requirements do not allow for any temporary supports, members, erection devices, or connections to be left in place permanently or where such items affect the final structural behavior, they shall be removed by the Erector. All costs associated therewith shall be included in the bid price.

# 3.3 ERECTION

- A. The erection work shall comply with the requirements of AISC Specification Section M4.
- B. Surveys: The following surveys shall be performed by a qualified land surveyor:
  - 1. Initial Survey: Check elevations of concrete and masonry bearing surfaces, anchor bolt locations, embedded connection plates, and all dimensions of existing structures to which new connections are to be made prior to erection and submit any discrepancies to the Engineer prior to the start of erection. Corrections or compensating adjustments to the structural steel shall be made and approved prior to the start of erection.
  - 2. Final Survey: Upon completion of erection of the steel frame, and before the start of work by other trades that may be supported, attached, or applied to the frame, a final survey shall be made and a report submitted certifying compliance with specified tolerances.

- C. Erection Tolerances: Erection tolerances of anchor rods, embedded items, and all structural steel shall conform to the AISC Code of Standard Practice, Section 7, unless stricter tolerances are specified elsewhere in the contract documents.
- D. Wherever the erection equipment is supported by the structure, the contractor shall be responsible for the retention of a licensed professional engineer to determine the adequacy of the member supporting the erection equipment in relation to the loads imposed thereon. The Contractor shall submit to the Architect/Engineer, for review, the loads that will be imposed by the erection equipment on the building structure. Where the imposed load exceeds the allowable strength, the Contractor shall be responsible for any additional materials, supports, bracing, connections and similar measures required to support the imposed load of the equipment while in use, subject to review by the Architect/Engineer.
- E. Anchor Rods: Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout. Use only steel wedges or shims.
- F. Base Plates and Bearing Plates: Remove loose latent material from bearing surfaces and base and bearing plates. Set plates to the elevation indicated on the drawings and level using steel shims (plastic shims will not be allowed) or by three leveling screws with weldments at the plate edges. After all protruding plates have been trimmed, grout plates solidly between bearing surfaces using the specified grout, ensuring no voids are present. Finish exposed surfaces, protect installed materials, and allow to wet cure. For proprietary grout materials, comply with manufacturer's instructions. Tighten anchor bolts after supported members have been positioned and plumbed.
- G. Field Assembly of Structural Steel:
  - 1. As erection of the steel progresses, the work shall be fastened securely to safely carry all dead load, wind, and erection forces. Particular care shall be exercised to ensure straightness and tautness of bracing immediately upon raising a steel column.
  - 2. Provide temporary planking and working platforms as necessary to effectively complete work.
  - 3. Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment. Level and plumb individual members of structure within specified AISC tolerances. The Contractor shall coordinate with Erector and Fabricator regarding possible discrepancies in member lengths between temperature at time of fabrication and temperatures during erection, and shall make necessary adjustments to ensure plumbness within AISC tolerances at 70°F. Compensate for cumulative welding draw, construction loadings, sequential applications of dead loads, or any other predictable conditions that could cause distortions to exceed tolerance limitations.
  - 4. On welded construction exposed to view or weather, remove erection bolts, fill holes with plug welds or filler and grind smooth at exposed surfaces.
  - 5. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces receiving field welds.
  - 6. Comply with all bolting and welding requirements of Part 2 of this specification.
- H. Field Modifications to Structural Steel: Errors in shop fabrication or deformation resulting from handling and transportation that prevent the proper assembly and structural fitting of parts shall be reported immediately to the Architect/Engineer, and approval of the method of correction shall be obtained. Approved corrections shall be made at no additional cost to the Owner. Do not use cutting torches, reamers, or other devices in the field for unauthorized correction of fabrication errors.
- I. Miscellaneous Framing: Provide supplemental structural steel support framing for steel deck where columns, or other framing members or floor openings interrupt normal deck bearing whether shown or not on the architectural, mechanical, or structural drawings.
- J. Removal of Erection Aids and Devices: The Erector shall remove all erection aids and devices that interfere with architectural finish or MEP requirements.
- K. Field Touch-Up Painting:

- 1. Clean field welds, unpainted areas of bolted connections (including all exposed areas of nuts, bolts, washers, filler plates, member end supplement plates, and welds), and any shop painted areas that are abraded. Apply paint to all exposed areas using same material and surface preparation as used for shop painting. Apply by brush or spray to provide minimum dry film thickness of 1.5 mils.
- 2. Clean field welds, ungalvanized areas of bolted connections (including all exposed areas of nuts, bolts, washers, filler plates, member end supplement plates, and welds), and any galvanized areas that are abraded. Prepare surfaces and apply two coats of the specified galvanizing repair paint in accordance with ASTM A 780.
- 3. The Contractor shall ensure that, at the substantial completion of the project, all structural steel, bolted and/or welded, required to be painted shall have all necessary steel surfaces painted (including touch-up painting as required) to prevent corrosion bleeding.
- L. Clean Up: Clean up all debris caused by the Work of this Section, keeping the premises neat and clean at all times.
- 3.4 FIELD QUALITY CONTROL
  - A. Field Testing and Inspection: Refer to Specification 014529 "Structural Testing and Inspections" for testing and inspection requirements associated with structural steel.

# END OF SECTION

#### SECTION 260010 SUPPLEMENTAL REQUIREMENTS FOR ELECTRICAL

#### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Supplemental requirements generally applicable to the Work specified in Division 26. This Section is also referenced by related Work specified in other Divisions.
- B. Related Requirements:
  - 1. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, windload, acoustical, and other field conditions applicable to Work specified in this Section.

#### 1.2 REFERENCES A. Abbreviations a

- Abbreviations and Acronyms for Electrical Terms and Units of Measure:
  - 1. 8P8C: An 8-position 8-contact modular jack.
  - 2. A: Ampere, unit of electrical current.
  - 3. AC or ac: Alternating current.
  - 4. AFCI: Arc-fault circuit interrupter.
  - 5. AIC: Ampere interrupting capacity.
  - 6. AL, Al, or ALUM: Aluminum.
  - 7. ASD: Adjustable-speed drive.
  - 8. ATS: Automatic transfer switch.
  - 9. AWG: American wire gauge; see ASTM B258.
  - 10. BAS: Building automation system.
  - 11. BIL: Basic impulse insulation level.
  - 12. BIM: Building information modeling.
  - 13. CAD: Computer-aided design or drafting.
  - 14. CATV: Community antenna television.
  - 15. CB: Circuit breaker.
  - 16. cd: Candela, the SI fundamental unit of luminous intensity.
  - 17. CO/ALR: Copper-aluminum, revised.
  - 18. COPS: Critical operations power system.
  - 19. CU or Cu: Copper.
  - 20. CU-AL or AL-CU: Copper-aluminum.
  - 21. dB: Decibel, a unitless logarithmic ratio of two electrical, acoustical, or optical power values.
  - 22. dB(A-weighted) or dB(A): Decibel acoustical sound pressure level with A-weighting applied in accordance with IEC 61672-1.
  - 23. dB(adjusted) or dBa: Decibel weighted absolute noise power with respect to 3.16 pW (minus 85 dBm).
  - 24. dBm: Decibel absolute power with respect to 1 mW.
  - 25. DC or dc: Direct current.
  - 26. DCOA: Designated critical operations area.
  - 27. DDC: Direct digital control (HVAC).
  - 28. EGC: Equipment grounding conductor.
  - 29. ELV: Extra-low voltage.
  - 30. EMF: Electromotive force.
  - 31. EMI: Electromagnetic interference.
  - 32. EPM: Electrical preventive maintenance.
  - 33. EPS: Emergency power supply.
  - 34. EPSS: Emergency power supply system.

- 35. ESS: Energy storage system.
- 36. EV: Electric vehicle.
- 37. EVPE: Electric vehicle power export equipment.
- 38. EVSE: Electric vehicle supply equipment.
- 39. fc: Footcandle, an internationally recognized unit of illuminance equal to one lumen per square foot or 10.76 lx. The simplified conversion 1 fc = 10 lx in the Specifications is common practice and considered adequate precision for building construction activities. When there are conflicts, lux is the primary unit; footcandle is specified for convenience.
- 40. FLC: Full-load current.
- 41. ft: Foot.
- 42. ft-cd: Foot-candle, the antiquated U.S. Standard unit of illuminance, equal to one international candle measured at a distance of one foot, that was superseded in 1948 by the unit "footcandle" after the SI unit candela (cd) replaced the international candle; see "fc,"
- 43. GEC: Grounding electrode conductor.
- 44. GFCI: Ground-fault circuit interrupter.
- 45. GFPE: Ground-fault protection of equipment.
- 46. GND: Ground.
- 47. HACR: Heating, air conditioning, and refrigeration.
- 48. HDPE: High-density polyethylene.
- 49. HID: High-intensity discharge.
- 50. HP or hp: Horsepower.
- 51. HVAC: Heating, ventilating, and air conditioning.
- 52. Hz: Hertz.
- 53. IBT: Intersystem bonding termination.
- 54. inch: Inch. To avoid confusion, the abbreviation "in." is not used.
- 55. IP: Ingress protection rating (enclosures); Internet protocol (communications).
- 56. IR: Infrared.
- 57. IS: Intrinsically safe.
- 58. IT&R: Inspecting, testing, and repair.
- 59. ITE: Information technology equipment.
- 60. kAIC: Kiloampere interrupting capacity.
- 61. kcmil or MCM: One thousand circular mils.
- 62. kV: Kilovolt.
- 63. kVA: Kilovolt-ampere.
- 64. kVAr or kVAR: Kilovolt-ampere reactive.
- 65. kW: Kilowatt.
- 66. kWh: Kilowatt-hour.
- 67. LAN: Local area network.
- 68. lb: Pound (weight).
- 69. Ibf: Pound (force).
- 70. LCD: Liquid-crystal display.
- 71. LCDI: Leakage-current detector-interrupter.
- 72. LED: Light-emitting diode.
- 73. Li-ion: Lithium-ion.
- 74. Im: Lumen, the SI derived unit of luminous flux.
- 75. LNG: Liquefied natural gas.
- 76. LP-Gas: Liquefied petroleum gas.
- 77. LRC: Locked-rotor current.
- 78. LV: Low voltage.
- 79. Ix: Lux, the SI derived unit of illuminance equal to one lumen per square meter.
- 80. m: Meter.
- 81. MCC: Motor-control center.
- 82. MDC: Modular data center.
- 83. MG set: Motor-generator set.

- 84. MIDI: Musical instrument digital interface.
- 85. MLO: Main lugs only.
- 86. MV: Medium voltage.
- 87. MVA: Megavolt-ampere.
- 88. mW: Milliwatt.
- 89. MW: Megawatt.
- 90. MWh: Megawatt-hour.
- 91. NC: Normally closed.
- 92. Ni-Cd: Nickel-cadmium.
- 93. Ni-MH: Nickel-metal hydride.
- 94. NIU: Network interface unit.
- 95. NO: Normally open.
- 96. NPT: National (American) standard pipe taper.
- 97. OCPD: Overcurrent protective device.
- 98. ONT: Optical network terminal.
- 99. PC: Personal computer.
- 100. PCS: Power conversion system.
- 101. PCU: Power-conditioning unit.
- 102. PF or pf: Power factor.
- 103. PHEV: Plug-in hybrid electric vehicle.
- 104. PLC: Programmable logic controller.
- 105. PLFA: Power-limited fire alarm.
- 106. PoE: Power over Ethernet.
- 107. PV: Photovoltaic.
- 108. PVC: Polyvinyl chloride.
- 109. pW: Picowatt.
- 110. RFI: (electrical) Radio-frequency interference; (contract) Request for interpretation.
- 111. RMS or rms: Root-mean-square.
- 112. RPM or rpm: Revolutions per minute.
- 113. SCADA: Supervisory control and data acquisition.
- 114. SCR: Silicon-controlled rectifier.
- 115. SPD: Surge protective device.
- 116. sq.: Square.
- 117. SWD: Switching duty.
- 118. TCP/IP: Transmission control protocol/Internet protocol.
- 119. TEFC: Totally enclosed fan-cooled.
- 120. TR: Tamper resistant.
- 121. TVSS: Transient voltage surge suppressor.
- 122. UL: (standards) Underwriters Laboratories, Inc.; (product categories) UL, LLC.
- 123. UL CCN: UL Category Control Number.
- 124. UPS: Uninterruptible power supply.
- 125. USB: Universal serial bus.
- 126. UV: Ultraviolet.
- 127. V: Volt, unit of electromotive force.
- 128. V(ac): Volt, alternating current.
- 129. V(dc): Volt, direct current.
- 130. VA: Volt-ampere, unit of complex electrical power.
- 131. VAR: Volt-ampere reactive, unit of reactive electrical power.
- 132. VFC: Variable-frequency controller.
- 133. VOM: Volt-ohm-multimeter.
- 134. VPN: Virtual private network.
- 135. VRLA: Valve regulated lead acid; also called "sealed lead acid (SLA)" or "valve regulated sealed lead acid."
- 136. W: Watt, unit of real electrical power.
- 137. Wh: Watt-hour, unit of electrical energy usage.

- 138. WPT: Wireless power transfer.
- 139. WPTE: Wireless power transfer equipment.
- 140. WR: Weather resistant.

Β.

- Abbreviations and Acronyms for Electrical Raceway Types:
  - 1. EMT: Electrical metallic tubing.
  - 2. EMT-A: Aluminum electrical metallic tubing.
  - 3. EMT-S: Steel electrical metallic tubing.
  - 4. EMT-SS: Stainless steel electrical metallic tubing.
  - 5. ENT: Electrical nonmetallic tubing.
  - 6. EPEC: Electrical HDPE underground conduit.
  - 7. EPEC-40: Schedule 40 electrical HDPE underground conduit.
  - 8. EPEC-80: Schedule 80 electrical HDPE underground conduit.
  - 9. EPEC-A: Type A electrical HDPE underground conduit.
  - 10. EPEC-B: Type B electrical HDPE underground conduit.
  - 11. ERMC: Electrical rigid metal conduit.
  - 12. ERMC-A: Aluminum electrical rigid metal conduit.
  - 13. ERMC-S: Steel electrical rigid metal conduit.
  - 14. ERMC-S-G: Galvanized-steel electrical rigid metal conduit.
  - 15. ERMC-S-PVC: PVC-coated-steel electrical rigid metal conduit.
  - 16. ERMC-SS: Stainless steel electrical rigid metal conduit.
  - 17. FMC: Flexible metal conduit.
  - 18. FMC-A: Aluminum flexible metal conduit.
  - 19. FMC-S: Steel flexible metal conduit.
  - 20. FMT: Steel flexible metallic tubing.
  - 21. FNMC: Flexible nonmetallic conduit. See "LFNC."
  - 22. HDPE: See EPEC.
  - 23. IMC: Steel electrical intermediate metal conduit.
  - 24. LFMC: Liquidtight flexible metal conduit.
  - 25. LFMC-A: Aluminum liquidtight flexible metal conduit.
  - 26. LFMC-S: Steel liquidtight flexible metal conduit.
  - 27. LFMC-SS: Stainless steel liquidtight flexible metal conduit.
  - 28. LFNC: Liquidtight flexible nonmetallic conduit.
  - 29. LFNC-A: Layered (Type A) liquidtight flexible nonmetallic conduit.
  - 30. LFNC-B: Integral (Type B) liquidtight flexible nonmetallic conduit.
  - 31. LFNC-C: Corrugated (Type C) liquidtight flexible nonmetallic conduit.
  - 32. PVC: Rigid PVC conduit.
  - 33. PVC-40: Schedule 40 rigid PVC conduit.
  - 34. PVC-80: Schedule 80 rigid PVC Conduit.
  - 35. PVC-A: Type A rigid PVC concrete-encased conduit.
  - 36. PVC-EB: Type EB rigid PVC concrete-encased underground conduit.
  - 37. RGS: See ERMC-S-G.
  - 38. RMC: See ERMC.
  - 39. RTRC: Reinforced thermosetting resin conduit.
  - 40. RTRC-AG: Low-halogen, aboveground reinforced thermosetting resin conduit.
  - 41. RTRC-AG-HW: Heavy wall, low-halogen, aboveground reinforced thermosetting resin conduit.
  - 42. RTRC-AG-SW: Standard wall, low-halogen, aboveground reinforced thermosetting resin conduit.
  - 43. RTRC-AG-XW: Extra heavy wall, low-halogen, aboveground reinforced thermosetting resin conduit.
  - 44. RTRC-BG: Low-halogen, belowground reinforced thermosetting resin conduit.
- C. Abbreviations and Acronyms for Electrical Single-Conductor and Multiple-Conductor Cable Types:
  - 1. AC: Armored cable.
  - 2. CATV: Coaxial general-purpose cable.

- 3. CATVP: Coaxial plenum cable.
- 4. CATVR: Coaxial riser cable.
- 5. CI: Circuit integrity cable.
- 6. CL2: Class 2 cable.
- 7. CL2P: Class 2 plenum cable.
- 8. CL2R: Class 2 riser cable.
- 9. CL2X: Class 2 cable, limited use.
- 10. CL3: Class 3 cable.
- 11. CL3P: Class 3 plenum cable.
- 12. CL3R: Class 3 riser cable.
- 13. CL3X: Class 3 cable, limited use.
- 14. CM: Communications general-purpose cable.
- 15. CMG: Communications general-purpose cable.
- 16. CMP: Communications plenum cable.
- 17. CMR: Communications riser cable.
- 18. CMUC: Under-carpet communications wire and cable.
- 19. CMX: Communications cable, limited use.
- 20. DG: Distributed generation cable.
- 21. FC: Flat cable.
- 22. FCC: Flat conductor cable.
- 23. FPL: Power-limited fire-alarm cable.
- 24. FPLP: Power-limited fire-alarm plenum cable.
- 25. FPLR: Power-limited fire-alarm riser cable.
- 26. IGS: Integrated gas spacer cable.
- 27. ITC: Instrumentation tray cable.
- 28. ITC-ER: Instrumentation tray cable, exposed run.
- 29. MC: Metal-clad cable.
- 30. MC-HL: Metal-clad cable, hazardous location.
- 31. MI: Mineral-insulated, metal-sheathed cable.
- 32. MTW: (machine tool wiring) Moisture-, heat-, and oil-resistant thermoplastic cable.
- 33. MV: Medium-voltage cable.
- 34. NM: Nonmetallic sheathed cable.
- 35. NMC: Nonmetallic sheathed cable with corrosion-resistant nonmetallic jacket.
- 36. NMS: Nonmetallic sheathed cable with signaling, data, and communications conductors, plus power or control conductors.
- 37. NPLF: Non-power-limited fire-alarm circuit cable.
- 38. NPLFP: Non-power-limited fire-alarm circuit cable for environmental air spaces.
- 39. NPLFR: Non-power-limited fire-alarm circuit riser cable.
- 40. NUCC: Nonmetallic underground conduit with conductors.
- 41. OFC: Conductive optical fiber general-purpose cable.
- 42. OFCG: Conductive optical fiber general-purpose cable.
- 43. OFCP: Conductive optical fiber plenum cable.
- 44. OFCR: Conductive optical fiber riser cable.
- 45. OFN: Nonconductive optical fiber general-purpose cable.
- 46. OFNG: Nonconductive optical fiber general-purpose cable.
- 47. OFNP: Nonconductive optical fiber plenum cable.
- 48. OFNR: Nonconductive optical fiber riser cable.
- 49. P: Marine shipboard cable.
- 50. PLTC: Power-limited tray cable.
- 51. PLTC-ER: Power-limited tray cable, exposed run.
- 52. PV: Photovoltaic cable.
- 53. RHH: (high heat) Thermoset rubber, heat-resistant cable.
- 54. RHW: Thermoset rubber, moisture-resistant cable.
- 55. SA: Silicone rubber cable.
- 56. SE: Service-entrance cable.

- 57. SER: Service-entrance cable, round.
- 58. SEU: Service-entrance cable, flat.
- 59. SIS: Thermoset cable for switchboard and switchgear wiring.
- 60. TBS: Thermoplastic cable with outer braid.
- 61. TC: Tray cable.
- 62. TC-ER: Tray cable, exposed run.
- 63. TC-ER-HL: Tray cable, exposed run, hazardous location.
- 64. THW: Thermoplastic, heat- and moisture-resistant cable.
- 65. THHN: Thermoplastic, heat-resistant cable with nylon jacket outer sheath.
- 66. THHW: Thermoplastic, heat- and moisture-resistant cable.
- 67. THWN: Thermoplastic, moisture- and heat-resistant cable with nylon jacket outer sheath.
- 68. TW: Thermoplastic, moisture-resistant cable.
- 69. UF: Underground feeder and branch-circuit cable.
- 70. USE: Underground service-entrance cable.
- 71. XHH: Cross-linked polyethylene, heat-resistant cable.
- 72. XHHW: Cross-linked polyethylene, heat- and moisture-resistant cable.
- D. Abbreviations and Acronyms for Electrical Flexible Cord Types:
  - 1. SEO: 600 V extra-hard-usage, hard-service cord with thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer covering for damp locations.
  - 2. SEOW: 600 V extra-hard-usage, hard-service cord with thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer covering for damp or wet locations.
  - 3. SEOO: 600 V extra-hard-usage, hard-service cord with oil-resistant thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer covering for damp locations.
  - 4. SEOOW: 600 V extra-hard-usage, hard-service cord with oil-resistant thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer covering for damp or wet locations.
  - 5. SJEO: 300 V hard-usage, junior hard-service cord with thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer cover for damp locations.
  - 6. SJEOW: 300 V hard-usage, junior hard-service cord with thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer cover for damp or wet locations.
  - 7. SJEOO: 300 V hard-usage, junior hard-service cord with oil-resistant thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer cover for damp locations.
  - 8. SJEOOW: 300 V hard-usage, junior hard-service cord with oil-resistant thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer cover for damp or wet locations.
  - 9. SJO: 300 V hard-usage, junior hard-service cord with thermoset insulation and oilresistant thermoset outer cover for damp locations.
  - 10. SJOW: 300 V hard-usage, junior hard-service cord with thermoset insulation and oilresistant thermoset outer cover for damp or wet locations.
  - 11. SJOO: 300 V hard-usage, junior hard-service cord with oil-resistant thermoset insulation and oil-resistant thermoset outer cover for damp locations.
  - 12. SJOOW: 300 V hard-usage, junior hard-service cord with oil-resistant thermoset insulation and oil-resistant thermoset outer cover for damp or wet locations.
  - 13. SJTO: 300 V hard-usage, junior hard-service cord with thermoplastic insulation and oilresistant thermoplastic outer cover for damp locations.
  - 14. SJTOW: 300 V hard-usage, junior hard-service cord with thermoplastic insulation and oilresistant thermoplastic outer cover for damp or wet locations.
  - 15. SJTOO: 300 V hard-usage, junior hard-service cord with oil-resistant thermoplastic insulation and oil-resistant thermoplastic outer cover for damp locations.
  - 16. SJTOOW: 300 V hard-usage, junior hard-service cord with oil-resistant thermoplastic insulation and oil-resistant thermoplastic outer cover for damp or wet locations.

- 17. SO: 600 V extra-hard-usage, hard-service cord with thermoset insulation and oil-resistant thermoset outer covering for damp locations.
- 18. SOW: 600 V extra-hard-usage, hard-service cord with thermoset insulation and oilresistant thermoset outer covering for damp or wet locations.
- 19. SOO: 600 V extra-hard-usage, hard-service cord with oil-resistant thermoset insulation and oil-resistant thermoset outer covering for damp locations.
- 20. SOOW: 600 V extra-hard-usage, hard-service cord with oil-resistant thermoset insulation and oil-resistant thermoset outer covering for damp or wet locations.
- 21. STO: 600 V extra-hard-usage, hard-service cord with thermoplastic insulation and oilresistant thermoplastic outer covering for damp locations.
- 22. STOW: 600 V extra-hard-usage, hard-service cord with thermoplastic insulation and oilresistant thermoplastic outer covering for damp or wet locations.
- 23. STOO: 600 V extra-hard-usage, hard-service cord with oil-resistant thermoplastic insulation and oil-resistant thermoplastic outer covering for damp locations.
- 24. STOOW: 600 V extra-hard-usage, hard-service cord with oil-resistant thermoplastic insulation and oil-resistant thermoplastic outer covering for damp or wet locations.
- E. Definitions:
  - 1. 8-Position 8-Contact (8P8C) Modular Jack: An unkeyed jack with up to eight contacts commonly used to terminate twisted-pair and multiconductor Ethernet cable. Also called a "TIA-1096 miniature 8-position series jack" (8PSJ), or an "IEC 8877 8-pole jack."
    - Be careful when suppliers use "RJ45" generically. Obsolete RJ45 jacks used for analog telephone cables have rejection keys. 8P8C jacks used for digital telephone cables and Ethernet cables do not have rejection keys.
  - 2. Basic Impulse Insulation Level (BIL): Reference insulation level expressed in impulse crest voltage with a standard wave not longer than 1.5 times 50 microseconds and 1.5 times 40 microseconds.
  - 3. Cable: In accordance with NIST NBS Circular 37 and IEEE standards, in the United States for the purpose of interstate commerce, the definition of "cable" is (1) a conductor with insulation, or a stranded conductor with or without insulation (single-conductor cable); or (2) a combination of conductors insulated from one another (multiple-conductor cable).
  - 4. Communications Jack: A fixed connecting device designed for insertion of a communications cable plug.
  - 5. Communications Outlet: One or more communications jacks, or cables and plugs, mounted in a box or ring, with a suitable protective cover.
  - 6. Conductor: In accordance with NIST NBS Circular 37 and IEEE standards, in the United States for the purpose of interstate commerce, the definition of "conductor" is (1) a wire or combination of wires not insulated from one another, suitable for carrying an electric current; (2) (National Electrical Safety Code) a material, usually in the form of wire, cable, or bar, suitable for carrying an electric current; or (3) (general) a substance or body that allows a current of electricity to pass continuously along it.
  - 7. Designated Seismic System: A system component that requires design in accordance with Ch. 13 of ASCE/SEI 7 and for which the Component Importance Factor is greater than 1.0.
  - 8. Direct Buried: Installed underground without encasement in concrete or other protective material.
  - 9. Enclosure: The case or housing of an apparatus, or the fence or wall(s) surrounding an installation, to prevent personnel from accidentally contacting energized parts or to protect the equipment from physical damage. Types of enclosures and enclosure covers include the following:
    - a. Cabinet: An enclosure that is designed for either surface mounting or flush mounting and is provided with a frame, mat, or trim in which a swinging door or doors are or can be hung.
    - b. Concrete Box: A box intended for use in poured concrete.

- c. Conduit Body: A means for providing access to the interior of a conduit or tubing system through one or more removable covers at a junction or terminal point. In the United States, conduit bodies are listed in accordance with outlet box requirements.
- d. Conduit Box: A box having threaded openings or knockouts for conduit, EMT, or fittings.
- e. Cutout Box: An enclosure designed for surface mounting that has swinging doors or covers secured directly to and telescoping with the walls of the enclosure.
- f. Device Box: A box with provisions for mounting a wiring device directly to the box.
- g. Extension Ring: A ring intended to extend the sides of an outlet box or device box to increase the box depth, volume, or both.
- h. Floor Box: A box mounted in the floor intended for use with a floor box cover and other components to complete the floor box enclosure.
- i. Floor-Mounted Enclosure: A floor box and floor box cover assembly with means to mount in the floor that is sealed against the entrance of scrub water at the floor level.
- j. Floor Nozzle: An enclosure used on a wiring system, intended primarily as a housing for a receptacle, provided with a means, such as a collar, for surfacemounting on a floor, which may or may not include a stem to support it above the floor level, and is sealed against the entrance of scrub water at the floor level.
- k. Junction Box: A box with a blank cover that joins different runs of raceway or cable and provides space for connection and branching of the enclosed conductors.
- I. Outlet Box: A box that provides access to a wiring system having pryout openings, knockouts, threaded entries, or hubs in either the sides or the back, or both, for the entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting an outlet box cover, but without provisions for mounting a wiring device directly to the box.
- m. Pedestal Floor Box Cover: A floor box cover that, when installed as intended, provides a means for typically vertical or near-vertical mounting of receptacle outlets above the floor's finished surface.
- n. Pull Box: A box with a blank cover that joins different runs of raceway and provides access for pulling or replacing the enclosed cables or conductors.
- o. Raised-Floor Box: A floor box intended for use in raised floors.
- p. Recessed Access Floor Box: A floor box with provisions for mounting wiring devices below the floor surface.
- q. Recessed Access Floor Box Cover: A floor box cover with provisions for passage of cords to recessed wiring devices mounted within a recessed floor box.
- r. Ring: A sleeve, which is not necessarily round, used for positioning a recessed wiring device flush with the plaster, concrete, drywall, or other wall surface.
- s. Ring Cover: A box cover, with raised center portion to accommodate a specific wall or ceiling thickness, for mounting wiring devices or luminaires flush with the surface.
- t. Termination Box: An enclosure designed for installation of termination base assemblies consisting of bus bars, terminal strips, or terminal blocks with provision for wire connectors to accommodate incoming or outgoing conductors, or both.
- 10. Emergency Systems: Those systems legally required and classed as emergency by municipal, state, federal, or other codes, or by any governmental agency having jurisdiction that are designed to ensure continuity of lighting, electrical power, or both, to designated areas and equipment in the event of failure of the normal supply for safety to human life.
- 11. Essential Electrical Systems: (healthcare facilities) Those systems designed to ensure continuity of electrical power to designated areas and functions of a healthcare facility during disruption of normal power sources, and also to minimize disruption within the internal wiring system.

- 12. Fault Limited: Providing or being served by a source of electrical power that is limited to not more than 100 W when tested in accordance with UL 62368-1.
  - a. The term "fault limited" is intended to encompass most Class 1, 2, and 3 powerlimited sources complying with Article 725 of NFPA 70; Class ES1 and ES2 electrical energy sources that are Class PS1 electrical power sources (e.g., USB); and Class ES3 electrical energy sources that are Class PS1 and PS2 electrical power sources (e.g., PoE). See UL 62368-1 for discussion of classes of electrical energy sources and classes of electrical power sources.
- 13. Jacket: A continuous nonmetallic outer covering for conductors or cables.
- 14. Luminaire: A complete lighting unit consisting of a light source such as a lamp, together with the parts designed to position the light source and connect it to the power supply. It may also include parts to protect the light source or the ballast or to distribute the light.
- 15. Mode: The terms "Active Mode," "Off Mode," and "Standby Mode" are used as defined in the Energy Independence and Security Act (EISA) of 2007.
- 16. Multi-Outlet Assembly: A type of surface, flush, or freestanding raceway designed to hold conductors, receptacles, and switches, assembled in the field or at the factory.
- 17. Plenum: A compartment or chamber to which one or more air ducts are connected and that forms part of the air distribution system.
- 18. Receptacle: A fixed connecting device arranged for insertion of a power cord plug. Also called a power jack.
- 19. Receptacle Outlet: One or more receptacles mounted in a box with a suitable protective cover.
- 20. Sheath: A continuous metallic covering for conductors or cables.
- 21. UL Category Control Number (CCN): An alphabetic or alphanumeric code used to identify product categories covered by UL's Listing, Classification, and Recognition Services.
- 22. Voltage Class: For specified circuits and equipment, voltage classes are defined as follows:
  - a. Control Voltage: Having electromotive force between any two conductors, or between a single conductor and ground, that is supplied from a battery or other Class 2 or Class 3 power-limited source.
  - b. Line Voltage: (1) (controls) Designed to operate using the supplied low-voltage power without transformation. (2) (transmission lines, transformers, SPDs) The line-to-line voltage of the supplying power system.
  - c. Extra-Low Voltage (ELV): Not having electromotive force between any two conductors, or between a single conductor and ground, exceeding 30 V(ac rms), 42 V(ac peak), or 60 V(dc).
  - d. Low Voltage (LV): Having electromotive force between any two conductors, or between a single conductor and ground, that is rated above 30 V but not exceeding 1000 V.
  - e. Medium Voltage (MV): Having electromotive force between any two conductors, or between a single conductor and ground, that is rated about 1 kV but not exceeding 69 kV.
  - f. High Voltage: (1) (circuits) Having electromotive force between any two conductors, or between a single conductor and ground, that is rated above 69 kV but not exceeding 230 kV. (2) (safety) Having sufficient electromotive force to inflict bodily harm or injury.
- 23. Wire: In accordance with NIST NBS Circular 37 and IEEE standards, in the United States for the purpose of interstate commerce, the definition of "wire" is a slender rod or filament of drawn metal. A group of small wires used as a single wire is properly called a "stranded wire." A wire or stranded wire covered with insulation is properly called an "insulated wire" or a "single-conductor cable." Nevertheless, when the context indicates that the wire is insulated, the term "wire" will be understood to include the insulation.

1.3 COORDINATION

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions:

- 1. Notify Architect Owner no fewer than seven days in advance of proposed interruption of electrical service.
- 2. Do not proceed with interruption of electrical service without Architect's Owner's written permission.
- 3. Coordinate interruption with systems impacted by outage including, but not limited to, the following:
  - a. Exercising generators.
  - b. Emergency lighting.
  - c. Elevators.
  - d. Fire-alarm systems.
- B. Arrange to provide temporary electrical power in accordance with requirements specified in Division 01.
- 1.4 PREINSTALLATION MEETINGS
- A. Electrical Preconstruction Conference: Schedule conference with Architect and Owner, not later than 10 days after notice to proceed. Agenda topics include, but are not limited to, the following:
  - 1. Electrical installation schedule.
  - 2. Status of power system studies.
  - 3. Value analysis proposals and requests for substitution of electrical equipment.
  - 4. Commissioning activities.
  - 5. Sustainability activities, including Measurement and Verification Plan.
- 1.5 SEQUENCING
  - A. Conduct and submit results of power system studies before submitting Product Data and Shop Drawings for electrical equipment.
- 1.6 ACTION SUBMITTALS
  - A. Coordination Drawings for Duct Banks:
    - 1. Show duct profiles and coordination with other utilities and underground structures.
    - 2. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.
- 1.7 INFORMATIONAL SUBMITTALS
  - A. Electrical Installation Schedule: At preconstruction meeting, and periodically thereafter as dates change, provide schedule for electrical installation Work to Owner and Architect including, but not limited to, milestone dates for the following activities:
    - 1. Submission of power system studies.
    - 2. Submission of specified coordination drawings.
    - 3. Submission of action submittals specified in Division 26.
    - 4. Orders placed for major electrical equipment.
    - 5. Arrival of major electrical equipment on-site.
    - 6. Preinstallation meetings specified in Division 26.
    - 7. Utility service outages.
    - 8. Utility service inspection and activation.
    - 9. Mockup reviews.
    - 10. Closing of walls and ceilings containing electrical Work.
    - 11. System startup, testing, and commissioning activities for major electrical equipment.
    - 12. System startup, testing, and commissioning activities for emergency lighting.
    - 13. System startup, testing, and commissioning activities for automation systems (SCADA, BMS, lighting, HVAC, fire alarm, fire pump, etc.).
    - 14. Pouring of concrete housekeeping pads for electrical equipment and testing of concrete samples.
    - 15. Requests for special inspections.
    - 16. Requests for inspections by authorities having jurisdiction.
    - B. Delegated Design Drawings for Structural Masonry Wall Penetrations: Where indicated on Drawings, provide reflected ceiling plan(s), supplemented by elevations, sections, and other details, drawn to scale, signed and sealed by a qualified structural professional engineer, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

- 1. Location and dimensions of structural members supporting wall.
- 2. Location and dimensions of columns near penetrations.
- 3. Location and dimension of headers and lintels.
- 4. Doors and windows near penetrations.
- 5. Location and dimensions of penetrating cuts.
- 6. Sprinkler piping and sleeves.
- 7. Plumbing piping and sleeves.
- 8. Ductwork and sleeves.
- 9. Cable tray and sleeves.
- 10. Conduit and sleeves.
- 11. Firestopping assemblies for rated penetrations.
- 12. Structural supports for piping, ductwork, and conduit on both sides of wall.
- C. Certificates:
  - 1. Welding certificates.
- D. Qualification Statements:
  - 1. For qualified regional manufacturer.
  - 2. For structural professional engineer.
  - 3. For electrical professional engineer.
  - 4. For lighting professional engineer.
  - 5. For EPM specialist.
  - 6. For welder.
  - 7. For lightning protection system Installer.
  - 8. For exterior athletic lighting Installer.
  - 9. For power quality specialist.
  - 10. For low-voltage electrical testing agency and on-site electrical testing supervisor.
  - 11. For power-limited electrical testing agency and on-site power-limited testing supervisor.
  - 12. For luminaire photometric testing laboratory.
  - 13. For lighting testing and inspecting agency.
- 1.8 CLOSEOUT SUBMITTALS
  - A. Facility EPM Program Binders:
    - 1. Complete Set: On approved online or cloud solution.
    - 2. Volumes 2 and 8: Reproducible hardcopy on archival quality, 28 lb (105 GSM), acid-free, bond paper.
  - B. Operation and Maintenance Data:
    - 1. Provide emergency operation, normal operation, and preventive maintenance manuals for each system, equipment, and device listed below:
      - a. New "EM" panelboards.
    - 2. Include the following information:
      - a. Manufacturer's operating specifications.
      - b. User's guides for software and hardware.
      - c. Schedule of maintenance material items recommended to be stored at Project site.
      - d. Detailed instructions covering operation under both normal and abnormal conditions.
      - e. Time-current curves for overcurrent protective devices and manufacturer's written instructions for testing and adjusting their settings.
      - f. List of load-current and overload-relay heaters with related motor nameplate data.
      - g. List of lamp types and photoelectric relays used on Project, with ANSI and manufacturers' codes.
      - h. Manufacturer's instructions for setting field-adjustable components.
      - i. Manufacturer's instructions for testing, adjusting, and reprogramming microprocessor controls.
      - j. EPSS: Manufacturer's system checklists, maintenance schedule, and maintenance log sheets in accordance with NFPA 110.
      - k. Exterior pole inspection and repair procedures.

- C. Software and Firmware Operational Documentation: Provide software and firmware operational documentation in Facility EPM Program Binders, including the following:
  - 1. Software operating and upgrade manuals.
  - 2. Names, versions, and website addresses for locations of installed software.
  - 3. Device address list.
  - 4. Printout of software application and graphic screens.
  - 5. Testing and adjusting of panic and emergency power features.
  - 6. For lighting controls, include the following:
    - a. Adjustments of scene preset controls, adjustable fade rates, and fade overrides.
    - b. Operation of adjustable zone controls.
- D. Software:
  - 1. Program Software Backup: Provide username and password for approved online or cloud solution.
  - 2. Provide to Owner upgrades and unrestricted licenses for installed and backup software, including operating systems and programming tools required for operation and maintenance.
- 1.9 QUALIFICATIONS
  - A. Electrical Professional Engineer: Professional engineer possessing active qualifications specified in Section 014000 "Quality Requirements," with expertise in electrical engineering, including electrical power system modeling and analysis of electrical safety in accordance with NFPA 70E.
    - B. Lighting Professional Engineer: Professional engineer possessing active qualifications in accordance with Section 014000 "Quality Requirements" and the following:
      - 1. Expertise in electrical engineering, lighting design, and structural requirements for exterior poles and standards.
      - 2. Lighting Certified (LC) Professional by the National Council on Qualifications for the Lighting Professions (NCQLP).
    - C. EPM Specialist: Recognized experts possessing the following qualifications in accordance with Section 014000 "Quality Requirements" and NFPA 70B:
      - 1. Technical Competence: Person should, by education, training, and experience, be wellrounded in all aspects of electrical maintenance.
      - 2. Administrative and Supervisory Skills: Person should be skilled in planning and development of long-range objectives to achieve specific results and should be able to command respect and solicit cooperation of persons involved in EPM Program development.
    - D. Welder: Installer possessing active qualifications specified in Section 014000 "Quality Requirements," with training and certification in accordance with AWS D1.1/D1.1M and AWS D1.2/D1.2M.
    - E. Lightning Protection System Installers: Installer possessing active qualifications specified in Section 014000 "Quality Requirements," and able to present unexpired UL-Listed Installer, UL Category Control Number OWAY, credentials prior to starting installation.
    - F. Low-Voltage Electrical Testing and Inspecting Agency: Entities possessing active credentials from a qualified electrical testing laboratory recognized by authorities having jurisdiction.
      - 1. On-site electrical testing supervisors must have documented certification and experience with testing electrical equipment in accordance with NETA testing standards.
    - G. Luminaire Photometric Testing Laboratory: Entity possessing active qualifications specified in Section 014000 "Quality Requirements" accredited under the NVLAP for Energy Efficient Lighting Products, and complying with applicable IES testing standards.
    - H. Lighting Testing and Inspecting Agency: Entity possessing active qualifications specified in Section 014000 "Quality Requirements" with documented training and experience with testing and inspecting lighting installations in accordance with IES LM-5.
- 1.10 FIELD CONDITIONS
  - A. Modeling, analysis, product selection, installation, and quality control for Work specified in Division 26 must comply with requirements specified in Section 260011 "Facility Performance Requirements for Electrical."

# PART 2 - PRODUCTS

# 2.1 SUBSTITUTION LIMITATIONS FOR ELECTRICAL EQUIPMENT

- A. Substitution requests for electrical equipment will be entertained under the following conditions:
  - 1. Substitution requests may be submitted for consideration prior to the Electrical Preconstruction Conference if accompanied by value analysis data indicating that substitution will comply with Project performance requirements while significantly increasing value for Owner throughout life of facility.
  - 2. Substitution requests may be submitted for consideration concurrently with submission of power system study reports when those reports indicate that substitution is necessary for safety of maintenance personnel and facility occupants.
  - 3. Contractor is responsible for sequencing and scheduling power system studies and electrical equipment procurement. After the Electrical Preconstruction Conference, insufficient lead time for electrical equipment delivery will not be considered a valid reason for substitution.
- 2.2 FACILITY ELECTRICAL PREVENTIVE MAINTENANCE (EPM) PROGRAM BINDERS
- A. Description: Set of binders containing operation and maintenance data for facility's electrical equipment that was compiled during analysis of installed electrical Work for Facility EPM Program development.
  - B. Applicable Standards:
    - 1. Regulatory Requirements: Comply with recommendations in NFPA 70B.
    - 2. General Characteristics:
      - a. Volume 1 Introduction:
        - 1) Summarize how Facility EPM Program Analysis was performed, how data were collected, and how volumes are organized.
        - 2) Describe Facility EPM Program and provide recommended policies and procedures for implementing the program and keeping it current.
        - 3) Provide place for Owner to identify contact information for employees responsible for implementing and maintaining Facility EPM Program.
      - b. Volume 2 Facility Safety, Hazards Awareness, and Emergency Procedures:
        - 1) Include training requirements for employees and contractors.
        - 2) Include list of known facility hazards impacting IT&R activities.
        - 3) Include approval and permitting procedures for IT&R activities.
        - 4) Include incident emergency response procedures.
        - 5) Include emergency shutdown procedures.
        - 6) Include electrical disaster recovery procedures.
      - c. Volume 3 Operating Procedures for Electrical Equipment and Controls:
        1) New "EM" panelboards.
      - d. Volume 4 Facility Diagrams and Schedules:
        - 1) Include single-line diagrams.
        - 2) Include grounding and bonding diagrams.
        - 3) Include essential wiring diagrams.
        - 4) Include system automation diagrams (SCADA, BMS, lighting, HVAC, etc.).
        - 5) Include records of switchgear, switchboard, and panelboard schedules.
        - 6) Include time-current curves for overcurrent protective devices.
        - 7) Include list of load-current and overload-relay heaters with related motor nameplate data.
      - e. Volume 5 Inventory of Facility Equipment Using Electrical Power:
        - 1) Include simplified floor plans showing equipment locations.
        - 2) Identify critical equipment (electrical or otherwise).
        - 3) Include identifying designations and nameplate data.
        - 4) Include warranty and maintenance contract information.

- f. Volume 6 Inventory of Facility Tools, Supplies, and Personnel Protective Equipment:
  - 1) Include schedules of maintenance material items recommended to be stored at facility.
  - 2) Include list of lamp types and photoelectric relays used in facility with ANSI and manufacturers' codes.
  - 3) Include calibration and servicing data for each item.
- g. Volume 7 Inspection, Testing, and Repair (IT&R) Plan:
  - 1) Include tables showing frequency of activities for each item.
  - 2) Include annual schedule with activities mapped to specific days of the year.
  - 3) Include exterior pole inspection and repair procedures.
- h. Volume 8 Inspection, Testing, and Repair (IT&R) Forms:
- i. Volume 9 Inspection, Testing, and Repair (IT&R) Procedures:
- j. Volume 10 Spare Parts List:
  - 1) Include list of all parts required to perform IT&R procedures.
  - 2) Identify quantities of which parts are recommended to be stored on-site.
  - 3) Include source contact information and budget cost for each item.
- k. Volume 11 Construction Project Closeout Record Documentation:
  - 1) Include records of power system studies and photometric studies.
  - 2) Include records of risk assessment studies.
  - 3) Include records of electrical system startup and commissioning activities.
  - 4) Include records of baseline inspections and tests.
  - 5) Include records of baseline infrared photographs with normal light photographs showing the location, direction, angle, and conditions necessary for reproducing each infrared photograph.
  - 6) Include records of baseline settings for adjustable equipment and devices.

# PART 3 - EXECUTION

- 3.1 EXAMINATION
  - A. Verification of Conditions:
  - B. Preinstallation Testing:
  - C. Evaluation and Assessment:
- 3.2 PREPARATION
- A. Protection of In-Place Conditions:
- 3.3 DEVELOPMENT OF FACILITY EPM PROGRAM
  - A. Facility EPM Program must be developed by qualified EPM specialist.
  - B. Conduct Facility EPM Program analysis in accordance with NFPA 70B recommendations.
    - 1. Renovation Projects:
      - a. Facility diagrams must include connected existing equipment for entire facility where known. Areas of uncertainty should be clearly indicated.
      - b. Obtain copies of existing operation and maintenance data and existing Facility EPM Program information from Owner.
      - c. Facility EPM Program analysis should identify existing equipment that does not have available operation and maintenance data, and should explain the Owner's risks because this equipment is not included in Facility EPM Program.
      - d. Data for existing equipment outside scope of Project may be inserted in Facility EPM Program Binders without analysis.
      - e. Data for existing equipment impacted by scope of Project should be analyzed and documented similar to Project's new equipment data as much as possible.
  - C. Compile operation and maintenance data from Facility EPM Program analysis and submit updated Facility EPM Program Binders.

- 3.4 INSTALLATION OF ELECTRICAL WORK
  - A. Unless more stringent requirements are specified in the Contract Documents or manufacturers' written instructions, comply with NFPA 70 and NECA NEIS 1 for installation of Work specified in Division 26. Consult Architect for resolution of conflicting requirements.
- 3.5 SYSTEM STARTUP
  - A. Commissioning Activities:
    - 1. Lighting Controls sequence of operations.
- 3.6 FIELD QUALITY CONTROL
  - A. Administrant for Low-Voltage Electrical Tests and Inspections:
    - 1. Engage qualified low-voltage electrical testing and inspecting agency to administer and perform tests and inspections.
    - 2. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.
    - 3. Administer and perform tests and inspections.
  - B. Administrant for Power-Limited Electrical Tests and Inspections:
    - 1. Owner will engage qualified power-limited electrical testing and inspecting agency to administer and perform tests and inspections.
    - 2. Engage qualified power-limited electrical testing and inspecting agency to administer and perform tests and inspections.
    - 3. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.
    - 4. Administer and perform tests and inspections.
- 3.7 CLOSEOUT ACTIVITIES
  - A. Demonstration:
    - 1. Demonstrate to Owner's maintenance and clerical personnel and building occupants how to operate the following systems and equipment:
      - a. Lighting control devices specified in Section 260923 "Lighting Control Devices."
      - b. Lighting control systems specified in Section 260943.16 "Addressable Luminaire Lighting Controls."
    - 2. Allow Owner to record demonstrations.
  - B. Training: 1. Tra
    - Train Owner's maintenance personnel on the following topics:
      - a. How to implement updated Facility EPM Program.
      - b. How to operate normal and emergency electrical systems, including justifications for, and limitations of, protective device settings recommended in study report specified in Section 260573.16 "Coordination Studies."
      - c. Electrical power safety fundamentals refresher including arc-flash hazard safety features of electrical power distribution equipment in facility, interpreting arc-flash warning labels, selecting appropriate personal protective equipment, and understanding significance of findings documented in study report specified in Section 260573.19 "Arc-Flash Hazard Analysis."
      - d. How to adjust, operate, and maintain devices specified in Section 260923 "Lighting Control Devices."
      - e. How to adjust, operate, and maintain hardware and software specified in Section 260936 "Modular Dimming Controls."
      - f. How to adjust, operate, and maintain hardware and software specified in Section 260943.16 "Addressable Luminaire Lighting Controls."
      - g. How to adjust, operate, and maintain control modules specified in Section 262416.16 "Electronically Operated Circuit-Breaker Panelboards."
      - h. How to adjust, operate, and maintain devices specified in Section 264313 "Surge Protective Devices for Low-Voltage Electrical Power Circuits."
      - i. How to adjust, operate, and maintain luminaires and photoelectric controls specified in Section 265619 "LED Exterior Lighting."

2. Allow Owner to record training sessions.

# END OF SECTION 260010

#### SECTION 260011 FACILITY PERFORMANCE REQUIREMENTS FOR ELECTRICAL

# PART 1 - GENERAL

- 1.1 SUMMARY
  - A. Section Includes:
    - 1. Field conditions and other facility performance requirements applicable to Work specified in Division 26.
- 1.2 FIELD CONDITIONS
  - A. Altitude:
    - 1. Sea level to 1000 ft. (300 m).
  - B. Ambient Temperature:
    - 1. 110 degrees Fahrenheit.
  - C. Temperature Variation: Allow for thermal movements from the following differential temperatures:
    - 1. Ambient Temperature Differential: 120 deg F (67 deg C).
    - 2. Material Surface Temperature Differential: 180 deg F (100 deg C).
    - 3. Ground Surface Temperature Differential to 10 ft. (3 m) Depth.
  - D. Ground Water:
    - 1. Assume ground-water level is 15 feet below ground surface unless a higher water table is indicated on Drawings.

# PART 2 - PRODUCTS (Not Used)

# PART 3 - EXECUTION (Not Used)

# END OF SECTION 260011

#### SECTION 260519 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

# PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Copper building wire.
  - 2. Nonmetallic underground conduit with conductors, Type NUCC.
  - 3. Metal-clad cable, Type MC.
  - 4. Mineral-insulated cable, Type MI.
  - 5. Connectors and splices.
- B. Related Requirements:
  - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
  - 2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, windload, acoustical, and other field conditions applicable to Work specified in this Section.
  - 3. Section 260523 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2, and 3 control cables.
  - 4. Section 271313 "Communications Copper Backbone Cabling" for twisted pair cabling used for data circuits.
  - 5. Section 271513 "Communications Copper Horizontal Cabling" for twisted pair cabling used for data circuits.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Product Schedule: Indicate type, use, location, and termination locations.
- 1.3 INFORMATIONAL SUBMITTALS
- A. Field quality-control reports.

#### PART 2 - PRODUCTS

- 2.1 COPPER BUILDING WIRE
  - A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
  - B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1. Alpha Wire; brand of Belden, Inc.
    - 2. Belden Inc.
    - 3. Encore Wire Corporation.
    - 4. Okonite Company (The).
    - 5. Southwire Company, LLC.
  - C. Standards:
    - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
    - 2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
  - D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.
  - E. Conductor Insulation:
    - 1. Type NM: Comply with UL 83 and UL 719.
    - 2. Type TC-ER: Comply with NEMA WC 70/ICEA S-95-658 and UL 1277.
    - 3. Type THHN and Type THWN-2: Comply with UL 83.

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- 4. Type THW and Type THW-2: Comply with NEMA WC-70/ICEA S-95-658 and UL 83.
- 5. Type UF: Comply with UL 83 and UL 493.
- F. Shield:
  - 1. Type TC-ER: Cable designed for use with ASDs, with oversized crosslinked polyethylene insulation, spiral-wrapped foil plus 85 percent coverage braided shields and insulated full-size ground wire, and sunlight- and oil-resistant outer PVC jacket.
- 2.2 NONMETALLIC UNDERGROUND CONDUIT WITH CONDUCTORS, TYPE NUCC
  - A. Description: A factory assembly of conductors or cables inside a nonmetallic, smooth wall raceway with a circular cross section.
  - B. Applicable Standards:
    - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
    - 2. General Characteristics:
      - a. Reference Standards: UL 1990.
- 2.3 METAL-CLAD CABLE, TYPE MC
  - A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.
  - B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1. AFC Cable Systems; Atkore International.
    - 2. Alpha Wire; brand of Belden, Inc.
    - 3. Belden Inc.
    - 4. Encore Wire Corporation.
    - 5. General Cable; Prysmian Group North America.
    - 6. Okonite Company (The).
    - 7. Southwire Company, LLC.
    - 8. WESCO.
  - C. Standards:
    - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
    - 2. Comply with UL 1569.
    - 3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
  - D. Circuits:
    - 1. Single circuit.
    - 2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.
  - E. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.
  - F. Ground Conductor: Insulated.
  - G. Conductor Insulation:
    - 1. Type TFN/THHN/THWN-2: Comply with UL 83.
    - 2. Type XHHW-2: Comply with UL 44.
  - H. Armor: Steel, interlocked.
  - I. Jacket: PVC applied over armor.
- 2.4 MINERAL-INSULATED CABLE, TYPE MI
  - A. Description: Solid copper conductors encased in compressed metal oxide with an outer metallic sheath, rated 600 V or less.
  - B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1. KME America, Inc.
    - 2. PYROTENAX; brand of nVent Electrical plc.

- C. Standards:
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
  - 2. UL 2196 for fire resistance.
  - 3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Conductors: Copper, complying with ASTM B3 for bare annealed copper.
- E. Insulation: Compressed magnesium oxide.
- F. Sheath: Copper.
- 2.5 CONNECTORS AND SPLICES
  - A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
  - B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1. ABB, Electrification Business.
    - 2. AFC Cable Systems; Atkore International.
    - 3. NSi Industries LLC.
    - 4. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
  - C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.
  - D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.
    - 1. Material: Copper.
    - 2. Type: One hole with standard barrels.
    - 3. Termination: Compression.

# PART 3 - EXECUTION

#### 3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders:
  - 1. Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
  - 2. Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. Conductors must be solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits:
  - 1. Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- C. ASD Output Circuits Cable: Extra-flexible stranded for all sizes.
- D. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.
- 3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS
  - A. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway
  - B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN/THWN-2, single conductors in raceway.
  - C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Underground feeder cable, Type UF.
  - D. Feeders in Cable Tray: Type THHN/THWN-2, single conductors in raceway
  - E. Exposed Branch Circuits, Including in Crawlspaces: Type THHN/THWN-2, single conductors in raceway.
  - F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.
  - G. Branch Circuits in Cable Tray: Type THHN/THWN-2, single conductors in raceway.

- H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless steel, wire-mesh, strain relief device at terminations to suit application.
- I. ASD Output Circuits: Type XHHW-2 in metal conduit.
- 3.3 INSTALLATION, GENERAL
  - A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
    - B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
    - C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
    - D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
    - E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
    - F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."
    - G. Complete cable tray systems installation according to Section 260536 "Cable Trays for Electrical Systems" prior to installing conductors and cables.
- 3.4 INSTALLATION OF FIRE-ALARM WIRE AND CABLE
  - A. Comply with NFPA 72.
  - B. Wiring Method: Install wiring in metal pathway according to Section 270528.29 "Hangers and Supports for Communications Systems."
    - 1. Install plenum cable in environmental airspaces, including plenum ceilings.
    - 2. Fire-alarm circuits and equipment control wiring associated with fire-alarm system must be installed in a dedicated pathway system.
      - a. Cables and pathways used for fire-alarm circuits, and equipment control wiring associated with fire-alarm system, may not contain any other wire or cable.
    - 3. Fire-Rated Cables: Use of two-hour, fire-rated fire-alarm cables, NFPA 70, Types MI and CI, is permitted.
    - 4. Signaling Line Circuits: Power-limited fire-alarm cables may be installed in the same cable or pathway as signaling line circuits.
  - C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with fire-alarm system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
  - D. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes; cabinets; or equipment enclosures where circuit connections are made.
  - E. Color-Coding: Color-code fire-alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire-alarm system junction boxes and covers red.
  - F. Risers: Install at least two vertical cable risers to serve the fire-alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent receipt or transmission of signals from other floors or zones.
  - G. Wiring to Remote Alarm Transmitting Device: 1 inch (25 mm) conduit between the fire-alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.5 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torquetightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inch (150 mm) of slack.
- D. Comply with requirements in Section 284621.11 "Addressable Fire-Alarm Systems" for connecting, terminating, and identifying wires and cables.
- 3.6 IDENTIFICATION
  - A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
  - B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.
- 3.7 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS
  - A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."
- 3.8 FIRESTOPPING
  - A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."
- 3.9 FIELD QUALITY CONTROL
- A. Tests and Inspections:
  - 1. After installing conductors and cables and before electrical circuitry has been energized, test conductors feeding the following critical equipment for compliance.
  - 2. Perform each of the following visual and electrical tests:
    - a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
    - b. Test bolted connections for high resistance using one of the following:
      - 1) A low-resistance ohmmeter.
      - 2) Calibrated torque wrench.
      - 3) Thermographic survey.
    - c. Inspect compression-applied connectors for correct cable match and indentation.
    - d. Inspect for correct identification.
    - e. Inspect cable jacket and condition.
    - f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500 V(dc) for 300 V rated cable and 1000 V(dc) for 600 V rated cable for a one-minute duration.
    - g. Continuity test on each conductor and cable.
    - h. Uniform resistance of parallel conductors.
  - B. Cables will be considered defective if they do not pass tests and inspections.
    - Prepare test and inspection reports to record the following:
    - 1. Procedures used.

C.

- 2. Results that comply with requirements.
- 3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

#### END OF SECTION 260519

#### SECTION 260523 CONTROL-VOLTAGE ELECTRICAL POWER CABLES

# PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section Includes:
  - 1. Category 6a balanced twisted pair cable.
  - 2. Control cable.
  - 3. Control-circuit conductors.
- B. Related Requirements:
  - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
  - 2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, windload, acoustical, and other field conditions applicable to Work specified in this Section.
- 1.2 ACTION SUBMITTALS
- A. Product Data: For each type of product.
- 1.3 INFORMATIONAL SUBMITTALS
  - A. Source quality-control reports.
  - B. Field quality-control reports.

# PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Flame Travel and Smoke Density in Plenums: As determined by testing identical products according to NFPA 262, by a qualified testing agency. Identify products for installation in plenums with appropriate markings of applicable testing agency.
  - 1. Flame Travel Distance: 60 inch (1520 mm) or less.
  - 2. Peak Optical Smoke Density: 0.5 or less.
  - 3. Average Optical Smoke Density: 0.15 or less.
- C. Flame Travel and Smoke Density for Riser Cables in Non-Plenum Building Spaces: As determined by testing identical products according to UL 1666.
- D. Flame Travel and Smoke Density for Cables in Non-Riser Applications and Non-Plenum Building Spaces: As determined by testing identical products according to UL 1685.
- 2.2 CATEGORY 6a BALANCED TWISTED PAIR CABLE
  - A. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of Category 6a cable at frequencies up to 500 MHz.
  - B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1. 3M.
    - 2. AMP NETCONNECT; a TE Connectivity Ltd. company.
    - 3. Belden Inc.
    - 4. Genesis Cable Products; Honeywell International, Inc.
    - 5. Superior Essex Inc.; subsidiary of LS Corp.
  - C. Standard: Comply with TIA-568-C.2 for Category 6a cables.
  - D. Conductors: 100 ohm, No. 14 AWG solid copper.
  - E. Shielding/Screening: Shielded twisted pairs (FTP).

- F. Cable Rating: Plenum.
- G. Jacket: Blue thermoplastic.
- 2.3 CONTROL CABLE

Β.

- A. Paired Cable: NFPA 70, Type CMG.
  - 1. One pair, twisted, No. 14 AWG, stranded (19x29) tinned-copper conductors.
  - 2. PVC insulation.
  - 3. Unshielded.
  - 4. PVC jacket.
  - 5. Flame Resistance: Comply with UL 1685.
  - Plenum-Rated, Paired Cable: NFPA 70, Type CMP.
    - 1. One pair, twisted, No. 14 AWG, stranded (19x29) tinned-copper conductors.
    - 2. PVC insulation.
    - 3. Unshielded.
    - 4. PVC jacket.
  - 5. Flame Resistance: Comply with NFPA 262.
- 2.4 CONTROL-CIRCUIT CONDUCTORS
  - A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1. Encore Wire Corporation.
    - 2. Southwire Company, LLC.
  - B. Class 1 Control Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway.
  - C. Class 2 Control Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway.
  - D. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway.
- 2.5 SOURCE QUALITY CONTROL
  - A. Testing Agency: Engage a qualified testing agency to evaluate cables.
  - B. Factory test twisted pair cables according to TIA-568-C.2.
  - C. Cable will be considered defective if it does not pass tests and inspections.
  - D. Prepare test and inspection reports.

# PART 3 - EXECUTION

- 3.1 EXAMINATION
  - A. Test cables on receipt at Project site.
  - 1. Test each pair of twisted pair cable for open and short circuits.
- 3.2 INSTALLATION OF RACEWAYS AND BOXES
  - A. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for raceway selection and installation requirements for boxes, conduits, and wireways as supplemented or modified in this Section.
    - 1. Outlet boxes must be no smaller than 2 inch (50 mm) wide, 3 inch (75 mm) high, and 2-1/2 inch (64 mm) deep.
    - 2. Flexible metal conduit must not be used.
  - B. Comply with TIA-569-D for pull-box sizing and length of conduit and number of bends between pull points.
  - C. Install manufactured conduit sweeps and long-radius elbows if possible.
  - D. Raceway Installation in Equipment Rooms:
    - 1. Position conduit ends adjacent to a corner on backboard if a single piece of plywood is installed, or in the corner of the room if multiple sheets of plywood are installed around perimeter walls of the room.
    - 2. Install cable trays to route cables if conduits cannot be located in these positions.

- 3. Secure conduits to backboard if entering the room from overhead.
- 4. Extend conduits 3 inch (75 mm) above finished floor.
- 5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
- 3.3 INSTALLATION OF CONDUCTORS AND CABLES
  - A. Comply with NECA 1.
  - B. General Requirements for Cabling:
    - 1. Comply with TIA-568-C Series of standards.
    - 2. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems."
    - 3. Terminate all conductors; cable must not contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
    - 4. Cables may not be spliced and must be continuous from terminal to terminal. Do not splice cable between termination, tap, or junction points.
    - 5. Cables serving a common system may be grouped in a common raceway. Install network cabling and control wiring and cable in separate raceway from power wiring. Do not group conductors from different systems or different voltages.
    - 6. Secure and support cables at intervals not exceeding 30 inch (760 mm) and not more than 6 inch (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
    - 7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Install lacing bars and distribution spools.
    - 8. Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable.
    - 9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Do not use heat lamps for heating.
    - 10. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Monitor cable pull tensions.
    - 11. Support: Do not allow cables to lie on removable ceiling tiles.
    - 12. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.
    - 13. Provide strain relief.
    - 14. Keep runs short. Allow extra length for connecting to terminals. Do not bend cables in a radius less than 10 times the cable OD. Use sleeves or grommets to protect cables from vibration at points where they pass around sharp corners and through penetrations.
    - 15. Ground wire must be copper, and grounding methods must comply with IEEE C2. Demonstrate ground resistance.
    - Balanced Twisted Pair Cable Installation:
    - 1. Comply with TIA-568-C.2.
    - 2. Install termination hardware as specified in Section 271513 "Communications Copper Horizontal Cabling" unless otherwise indicated.
    - 3. Do not untwist balanced twisted pair cables more than 1/2 inch (12 mm) at the point of termination to maintain cable geometry.
    - Installation of Control-Circuit Conductors:
    - 1. Install wiring in raceways.
    - 2. Use insulated spade lugs for wire and cable connection to screw terminals.
    - 3. Comply with requirements specified in Section 260533 "Raceways and Boxes for Electrical Systems."
  - E. Open-Cable Installation:

C.

D.

- 1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
- 2. Suspend copper cable not in a wireway or pathway a minimum of 8 inch (200 mm) above ceilings by cable supports not more than 30 inch (760 mm) apart.
- 3. Cable must not be run through or on structural members or in contact with pipes, ducts, or other potentially damaging items. Do not run cables between structural members and corrugated panels.
- F. Separation from EMI Sources:

- 1. Comply with BICSI TDMM and TIA-569-D recommendations for separating unshielded copper voice and data communications 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 must be as follows:
  - a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 5 inch (127 mm).
  - b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 12 inch (305 mm).
  - c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 24 inch (600 mm).
- 3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment must be as follows:
  - a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 2-1/2 inch (64 mm).
  - b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 6 inch (150 mm).
  - c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 12 inch (305 mm).
- 4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures must be as follows:
  - a. Electrical Equipment or Circuit Rating Less Than 2 kVA: No requirement.
  - b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 3 inch (75 mm).
  - c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 6 inch (150 mm).
- 5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or 5 HP and Larger: A minimum of 48 inch (1200 mm).
- 3.4 CONTROL-CIRCUIT CONDUCTORS
- A. Minimum Conductor Sizes:
  - 1. Class 1 remote-control and signal circuits; No 14 AWG.
  - 2. Class 2 low-energy, remote-control, and signal circuits; No. 14 AWG.
  - 3. Class 3 low-energy, remote-control, alarm, and signal circuits; No 12 AWG.
- 3.5 FIRESTOPPING
  - A. Comply with requirements in Section 078413 "Penetration Firestopping."
  - B. Comply with TIA-569-D, Annex A, "Firestopping."
  - C. Comply with BICSI TDMM, "Firestopping" Chapter.
- 3.6 GROUNDING
  - A. For data communication wiring, comply with TIA-607-B and with BICSI TDMM, "Bonding and Grounding (Earthing)" Chapter.
  - B. For control-voltage wiring and cabling, comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."
- 3.7 IDENTIFICATION
  - A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
  - B. Identify data and communications system components, wiring, and cabling according to TIA-606-B; label printers must use label stocks, laminating adhesives, and inks complying with UL 969.
  - C. Identify each wire on each end and at each terminal with a number-coded identification tag. Each wire must have a unique tag.
- 3.8 FIELD QUALITY CONTROL
  - A. Tests and Inspections:
    - 1. Visually inspect cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm 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.
  - a. Test instruments must meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in its "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in its "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
- B. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.
- C. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

#### SECTION 260526 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

## PART 1 - GENERAL

- 1.1 SUMMARY
  - A. Section Includes:
    - 1. Grounding and bonding conductors.
    - 2. Grounding and bonding clamps.
    - 3. Grounding and bonding bushings.
    - 4. Grounding and bonding hubs.
    - 5. Grounding and bonding connectors.
    - 6. Grounding and bonding busbars.
    - 7. Grounding (earthing) electrodes.
  - B. Related Requirements:
    - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
    - 2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, windload, acoustical, and other field conditions applicable to Work specified in this Section.
- 1.2 ACTION SUBMITTALS

## A. Product Data:

C.

- 1. For each type of product indicated.
- B. Shop Drawings: Plans showing dimensioned locations of grounding features described in "Field Quality Control" Article, including the following:
  - 1. Rod electrodes.
  - 2. Grounding arrangements and connections for separately derived systems.
  - Field Quality-Control Submittals:
  - 1. Field quality-control reports.
- 1.3 CLOSEOUT SUBMITTALS
  - A. Operation and Maintenance Data:
    - 1. In addition to items specified in Section 260010 "Supplemental Requirements for Electrical," include the following:
      - a. Plans showing locations of grounding features described in "Field Quality Control" Article, including the following:
        - 1) Rod electrodes.
        - 2) Grounding arrangements and connections for separately derived systems.
        - 3) Tests must determine if ground-resistance or impedance values remain within specified maximums, and instructions must recommend corrective action if values do not.
        - 4) Include recommended testing intervals.

## PART 2 - PRODUCTS

- 2.1 GROUNDING AND BONDING CONDUCTORS
  - A. Equipment Grounding Conductor:
    - 1. General Characteristics: 600 V, THHN/THWN-2 or THWN-2, copper or tinned-copper wire or cable, green color, in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
  - B. Isolated Equipment Grounding Conductor:

- 1. General Characteristics: 600 V, THHN/THWN-2 or THWN-2, copper or tinned-copper wire or cable, green color with one or more yellow stripes, in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. ASTM Bare Copper Grounding and Bonding Conductor:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Southwire Company, LLC.
    - b. Superior Essex Inc.; subsidiary of LS Corp.
  - 2. Referenced Standards: Complying with one or more of the following:
    - a. Soft or Annealed Copper Wire: ASTM B3
    - b. Concentric-Lay Stranded Copper Conductor: ASTM B8.
    - c. Tin-Coated Soft or Annealed Copper Wire: ASTM B33.
    - d. 19-Wire Combination Unilay-Stranded Copper Conductor: ASTM B787/B787M.
- D. UL KDER Armored Grounding Wire:
  - 1. Description: Single corrosion-resistant copper, aluminum, or copper-clad aluminum conductor within helically formed steel armor.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Southwire Company, LLC.
    - b. Superior Essex Inc.; subsidiary of LS Corp.
  - 3. Regulatory Requirements:
    - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
  - 4. Listing Criteria:
    - a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
- E. UL KDSH Protector Grounding Conductor:
  - 1. Description: Conductors intended to be used for grounding primary protector or metallic members of cable sheath in accordance with Chapters 7 and 8 of NFPA 70.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Southwire Company, LLC.
    - b. Superior Essex Inc.; subsidiary of LS Corp.
  - 3. Regulatory Requirements:
    - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
  - 4. Listing Criteria:
    - a. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.
  - 5. Options:
    - a. Color: green.
- 2.2 GROUNDING AND BONDING CLAMPS
  - A. Description: Clamps suitable for attachment of grounding and bonding conductors to grounding electrodes, pipes, tubing, and rebar. Grounding and bonding clamps specified in this article are also suitable for use with communications applications; see Section 270526 "Grounding and Bonding for Communications Systems," for selection and installation guidelines.
    - B. Source Limitations: Obtain products from single manufacturer.
    - C. Performance Criteria:
      - 1. Regulatory Requirements:
        - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
      - 2. Listing Criteria:

- a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
- b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.
- 2.3 GROUNDING AND BONDING BUSHINGS
  - A. Description: Bonding bushings connect conduit fittings, tubing fittings, threaded metal conduit, and unthreaded metal conduit to metal boxes and equipment enclosures, and have one or more bonding screws intended to provide electrical continuity between bushing and enclosure. Grounding bushings have provision for connection of bonding or grounding conductor and may or may not also have bonding screws.
  - B. Source Limitations: Obtain products from single manufacturer.
  - C. Performance Criteria:
    - 1. Regulatory Requirements:
      - Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
    - 2. Listing Criteria:
    - a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
- 2.4 GROUNDING AND BONDING HUBS
  - A. Description: Hubs with certified grounding or bonding locknut.
  - B. Source Limitations: Obtain products from single manufacturer.
  - C. Performance Criteria:
    - 1. Regulatory Requirements:
      - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
    - 2. Listing Criteria:
      - a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
- 2.5 GROUNDING AND BONDING CONNECTORS
  - A. Source Limitations: Obtain products from single manufacturer.
  - B. Performance Criteria:
    - 1. Regulatory Requirements:
      - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
    - 2. Listing Criteria:
      - a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
      - b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.
- 2.6 GROUNDING AND BONDING BUSBARS
  - A. Description: Miscellaneous grounding and bonding device that serves as common connection for multiple grounding and bonding conductors.
  - B. Source Limitations: Obtain products from single manufacturer.
  - C. Performance Criteria:
    - 1. Regulatory Requirements:
      - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
    - 2. Listing Criteria:
      - a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
- 2.7 GROUNDING (EARTHING) ELECTRODES
  - A. Description: Grounding electrodes include rod electrodes, ring electrodes, metal underground water pipes, metal building frames, concrete-encased electrodes, and pipe and plate electrodes.
  - B. Source Limitations: Obtain products from single manufacturer.
  - C. Performance Criteria:
    - 1. Regulatory Requirements:

- a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
- 2. Listing Criteria:

## PART 3 - EXECUTION

- 3.1 EXAMINATION
  - A. Examine facility's grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of electrical system.
  - B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
  - C. Proceed with connection of electrical service equipment only after unsatisfactory conditions have been corrected.
- 3.2 SELECTION OF BUSBARS
  - A. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
    - 1. Install bus horizontally, on insulated spacers 2 inch (50 mm) minimum from wall, 6 inch (150 mm) above finished floor unless otherwise indicated.
    - 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.
- 3.3 SELECTION OF GROUNDING AND BONDING CONDUCTORS
  - A. Conductors: Install solid conductor for 8 AWG and smaller, and stranded conductors for 6 AWG and larger unless otherwise indicated.
  - B. Custom-Length Insulated Equipment Bonding Jumpers: 6 AWG, 19-strand, Type THHN.
  - C. Bonding Cable: 28 kcmil, 14 strands of 17 AWG conductor, 1/4 inch (6 mm) in diameter.
  - D. Bonding Conductor: 4 AWG or 6 AWG, stranded conductor.
  - E. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inch (41 mm) wide and 1/16 inch (1.6 mm) thick.
  - F. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inch (41 mm) wide and 1/16 inch (1.6 mm) thick.
  - G. Underground Grounding Conductors: Install bare -copper conductor, 2/0 AWG minimum.
    - 1. Bury at least 30 inch (750 mm) below grade.
    - 2. Duct-Bank Grounding Conductor: Bury 12 inch (300 mm) above duct bank when indicated as part of duct-bank installation.
- 3.4 SELECTION OF CONNECTORS
  - A. Conductor Terminations and Connections:
    - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
    - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
    - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
    - 4. Connections to Structural Steel: Welded connectors.
- 3.5 INSTALLATION
  - A. Comply with manufacturer's published instructions.
  - B. Reference Standards:
    - 1. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
    - 2. Consult Architect for resolution of conflicting requirements.
  - C. Special Techniques:
    - 1. Conductors:

- a. Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- 2. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.
  - a. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
  - b. Make connections with clean, bare metal at points of contact.
  - c. Make aluminum-to-steel connections with stainless steel separators and mechanical clamps.
  - d. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
  - e. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
  - f. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
    - 1) Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate adjacent parts.
    - 2) Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
    - 3) Use exothermic-welded connectors for outdoor locations; if disconnect-type connection is required, use bolted clamp.
  - g. Grounding and Bonding for Piping:
    - 1) Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use bolted clamp connector or bolt lug-type connector to pipe flange by using one of lug bolts of flange. Where dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
    - 2) Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with bolted connector.
    - 3) Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
  - h. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.
  - i. Grounding for Steel Building Structure: Install driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 ft (18 m) apart.
- 3. Equipment Grounding:
  - a. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
    - 1) Feeders and branch circuits.
    - 2) Lighting circuits.
    - 3) Receptacle circuits.
    - 4) Single-phase motor and appliance branch circuits.
    - 5) Three-phase motor and appliance branch circuits.
    - 6) Flexible raceway runs.
    - 7) Armored and metal-clad cable runs.
  - b. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air

cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

- c. Isolated Equipment Enclosure Circuits: For designated equipment supplied by branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of applicable derived system or service unless otherwise indicated.
- 3.6 FIELD QUALITY CONTROL
- A. Testing Preparation:
  - B. Field tests and inspections must be witnessed by Architect, authorities having jurisdiction, and Owner.
  - C. Tests and Inspections:
    - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
    - 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with calibrated torque wrench in accordance with manufacturer's published instructions.
    - 3. Test completed grounding system at each location where maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal. Make tests at ground rods before conductors are connected.
      - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
      - b. Perform tests by fall-of-potential method in accordance with IEEE Std 81.
      - c. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.
  - D. Nonconforming Work:
    - 1. Grounding system will be considered defective if it does not pass tests and inspections.
    - 2. Remove and replace defective components and retest.
  - E. Collect, assemble, and submit test and inspection reports.
    - 1. Report measured ground resistances that exceed the following values:
      - a. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10  $\Omega$ .
      - b. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 Ω.
      - c. Power and Lighting Equipment or System with Capacity More Than 1000 kVA:  $3 \Omega$ .
      - d. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 Ω.
- 3.7 PROTECTION
  - A. After installation, protect grounding and bonding cables and equipment from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

#### SECTION 260529 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section Includes:
  - 1. Support, anchorage, and attachment components.
  - 2. Fabricated metal equipment support assemblies.
- B. Related Requirements:
  - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
  - 2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, windload, acoustical, and other field conditions applicable to Work specified in this Section.

## 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
    - a. Slotted support systems, hardware, and accessories.
    - b. Clamps.
    - c. Hangers.
    - d. Sockets.
    - e. Eye nuts.
    - f. Fasteners.
    - g. Anchors.
    - h. Saddles.
    - i. Brackets.
  - 2. Include rated capacities and furnished specialties and accessories.
- B. Shop Drawings: For fabrication and installation details for electrical hangers and support systems.
  - 1. Hangers. Include product data for components.
  - 2. Slotted support systems.
  - 3. Equipment supports.
- C. Delegated Design Submittal: For hangers and supports for electrical systems.
- 1. Include design calculations and details of hangers.
- 1.3 INFORMATIONAL SUBMITTALS
  - A. Welding certificates.

## PART 2 - PRODUCTS

- 2.1 PERFORMANCE REQUIREMENTS
  - A. Delegated Design: Engage a qualified structural professional engineer to design hanger and support system.
  - B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
    - 1. Flame Rating: Class 1.
    - 2. Self-extinguishing according to ASTM D635.
  - SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS
  - A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32 inch (10 mm) diameter holes at a maximum of 8 inch (200 mm) on center in at least one surface.

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- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the
- 2. following:
  - a. Allied Tube & Conduit.
  - b. Cooper B-Line, Inc.; a division of Cooper Industries.
  - c. Thomas & Betts Corporation.
  - d. Unistrut; Tyco International, Ltd.
- 3. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
- 4. Material for Channel, Fittings, and Accessories: Stainless steel, Type 304.
- 5. Channel Width: Selected for applicable load criteria.
- 6. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
- 7. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
- 8. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
- 9. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs must have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body must be made of malleable iron.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A36/A36M steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

Verify suitability of fasteners in "Powder-Actuated Fasteners" Subparagraph below for use in lightweight concrete or concrete slabs less than 4 inch (100 mm) thick.

- 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) Hilti, Inc.
    - 2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
- 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) Hilti, Inc.
    - 2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
- 3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
- 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
- 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F3125/F3125M, Grade A325 (Grade A325M).
- 6. Toggle Bolts: Stainless steel springhead type.
- 7. Hanger Rods: Threaded steel.
- FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

Equipment supports in this article require calculation of load and strength for each component and detailing of each assembly. Coordinate specifications for each equipment support with structural engineer and with Drawings.

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- Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions Α. of supported equipment.
- Β. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

# **PART 3 - EXECUTION**

#### 3.1 SELECTION

- Comply with the following standards for selection and installation of hangers and supports, Α. except where requirements on Drawings or in this Section are stricter:
  - NECA NEIS 101 1.
  - NECA NEIS 105. 2.
- Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping Β. materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- Comply with requirements for raceways and boxes specified in Section 260533 "Raceway and C. Boxes for Electrical Systems."
- D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and ERMC as required by NFPA 70. Minimum rod size must be 1/4 inch (6 mm) in diameter.
- Ε. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  - Secure raceways and cables to these supports with two-bolt conduit clamps. 1.
- 3.2 INSTALLATION OF SUPPORTS
  - Comply with NECA NEIS 101 for installation requirements except as specified in this article. Α.

Retain "Raceway Support Methods" Paragraph below to permit raceways running perpendicular to bar joists and trusses to be supported by letting them rest within the joist or truss openings. NECA NEIS 1 does not mention this method. If seismic design requirements apply, consult structural engineer or authorities having jurisdiction before permitting this support method.

- Raceway Support Methods: In addition to methods described in NECA NEIS 1, EMT may be Β. supported by openings through structure members, in accordance with NFPA 70.
- Strength of Support Assemblies: Where not indicated, select sizes of components so strength C. will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination must be weight of supported components plus 200 lb (90 kg).
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  - To Existing Concrete: Expansion anchor fasteners. 1.
  - 2. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inch (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inch (100 mm) thick.
  - To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with 3. MSS SP-69.
  - 4. To Light Steel: Sheet metal screws.
  - 5. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- Ε. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.
- INSTALLATION OF FABRICATED METAL SUPPORTS 3.3
  - Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated Α. metal supports.
  - Β. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

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C. Field Welding: Comply with AWS D1.1/D1.1M. Submit welding certificates.

## 3.4 CONCRETE BASES

Coordinate this article with Section 033000 "Cast-in-Place Concrete." Coordinate paragraphs and subparagraphs below with Sections specifying supported equipment.

- A. Construct concrete bases of dimensions indicated, but not less than 4 inch (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000 psi (20.7 MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete."
- C. Anchor equipment to concrete base as follows:
  - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
- 3.5 PAINTING
- A. Touchup:
  - 1. Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
    - a. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).
  - B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

#### SECTION 260533 RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section Includes:
  - 1. Type EMT-A and Type EMT-SS raceways and elbows.
  - 2. Type EMT-S raceways and elbows.
  - 3. Type PVC raceways and fittings.
  - 4. Fittings for conduit, tubing, and cable.
  - 5. Threaded metal joint compound.
  - 6. Solvent cements.
  - 7. Strut-type channel raceways and fittings.
  - 8. Metallic outlet boxes, device boxes, rings, and covers.
  - 9. Termination boxes.
  - 10. Cabinets, cutout boxes, junction boxes, pull boxes, and miscellaneous enclosures.
  - 11. Cover plates for device boxes.
  - 12. Hoods for outlet boxes.
- B. Related Requirements:
  - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
  - 2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, windload, acoustical, and other field conditions applicable to Work specified in this Section.
- 1.2 ACTION SUBMITTALS
  - A. Product Data: For the following:
    - 1. Surface metal raceways.
    - 2. Cabinets, cutout boxes, and miscellaneous enclosures.
  - B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details. Show that floor boxes are located to avoid interferences and are structurally allowable. Indicate floor thicknesswhere boxes are embedded in concrete floors and underfloor clearances where boxes are installed in raised floors.
- 1.3 INFORMATIONAL SUBMITTALS
  - A. Manufacturers' Instructions:
    - 1. For Type ERMC-S-PVC.

## PART 2 - PRODUCTS

- 2.1 TYPE EMT-A AND TYPE EMT-SS RACEWAYS AND ELBOWS
  - A. Performance Criteria:
    - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
    - 2. General Characteristics: UL 797A and UL Category Control Number FJMX.
  - B. Aluminum Electrical Metal Tubing (EMT-A) and Elbows:
    - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      - a. Penn Aluminum Conduit & EMT; Penn Aluminum International LLC; Berkshire Hathaway.
    - 2. Material: Aluminum.

- 3. Options:
  - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
- C. Stainless Steel Electrical Metal Tubing (EMT-SS) and Elbows:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ABB,ElectrificationBusiness.
      - b. CantexInc.
      - c. JM Eagle.
  - 2. Material: Stainless steel.
  - 3. Options:

a.

- a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
- TYPE EMT-S RACEWAYS AND ELBOWS
- A. Performance Criteria:

2.2

2.3

2.4

- 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
- 2. General Characteristics: UL 797 and UL Category Control Number FJMX.
- B. Steel Electrical Metal Tubing (EMT-S) and Elbows:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Allied Tube & Conduit; Atkore International.
    - b. Emerson Electric Co.
    - c. Picoma; Zekelman Industries.
    - d. Western Tube; Zekelman Industries.
    - e. Wheatland Tube; Zekelman Industries.
  - 2. Material: Steel.
  - 3. Options:
    - a. Exterior Coating: Zinc.
    - b. Interior Coating: Zinc with organic top coating.
    - c. Minimum Trade Size: Metric designator 21 (trade size 3/4).
  - TYPE FMC-S AND TYPE FMC-A RACEWAYS
- A. Performance Criteria:
  - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
  - 2. General Characteristics: UL 1 and UL Category Control Number DXUZ.
  - B. Steel Flexible Metal Conduit (FMC-S):
    - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - a. ABB, Electrification Business.
      - b. International Metal Hose Co.
      - c. Penn Aluminum Conduit & EMT; Penn Aluminum International LLC; Berkshire Hathaway.
    - 2. Material: Steel.
    - 3. Options:
      - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
    - TYPE FMT RACEWAYS
  - A. Performance Criteria:
    - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
    - 2. General Characteristics: UL 1652 and UL Category Control Number ILJW.

- B. Steel Flexible Metallic Tubing (FMT):
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. International Metal Hose Co.
    - b. Southwire Company, LLC.
  - 2. Options:
    - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
- 2.5 TYPE PVC RACEWAYS AND FITTINGS
  - A. Performance Criteria:
    - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
    - 2. General Characteristics: UL 651 and UL Category Control Number DZYR.
  - B. Schedule 40 Rigid PVC Conduit (PVC-40) and Fittings:
    - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - a. ABB, Electrification Business.
      - b. JM Eagle.
      - c. NAPCO; Westlake Chemical Corp.
      - d. Opti-Com Manufacturing Network, Inc (OMNI).
    - 2. Dimensional Specifications: Schedule 40.
    - 3. Options:
      - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
    - b. Markings: For use with maximum 90 deg C wire.
  - C. Schedule 80 Rigid PVC Conduit (PVC-80) and Fittings:
    - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - a. ABB, Electrification Business.
      - b. JM Eagle.
      - c. Opti-Com Manufacturing Network, Inc (OMNI).
    - 2. Dimensional Specifications: Schedule 80.
    - 3. Options:
      - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
      - b. Markings: For use with maximum 90 deg C wire.
  - D. Type A Rigid PVC Concrete-Encased Conduit (PVC-A) and Fittings:
    - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - a. Southern Pipe, Inc.
    - 2. Dimensional Specifications: Type A.
    - 3. Options:
      - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
  - E. Type EB Rigid PVC Concrete-Encased Underground Conduit (PVC-EB) and Fittings:
    - Manufacturers: Subject to compliance with requirements, provide products by the following:

       JM Eagle.
      - a. om Eaglo.
    - 2. Dimensional Specifications: Type EB.

- 3. Options:
  - a. Minimum Trade Size: Metric designator 53 (trade size 2).
- 2.6 FITTINGS FOR CONDUIT, TUBING, AND CABLE
  - A. Performance Criteria:
    - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
    - B. Fittings for Type ERMC, Type IMC, Type PVC, Type EPEC, and Type RTRC Raceways:
      - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
        - a. ABB, Electrification Business.
        - b. Crouse-Hinds; brand of Eaton, Electrical Sector.
        - c. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
        - d. Konkore Fittings; Atkore International.
        - e. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
        - f. Penn Aluminum Conduit & EMT; Penn Aluminum International LLC; Berkshire Hathaway.
        - g. Southwire Company, LLC.
      - 2. General Characteristics: UL 514B and UL Category Control Number DWTT.
      - 3. Options:
        - a. Material: Steel.
        - b. Coupling Method: Compression coupling.
        - c. Conduit Fittings for Hazardous (Classified) Locations: UL 1203.
        - d. Expansion and Deflection Fittings: UL 651 with flexible external bonding jumper.
    - C. Fittings for Type EMT Raceways:
      - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
        - a. ABB, Electrification Business.
        - b. Allied Tube & Conduit; Atkore International.
        - c. Crouse-Hinds; brand of Eaton, Electrical Sector.
        - d. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
        - e. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
        - f. Southwire Company, LLC.
      - 2. General Characteristics: UL 514B and UL Category Control Number FKAV.
      - 3. Options:
        - a. Material: Steel.
        - b. Coupling Method: Compression coupling.
        - c. Conduit Fittings for Hazardous (Classified) Locations: UL 1203.
        - d. Expansion and Deflection Fittings: UL 651 with flexible external bonding jumper.
    - D. Fittings for Type FMC Raceways:
      - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
        - a. American Fittings Corp. (AMFICO).
        - b. Southwire Company, LLC.
      - 2. General Characteristics: UL 514B and UL Category Control Number ILNR.
    - E. Fittings for Type LFMC and Type LFNC Raceways:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Liquid Tight Connector Company
- 2. General Characteristics: UL 514B and UL Category Control Number DXAS.
- 2.7 ELECTRICALLY CONDUCTIVE CORROSION-RESISTANT COMPOUNDS FOR THREADED CONDUIT
  - A. Performance Criteria:
    - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
    - 2. General Characteristics: UL 2419 and UL Category Control Number FOIZ.
  - B. Manufacturers: Subject to compliance with requirements, provide products by the following: a. ABB, Electrification Business.
- 2.8 SOLVENT CEMENTS
  - A. Performance Criteria:
    - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
    - 2. General Characteristics: As recommended by conduit manufacturer in accordance with UL 514B and UL Category Control Number DWTT.
    - 3. Sustainability Characteristics:
  - B. Solvent Cements for Type PVC Raceways and Fittings:
  - 1. < Double click here to find, evaluate, and insert list of manufacturers and products.>
- 2.9 SURFACE METAL RACEWAYS AND FITTINGS
  - A. Performance Criteria:
    - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
    - 2. General Characteristics: UL 5 and UL Category Control Number RJBT.
  - B. Surface Metal Raceways and Fittings with Metal Covers:
    - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - a. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
      - b. Wiremold; Legrand North America, LLC.
    - 2. Options:
      - a. Galvanized steel base with snap-on covers.
      - b. Manufacturer's standard enamel finish in color selected by Architect.
      - c. Wiring Channels: Dual or Triple, refer to drawings. Multiple channels must be capable of housing a standard 20 to 30 A NEMA device flush within the raceway.
- 2.10 STRUT-TYPE CHANNEL RACEWAYS AND FITTINGS
  - A. Performance Criteria:
    - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
    - 2. General Characteristics: UL 5B and UL Category Control Number RIUU.
  - B. Strut-Type Channel Raceways and Fittings with Metallic Covers:
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - b. ABB, Electrification Business.
    - c. Cooper B-line; brand of Eaton, Electrical Sector.
    - d. Power-Strut; Atkore International.
    - 2. Options:

- a. Manufacturer's standard enamel finish in color selected by Architect.
- 2.11 METALLIC OUTLET BOXES, DEVICE BOXES, RINGS, AND COVERS
  - A. Performance Criteria:
    - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
    - 2. General Characteristics: UL 514A and UL Category Control Number QCIT.
    - B. Metallic Outlet Boxes:
      - 1. Description: Box having pryout openings, knockouts, threaded entries, or hubs in either the sides of the back, or both, for entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting outlet box cover, but without provisions for mounting wiring device directly to box.
      - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
        - a. ABB, Electrification Business.
        - b. Crouse-Hinds; brand of Eaton, Electrical Sector.
        - c. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
        - d. Hubbell Premise Wiring; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
        - e. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
        - f. Killark; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
        - g. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
        - h. Pass & Seymour; Legrand North America, LLC.
        - i. Wiremold; Legrand North America, LLC.
      - 3. Options:
        - a. Material: Sheet steel.
        - b. Sheet Metal Depth: Minimum 1.5 inch (38 mm).
        - c. Luminaire Outlet Boxes and Covers: Nonadjustable, listed and labeled for attachment of luminaire weighing up to 50 lb (23 kg).
        - d. Paddle Fan Outlet Boxes and Covers: Nonadjustable, designed for attachment of paddle fan weighing up to 70 lb (32 kg).
    - C. Metallic Conduit Bodies:
      - 1. Description: Means for providing access to interior of conduit or tubing system through one or more removable covers at junction or terminal point. In the United States, conduit bodies are listed in accordance with outlet box requirements.
      - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
        - a. ABB, Electrification Business.
        - b. Crouse-Hinds; brand of Eaton, Electrical Sector.
        - c. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
        - d. Killark; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
        - e. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
        - f. Pass & Seymour; Legrand North America, LLC.
    - D. Metallic Device Boxes:
      - 1. Description: Box with provisions for mounting wiring device directly to box.
      - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
        - a. ABB, Electrification Business.

- b. Crouse-Hinds; brand of Eaton, Electrical Sector.
- c. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
- d. Hubbell Premise Wiring; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
- e. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
- f. Killark; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
- g. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
- 3. Options:
  - a. Material: Sheet steel.
  - b. Sheet Metal Depth: minimum 1.5 inch (38 mm).
- 4. Description: Ring intended to extend sides of outlet box or device box to increase box depth, volume, or both.
- 5. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. ABB, Electrification Business.
  - b. Cooper B-line; brand of Eaton, Electrical Sector.
  - c. Crouse-Hinds; brand of Eaton, Electrical Sector.
  - d. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
  - e. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
  - f. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
  - g. Pass & Seymour; Legrand North America, LLC.

## 2.12 TERMINATION BOXES

- A. Description: Enclosure for termination base consisting of lengths of bus bars, terminal strips, or terminal blocks with provision for wire connectors to accommodate incoming or outgoing conductors or both.
- B. Performance Criteria:
  - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
  - 2. General Characteristics: UL 1773 and UL Category Control Number XCKT.
- C. Termination Boxes and Termination Bases for Installation on Line Side of Service Equipment:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ABB, Electrification Business.
    - b. Cooper B-line; brand of Eaton, Electrical Sector.
    - c. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
    - d. Erickson Electrical Equipment Company.
    - e. Square D; Schneider Electric USA.
  - 2. Additional Characteristics: Listed and labeled for installation on line side of service equipment.
- D. Termination Boxes and Termination Bases for Installation on Load Side of Service Equipment:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ABB, Electrification Business.
    - b. Cooper B-line; brand of Eaton, Electrical Sector.
    - c. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.

- Erickson Electrical Equipment Company. d.
- e. Square D: Schneider Electric USA.
- 2. Additional Characteristics: Listed and labeled for installation on load side of service equipment.
- 2.13 CABINETS, CUTOUT BOXES, JUNCTION BOXES, PULL BOXES, AND MISCELLANEOUS **ENCLOSURES** 
  - Performance Criteria: Α.
    - Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked 1. for intended location and use. 2.
      - General Characteristics:
        - Non-Environmental Characteristics: UL 50. a.
        - Environmental Characteristics: UL 50E. b.
  - Indoor junction boxes, enclosures, and cabinets: Β.
    - Description: Enclosure provided with frame, mat, or trim in which swinging door or doors 1 are or can be hung.
    - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - ABB, Electrification Business. a.
      - Cooper B-line; brand of Eaton, Electrical Sector. b.
      - Crouse-Hinds: brand of Eaton. Electrical Sector. C.
      - Erickson Electrical Equipment Company. d.
      - Killark; brand of Hubbell Electrical Solutions; Hubbell Incorporated. e.
      - f. Siemens Industry, Inc., Building Technologies Division.
      - Square D; Schneider Electric USA. g.
    - Additional Characteristics: UL Category Control Number CYIV. 3.
    - 4. Options:
      - Degree of Protection: Type 1. a.
  - C. Outdoor junction boxes, enclosures, and cabinets:
    - Description: Enclosure provided with frame, mat, or trim in which swinging door or doors 1. are or can be hung.
    - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the followina:
      - ABB. Electrification Business. a.
      - Cooper B-line; brand of Eaton, Electrical Sector. b.
      - Crouse-Hinds; brand of Eaton, Electrical Sector. c.
      - Erickson Electrical Equipment Company. d.
      - Killark; brand of Hubbell Electrical Solutions; Hubbell Incorporated. e.
      - Siemens Industry, Inc., Building Technologies Division, f.
      - Square D; Schneider Electric USA. g.
    - 3. Additional Characteristics: UL Category Control Number CYIV.
    - 4. Options:
      - Degree of Protection: Type 4X. a.
- 2.14 HOODS FOR OUTLET BOXES
  - Performance Criteria: Α.
    - Regulatory Reguirements: Listed and labeled in accordance with NFPA 70 and marked 1. for intended location and use.
    - 2. General Characteristics:
      - Reference Standards: a.
        - UL 514D and UL Category Control Numbers QCIT and QCMZ. 1)

- 2) Receptacle, hood, cover plate, gaskets, and seals comply with UL 498 Supplement SA when mated with box or enclosure complying with UL 514A, UL 514C, or UL 50E.
- Mounts to box using fasteners different from wiring device.
- B. Re-attachable Hoods for Outlet Boxes:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. ABB, Electrification Business.
  - 2. Options:

b.

- a. Provides clear or gray, weatherproof, "while-in-use" cover.
- C. Extra-Duty, While-in-Use Hoods for Outlet Boxes:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ABB, Electrification Business.
    - b. Allied Tube & Conduit; Atkore International.
    - c. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
    - d. Intermatic, Inc.
  - 2. Additional Characteristics: Marked "Extra-Duty" in accordance with UL 514D.
  - 3. Options:
    - a. Provides clear or gray, weatherproof, "while-in-use" cover.

## PART 3 - EXECUTION

## 3.1 SELECTION OF RACEWAYS

- A. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of raceways. Consult Architect for resolution of conflicting requirements.
- B. Outdoors:
  - 1. Exposed and Subject to Severe Physical Damage: IMC.
  - 2. Exposed and Subject to Physical Damage: IMC or Corrosion-resistant EMT.
    - a. Locations less than 2.5 m (8 ft) above finished floor.
  - 3. Exposed and Not Subject to Physical Damage: Corrosion-resistant EMT.
  - 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
- C. Indoors:

D.

- 1. Exposed and Subject to Severe Physical Damage: IMC. Subject to severe physical damage includes the following locations:
  - a. Mechanical rooms.
- 2. Exposed and Subject to Physical Damage: IMC EMT. Subject to physical damage includes the following locations:
  - a. Locations less than 2.5 m (8 ft) above finished floor.
  - b. Stub-ups to above suspended ceilings.
- 3. Exposed and Not Subject to Physical Damage: EMT.
- 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
- 5. Damp or Wet Locations: Corrosion-resistant EMT.
- 6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC or FMC.
- 7. Circuits Operating Above 60 Hz: EMT-A.
- Raceway Fittings: Select fittings in accordance with NEMA FB 2.10 guidelines.
- 1. ERMC and IMC: Provide threaded type fittings unless otherwise indicated.

- 3.2 SELECTION OF BOXES AND ENCLOSURES
  - A. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of boxes and enclosures. Consult Architect for resolution of conflicting requirements.
  - B. Degree of Protection:
    - 1. Outdoors:
      - a. Type 3R unless otherwise indicated.
      - b. Locations Exposed to Hosedown: Type 4.
      - c. Locations Aboveground Where Mechanism Must Operate When Ice Covered: Type 3S.
      - d. Locations in-Ground or Exposed to Corrosive Agents: Type 4X.
      - e. Locations in-Ground or Exposed to Corrosive Agents Where Mechanism Must Operate When Ice Covered: Type 3SX.
    - 2. Indoors:
      - a. Type 1 unless otherwise indicated.
      - b. Damp or Dusty Locations: Type 2.
      - c. Locations Exposed to Airborne Dust, Lint, Fibers, or Flyings: Type 4 or Type 6.
      - d. Locations Exposed to Corrosive Agents: Type 4X or Type 6P.
  - C. Exposed Boxes Installed Less Than 2.5 m (8 ft) Above Floor:
    - 1. Provide exposed cover. Flat covers with angled mounting slots or knockouts are prohibited.
- 3.3 INSTALLATION OF RACEWAYS
  - A. Installation Standards:
    - 1. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for installation of raceways. Consult Architect for resolution of conflicting requirements.
    - 2. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
    - 3. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
    - 4. Comply with NECA NEIS 101 for installation of steel raceways.
    - 5. Comply with NECA NEIS 102 for installation of aluminum raceways.
    - 6. Install raceways square to the enclosure and terminate at enclosures without hubs with locknuts on both sides of enclosure wall. Install locknuts hand tight, plus one-quarter turn more.
    - 7. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to metric designator 35 (trade size 1-1/4) and insulated throat metal bushings on metric designator 41 (trade size 1-1/2) and larger conduits terminated with locknuts..
    - 8. Raceway Terminations at Locations Subject to Moisture or Vibration:
      - a. Provide insulating bushings to protect conductors, including conductors smaller than No. 4 AWG..
  - B. General Requirements for Installation of Raceways:
    - 1. Complete raceway installation before starting conductor installation.
      - 2. Provide stub-ups through floors with coupling threaded inside for plugs, set flush with finished floor. Plug coupling until conduit is extended above floor to final destination or a minimum of 2 ft (0.6 m) above finished floor.
      - 3. Install no more than equivalent of three 90-degree bends in conduit run. Support within 12 inch (300 mm) of changes in direction.
      - 4. Make bends in raceway using large-radius preformed ells except for parallel bends. Field bending must be in accordance with NFPA 70 minimum radii requirements. Provide only equipment specifically designed for material and size involved.
      - 5. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
      - 6. Support conduit within 12 inch (300 mm) of enclosures to which attached.

- 7. Install raceway sealing fittings at accessible locations in accordance with NFPA 70 and fill them with listed sealing compound. For concealed raceways, install fitting in flush steel box with blank cover plate having finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings in accordance with NFPA 70.
- 8. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal interior of raceways at the following points:
  - a. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
  - b. Where an underground service raceway enters a building or structure.
  - c. Conduit extending from interior to exterior of building.
  - d. Conduit extending into pressurized duct and equipment.
  - e. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
  - f. Where otherwise required by NFPA 70.
- 9. Do not install raceways or electrical items on "explosion-relief" walls or rotating equipment.
- 10. Do not install conduits within 2 inch (50 mm) of the bottom side of a metal deck roof.
- 11. Keep raceways at least 6 inch (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- 12. Cut conduit perpendicular to the length. For conduits metric designator 53 (trade size 2) and larger, use roll cutter or a guide to make cut straight and perpendicular to the length. Ream inside of conduit to remove burrs.
- 13. Install pull wires in empty raceways. Provide polypropylene or monofilament plastic line with not less than 200 lb (90 kg) tensile strength. Leave at least 12 inch (300 mm) of slack at both ends of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- C. Requirements for Installation of Specific Raceway Types:
  - 1. Types EMT-A, ERMC-A, and FMC-A:
    - a. Do not install aluminum raceways or fittings in contact with concrete or earth.
  - 2. Types ERMC and IMC:
    - a. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound that maintains electrical conductivity to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
  - 3. Types FMC, LFMC:
    - a. Comply with NEMA RV 3. Provide a maximum of 36 inch (915 mm) of flexible conduit fo requipment subject to vibration, noise transmission, or movement; and for transformers and motors.
- D. Stub-ups to Above Recessed Ceilings:
  - 1. Provide EMT, IMC, or ERMC for raceways.
  - 2. Provide a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- E. Raceway Fittings: Install fittings in accordance with NEMA FB 2.10 guidelines.
  - 1. ERMC-S-PVC: Provide only fittings listed for use with this type of conduit. Patch and seal joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Provide sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
  - 2. EMT: Provide compression, fittings. Comply with NEMA FB 2.10.
  - 3. Flexible Conduit: Provide only fittings listed for use with flexible conduit type. Comply with NEMA FB 2.20.
- 3.4 INSTALLATION OF BOXES AND ENCLOSURES
  - A. Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures.

- B. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- C. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box, whether installed indoors or outdoors.
- D. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- E. Locate boxes so that cover or plate will not span different building finishes.
- F. Support boxes in recessed ceilings independent of ceiling tiles and ceiling grid.
- G. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for purpose.
- H. Fasten junction and pull boxes to, or support from, building structure. Do not support boxes by conduits.
- I. Set metal floor boxes level and flush with finished floor surface.
- J. Do not install aluminum boxes, enclosures, or fittings in contact with concrete or earth.
- K. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to ensure a continuous ground path.
- L. Boxes and Enclosures in Areas or Walls with Acoustical Requirements:
  - 1. Seal openings and knockouts in back and sides of boxes and enclosures with acoustically rated putty.
  - 2. Provide gaskets for wallplates and covers.
- 3.5 FIRESTOPPING
  - A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

## 3.6 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
  - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

## 3.7 CLEANING

A. Boxes: Remove construction dust and debris from device boxes, outlet boxes, and floormounted enclosures before installing wallplates, covers, and hoods.

#### SECTION 260543 UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section Includes:
  - 1. Type PVC raceways and fittings.
  - 2. Fittings for conduit, tubing, and cable.
  - 3. Threaded metal joint compound.
  - 4. Solvent cements.
  - 5. Duct accessories.
  - 6. Duct sealing.
- B. Related Requirements:
  - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
  - 2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, windload, acoustical, and other field conditions applicable to Work specified in this Section.
  - 3. Section 260519 "Low-Voltage for Electrical Power Conductors and Cables" for nonmetallic underground conduit with conductors (Type NUCC).

## 1.2 DEFINITIONS

- A. Duct: A single raceway or multiple raceways, installed singly or as components of a duct bank.
- B. Duct Bank: Two or more ducts installed in parallel, direct buried or with additional casing materials such as concrete.
- 1.3 PREINSTALLATION MEETINGS
  - A. Preinstallation Conference: Conduct conference at Project site.
  - B. Preinstallation Coordination Meeting(s): For underground ducts and raceways. Conduct meeting(s) at Project site before installation.
    - 1. Attendees: Installers, fabricators, representatives of manufacturers, and administrants for field tests and inspections. Notify Architect, Construction Manager, and Owner's Commissioning Authority of scheduled meeting dates.

## 1.4 ACTION SUBMITTALS

A. Product Data:

1.5

- 1. Duct-bank materials, including spacers and miscellaneous components.
- 2. Ducts, conduits, and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
- 3. Underground-line warning tape.
- 4. Warning planks.
- B. Field Quality-Control Submittals:
  - 1. Field quality-control reports.
  - INFORMATIONAL SUBMITTALS
- A. Manufacturers' Published Instructions: Record copy of official installation instructions issued to Installer by manufacturer for the following:
  - 1. For Type ERMC-S-PVC.
  - B. Source Quality-Control Submittals:
    - 1. Source quality-control reports.
- 1.6 MAINTENANCE MÁTERIAL SÚBMITTALS
- A. Spare Parts: Furnish to Owner spare parts necessary for repairing or adding more cables to manholes or handholes that are packaged with protective covering for storage and identified with labels describing contents.

## PART 2 - PRODUCTS

#### 2.1 TYPE PVC RACEWAYS AND FITTINGS

- A. Performance Criteria:
  - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
  - 2. General Characteristics: UL 651 and UL CCN DZYR.
  - B. Schedule 40 Rigid PVC Conduit (PVC-40) and Fittings:
    - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - a. ABB, Electrification Business.
      - b. JM Eagle.
      - c. NAPCO; Westlake Chemical Corp.
      - d. Opti-Com Manufacturing Network, Inc (OMNI).
    - 2. Dimensional Specifications: Schedule 40.
    - 3. Options:
      - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
      - b. Markings: For use with maximum 90 deg C wire.
  - C. Schedule 80 Rigid PVC Conduit (PVC-80) and Fittings:
    - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - a. ABB, Electrification Business.
      - b. JM Eagle.
      - c. Opti-Com Manufacturing Network, Inc (OMNI).
    - 2. Dimensional Specifications: Schedule 80.
    - 3. Options:
      - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
      - b. Markings: For use with maximum 90 deg C wire.
    - FITTINGS FOR CONDUIT, TUBING, AND CABLE

## A. Performance Criteria:

2.2

- 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
- B. Metallic Fittings for Type ERMC, Type IMC, Type PVC, Type EPEC, and Type RTRC Raceways:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ABB, Electrification Business.
    - b. Crouse-Hinds; brand of Eaton, Electrical Sector.
    - c. Penn Aluminum Conduit & EMT; Penn Aluminum International LLC; Berkshire Hathaway.
    - d. Southwire Company, LLC.
  - 2. General Characteristics: UL 514B and UL CCN DWTT.
  - 3. Options:
    - a. Material: Steel.
      - b. Coupling Method: Raintight compression coupling with distinctive color gland nut.
      - c. Conduit Fittings for Hazardous (Classified) Locations: UL 1203.
      - d. Expansion and Deflection Fittings: UL 651 with flexible external bonding jumper.

- 2.3 ELECTRICALLY CONDUCTIVE CORROSION-RESISTANT COMPOUNDS FOR THREADED CONDUIT
  - A. Performance Criteria:
    - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
    - 2. General Characteristics: UL Subject 2419 and UL CCN FOIZ.
  - B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ABB, Electrification Business.
- 2.4 SOLVENT CEMENTS
  - A. Performance Criteria:
    - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
    - 2. General Characteristics: As recommended by conduit manufacturer in accordance with UL 514B and UL CCN DWTT.
  - B. Solvent Cements for Type PVC Raceways and Fittings:
- 2.5 DUCT ACCESSORIES
  - A. Duct Spacers: Factory-fabricated, rigid, PVC interlocking spacers; sized for type and size of duct with which used, and selected to provide minimum duct spacing indicated while supporting duct during concreting or backfilling.
    - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - a. ABB, Electrification Business.
      - b. Allied Tube & Conduit; Atkore International.
      - c. Cantex Inc.
  - B. Underground-Line Warning Tape: In accordance with Section 260553 "Identification for Electrical Systems."
  - C. Concrete Warning Planks: Nominal 12 by 24 by 3 inch (300 by 600 by 75 mm) in size, manufactured from 6000 psi (41 MPa) concrete.
    - 1. Color: Red dye added to concrete during batching.
    - 2. Mark each plank with "ELECTRIC" in 2 inch (50 mm) high, 3/8 inch (10 mm) deep letters.
- 2.6 DUCT SEALING
  - A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1. ABB, Electrification Business.
    - 2. Ideal Industries, Inc.
    - 3. NSi Industries LLC.
  - B. Duct-Sealing Compound: Nonhardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F (2 deg C). Compound must be capable of withstanding temperature of 300 deg F (150 deg C) without slump and adhering to clean surfaces of plastic ducts, metallic conduit, conduit and duct coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals. Duct sealing compound must be removable without damaging ducts or cables.
  - C. Inflatable Duct-Sealing System: Wraparound inflatable bladder that seals ducts that are empty or containing conductors against air and water infiltration. System is suitable for use in steel, plastic, or concrete ducts and penetrations.

## PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Coordinate layout and installation of duct, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in field. Notify Architect if there is conflict between areas of excavation and existing structures or archaeological sites to remain.
- B. Coordinate elevations of duct and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of duct, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct will drain to manholes and handholes, and as approved by Architect.
- C. Clear and grub vegetation to be removed, and protect vegetation to remain in accordance with Section 311000 "Site Clearing." Remove and stockpile topsoil for reapplication in accordance with Section 311000 "Site Clearing."
- 3.2 SELECTION OF UNDERGROUND DUCTS
  - A. Duct for Electrical Cables More Than 600 V: PVC-40, concrete encased unless otherwise indicated.
  - B. Duct for Electrical Feeders 600 V and Less: PVC-40, unless otherwise indicated.
  - C. Duct for Electrical Branch Circuits: PVC-80, direct buried unless otherwise indicated.
  - D. Stub-ups: Concrete encased, PVC-40.
- 3.3 SELECTION OF UNDERGROUND ENCLOSURES

## 3.4 EARTHWORK

- A. Excavation and Backfill: Comply with Section 312000 "Earth Moving," but do not use heavyduty, hydraulic-operated, compaction equipment.
- B. Restoration: Restore area immediately after backfilling is completed.
- C. Restore surface features at areas disturbed by excavation, and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
- D. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Section 329200 "Turf and Grasses" and Section 329300 "Plants."
- E. Cut and patch existing pavement in path of underground duct, and underground structures in accordance with "Cutting and Patching" Article in Section 017300 "Execution."
- 3.5 INSTALLATION OF DUCTS
  - A. Reference Standards:
    - 1. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NEMA TCB 2 for installation of underground ducts.
    - 2. Consult Architect for resolution of conflicting requirements.
  - B. Special Techniques:
    - 1. Where indicated on Drawings, install duct, spacers, and accessories into duct-bank configuration shown.
    - 2. Steel raceway, bends, and fittings in single duct run must be of same type.
    - 3. Slope: Pitch duct minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope duct from high point between two manholes to drain in both directions.
    - 4. Install expansion fitting near center of straight line duct with calculated expansion of more than 3/4 inch (19 mm).
    - 5. Curves and Bends:
      - a. Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with minimum radius of 48 inch (1200 mm), both horizontally and vertically, at other locations unless otherwise indicated.
      - b. Field bending must be in accordance with NFPA 70 minimum radii requirements, except bends over 45 degrees must be made with minimum radius of 48 inch

(1200 mm). Use only equipment specifically designed for material and size involved. Use PVC heating bender for bending PVC conduit.

- c. Duct must have maximum of 180 degrees of bends between pull points.
- 6. Joints: Use solvent-cemented joints in nonmetallic duct and fittings and make watertight in accordance with manufacturer's published instructions. Stagger couplings so those of adjacent duct do not lie in same plane. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with minimum 3 inch (75 mm) of concrete for minimum of 12 inch (300 mm) on each side of coupling.
  - a. Install insulated grounding bushings on steel raceway terminations that are less than 12 inch (300 mm) below grade or floor level and do not terminate in hubs.
- 7. Installation Adjacent to High-Temperature Steam Lines: Where duct is installed parallel to underground steam lines, perform calculations showing duct will not be subject to environmental temperatures above 104 deg F (40 deg C). Where environmental temperatures are calculated to rise above 104 deg F (40 deg C), and anywhere duct crosses above underground steam line, install insulation blankets listed for direct burial to maintain maximum environmental temperature of 104 deg F (40 deg C).
- 8. End Bell Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inch (250 mm) o.c. for 5 inch (125 mm) duct, and vary proportionately for other duct sizes.
  - a. Begin change from regular spacing to end-bell spacing 10 ft (3 m) from end bell, without reducing duct slope and without forming trap in line.
  - b. Grout end bells into structure walls from both sides to provide watertight entrances.
- 9. Building Wall Penetrations: Make transition from underground duct to steel raceway at least 10 ft (3 m) outside building wall, without reducing duct line slope away from building and without forming trap in line. Use fittings manufactured for transition to steel raceway type installed. Install steel raceway penetrations of building walls as specified in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."
- 10. Install manufactured steel raceway elbows for stub-ups at poles unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
  - a. Couple steel elbows to ducts with adapters designed for this purpose, and encase coupling with minimum 3 inch (75 mm) of concrete for minimum of 12 inch (300 mm) on each side of coupling.
- 11. Sealing: Provide temporary closure at terminations of duct with pulled cables. Seal spare duct at terminations. Use sealing compound and plugs to withstand at least 15 psig (1.03 MPa) hydrostatic pressure.
- 12. Pulling Cord: Install 200 lbf (1000 N) test nylon cord in empty ducts.
- 13. Concrete-Encased Ducts:
  - a. Excavate trench bottom to provide firm and uniform support for duct. Prepare trench bottoms as specified in Section 312000 "Earth Moving" for pipes 6 inch (150 mm) or less in nominal diameter.
  - b. Width: Excavate trench 3 inch (75 mm) wider than duct on each side.
  - c. Depth: Install so top of duct envelope is at least 24 inch (600 mm) below finished grade in areas not subject to deliberate traffic, and at least 30 inch (750 mm) below finished grade in deliberate traffic paths for vehicles unless otherwise indicated. Install so top of duct envelope is below local frost line.
  - d. Support duct on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.
  - e. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than four spacers per 20 ft (6 m) of duct. Place spacers within 24 inch (600 mm) of duct ends. Stagger spacers approximately 6 inch (150 mm) between tiers. Secure spacers to earth and to duct to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.

- f. Minimum Space between Ducts: 3 inch (75 mm) between edge of duct and exterior envelope wall, 2 inch (50 mm) between ducts for like services, and 4 inch (100 mm) between power and communications ducts.
- g. Èlbows:
  - 1) Use manufactured duct elbows for stub-ups and at changes of direction in duct unless otherwise indicated. Extend encasement throughout length of elbow.
- h. Stub-ups to Outdoor Equipment: Extend concrete-encased steel raceway horizontally minimum of 60 inch (1500 mm) from edge of equipment base.
  - 1) Stub-ups must be minimum 4 inch (100 mm) above finished floor and minimum 3 inch (75 mm) from conduit side to edge of slab.
- i. Stub-ups to Indoor Equipment: Extend concrete-encased steel raceway horizontally minimum of 60 inch (1500 mm) from edge of wall. Install insulated grounding bushings on terminations at equipment.
  - 1) Stub-ups must terminate in coupling installed flush with finished floor and no less than 3 inch (75 mm) from conduit side to edge of slab.
- j. Reinforcement: Reinforce concrete-encased duct where crossing disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
- k. Forms: Use walls of trench to form side walls where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
- I. Concrete Cover: Install minimum of 3 inch (75 mm) of concrete cover between edge of duct to exterior envelope wall, 2 inch (50 mm) between duct of like services, and 4 inch (100 mm) between power and communications ducts.
- m. Place minimum 6 inch (150 mm) of engineered fill above concrete encasement of duct.
- n. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
  - 1) Start at one end and finish at other, allowing for expansion and contraction of duct as its temperature changes during and after pour. Use expansion fittings installed in accordance with manufacturer's published instructions, or use other specific measures to prevent expansion-contraction damage.
  - 2) If more than one pour is necessary, terminate each pour in vertical plane and install 3/4 inch (15 mm) reinforcing-rod dowels extending minimum of 18 inch (450 mm) into concrete on both sides of joint near corners of envelope.
- o. Pouring Concrete: Comply with requirements in "Concrete Placement" Article in Section 033000 "Cast-in-Place Concrete." Place concrete carefully during pours to prevent voids under and between duct and at exterior surface of envelope. Do not allow heavy mass of concrete to fall directly onto ducts. Allow concrete to flow around duct and rise up in middle, uniformly filling open spaces. Do not use powerdriven agitating equipment unless specifically designed for duct-installation application.
- 14. Direct-Buried Duct:
  - a. Excavate trench bottom to provide firm and uniform support for duct. Comply with requirements in Section 312000 "Earth Moving" for preparation of trench bottoms for pipes less than 6 inch (150 mm) in nominal diameter.
  - b. Width: Excavate trench 12 inch (300 mm) wider than duct on each side.
  - c. Depth: Install top of duct at least 36 inch (900 mm) below finished grade unless otherwise indicated.
  - d. Set elevation of top of conduit below frost line.
  - e. Place minimum 3 inch (75 mm) of sand as bed for duct. Place sand to minimum of 6 inch (150 mm) above top level of duct.
  - f. Support ducts on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.

- g. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than four spacers per 20 ft (6 m) of duct. Place spacers within 24 inch (600 mm) of duct ends. Stagger spacers approximately 6 inch (150 mm) between tiers. Secure spacers to earth and to ducts to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
- h. Install duct with minimum of 3 inch (75 mm) between ducts for like services and 6 inch (150 mm) between power and communications duct.
- i. Install manufactured duct elbows for stub-ups, at building entrances, and at changes of direction in duct direction unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
  - 1) Couple RNC duct to steel raceway with adapters designed for this purpose, and encase coupling with minimum 3 inch (75 mm) of concrete.
  - 2) Stub-ups to Outdoor Equipment: Extend concrete-encased steel raceway horizontally minimum of 60 inch (1500 mm) from edge of base. Install insulated grounding bushings on terminations at equipment.
    - a) Stub-ups must be minimum 4 inch (100 mm) above finished base and minimum 3 inch (75 mm) from conduit side to edge of base.
  - 3) Stub-ups to Indoor Equipment: Extend concrete-encased steel raceway horizontally on exterior of wall minimum of 60 inch (1500 mm) from edge of wall. Install insulated grounding bushings on terminations at equipment.
  - 4) Stub-ups through interior floors must terminate in coupling installed flush with finished floor and no less than 3 inch (75 mm) from conduit side to edge of equipment pad or floor slab.
- j. After installing first tier of duct, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand place backfill to 4 inch (100 mm) over duct and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction. Comply with requirements in Section 312000 "Earth Moving" for installation of backfill materials.
- 15. Warning Planks: Bury warning planks approximately 12 inch (300 mm) above directburied duct, placing them 36 inch (900 mm) o.c. Align planks along width and along centerline of duct. Provide additional plank for each 12 inch (300 mm) increment of ductbank width over nominal 18 inch (450 mm). Space additional planks 12 inch (300 mm) apart, horizontally across width of ducts.
- 16. Underground-Line Warning Tape: Bury conducting underground line specified in Section 260553 "Identification for Electrical Systems" no less than 12 inch (300 mm) above concrete-encased duct and approximately 12 inch (300 mm) below grade. Align tape parallel to and within 3 inch (75 mm) of centerline conduit. Provide additional warning tape for each 12 inch (300 mm) increment of conduit width over nominal 18 inch (450 mm). Space additional tapes 12 inch (300 mm) apart, horizontally across width of ducts.
- 17. Ground ducts in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Interfaces with Other Work:
  - 1. Coordinate installation of new products with existing conditions.
- 3.6 FIELD QUALITY CONTROL
  - A. Acceptance Testing Preparation:
  - B. Field tests and inspections must be witnessed by Architect and authorities having jurisdiction.
  - C. Tests and Inspections:
    - 1. Demonstrate capability and compliance with requirements on completion of installation of underground duct, and utility structures.

- 2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide minimum 12 inch (300 mm) long mandrel equal to duct size minus 1/4 inch (6 mm). If obstructions are indicated, remove obstructions and retest.
- D. Nonconforming Work:
  - 1. Underground ducts, raceways, and structures will be considered defective if they do not pass tests and inspections.
  - 2. Correct deficiencies and retest as specified above to demonstrate compliance.
- E. Assemble and submit test and inspection reports.
- F. Manufacturer Services:
  - 1. Engage factory-authorized service representative to support field tests and inspections.
- 3.7 CLEANING
  - A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of duct until duct cleaner indicates that duct is clear of dirt and debris. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
  - B. Clean internal surfaces of manholes, including sump, and building interiors affected by Work.
    - 1. Sweep floor, removing dirt and debris.
    - 2. Remove foreign material.

#### SECTION 260544 SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section Includes:
  - 1. Round sleeves.
  - 2. Rectangular sleeves.
  - 3. Sleeve-seal systems.
  - 4. Sleeve-seal fittings.
  - 5. Pourable sealants.
  - 6. Grout.
- B. Related Requirements:
  - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
  - 2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, windload, acoustical, and other field conditions applicable to Work specified in this Section.
  - 3. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fireresistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.
- 1.2 ACTION SUBMITTALS
  - A. Product Data: For each type of product.

## PART 2 - PRODUCTS

- 2.1 ROUND SLEEVES
  - A. Steel Wall Sleeves:
    - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - a. Advance Products & Systems, LLC.
      - b. CCI Piping Systems.
      - c. Specified Technologies, Inc.
    - 2. General Characteristics: ASTM A53/A53M, Type E, Grade B, Schedule 40, zinc coated, plain ends and integral waterstop.
  - B. Cast-Iron Wall Sleeves:
    - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - a. American Cast Iron Pipe Company.
    - 2. General Characteristics: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop.
  - C. PE or PP Molded Sleeves:
    - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Crete-Sleeve.
- 2. General Characteristics: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- D. Round, Galvanized-Steel, Sheet Metal Sleeves:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Specified Technologies, Inc.
  - 2. General Characteristics: Galvanized-steel sheet; thickness not less than 0.0239 inch (0.6 mm); round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.
- 2.2 RECTANGULAR SLEEVESA. Rectangular, Galvanized-Steel, Sheet Metal Sleeves:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Abesco Fire LLC.
    - b. Specified Technologies, Inc.
    - c. Wiremold; Legrand North America, LLC.
  - 2. General Characteristics:
    - a. Material: Galvanized sheet steel.
    - b. Minimum Metal Thickness:
      - 1) For sleeve cross-section rectangle perimeter less than 50 inch (1270 mm) and with no side larger than 16 inch (400 mm), thickness must be 0.052 inch (1.3 mm).
      - 2) For sleeve cross-section rectangle perimeter not less than 50 inch (1270 mm) or with one or more sides larger than 16 inch (400 mm), thickness must be 0.138 inch (3.5 mm).

## 2.3 SLEEVE-SEAL SYSTEMS

Sleeve-seal systems in this article are used for conduit penetrations in slabs-on-grade and in below-grade exterior walls.

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Advance Products & Systems, LLC.
  - 2. CALPICO, Inc.
- B. General Characteristics: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable or between raceway and cable.
- C. Options:

Retain first option in "Sealing Elements" Subparagraph below unless Nitrile (Buna N) rubber gasket material is required because hydrocarbons are present in the soil.

- 1. Sealing Elements: EPDM or Nitrile (Buna N) rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
- 2. Pressure Plates: Carbon steel or Fiber-reinforced plastic.
- 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

#### 2.4 SLEEVE-SEAL FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Holdrite; a division of Reliance Worldwide Corporation.
- B. General Characteristics: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit must have plastic or rubber waterstop collar with center opening to match piping OD.
- 2.5 POURABLE SEALANTS
  - A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1. Specified Technologies, Inc.
  - B. Performance Criteria:
    - 1. General Characteristics: Single-component, neutral-curing elastomeric sealants of grade indicated below.
      - a. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
- 2.6 GROUT
  - A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1. Specified Technologies, Inc.
  - B. General Characteristics: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
    - 1. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
    - 2. Design Mix: 5000 psi (34.5 MPa), 28-day compressive strength.
    - 3. Packaging: Premixed and factory packaged.
- 2.7 POURABLE SEALANTS
  - A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1. Specified Technologies, Inc.
  - B. Performance Criteria:
    - 1. General Characteristics: Single-component, neutral-curing elastomeric sealants of grade indicated below.
      - a. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

## PART 3 - EXECUTION

- 3.1 INSTALLATION OF SLEEVES FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS
  - A. Sleeves for Conduits Penetrating Above-Grade, Non-Fire-Rated, Concrete and Masonry-Unit Floors and Walls:
    - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

- a. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall or floor so no voids remain. Tool exposed surfaces smooth; protect material while curing.
- b. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
- 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- 3. Size pipe sleeves to provide 1/4 inch (6.4 mm) annular clear space between sleeve and raceway or cable, unless sleeve-seal system is to be installed.
- 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
- 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inch (50 mm) above finished floor level. Install sleeves during erection of floors.
- B. Sleeves for Conduits Penetrating Non-Fire-Rated Wall Assemblies:
  - 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
  - 2. Seal space outside of sleeves with approved joint compound for wall assemblies.
- C. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve-seal systems. Size sleeves to allow for 1 inch (25 mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
  - 1. Install steel pipe sleeves. Size sleeves to allow for 1 inch (25 mm) annular clear space between raceway or cable and sleeve for installing sleeve-seal system. Grout sleeve into wall or floor opening.
- D. Underground, Exterior-Wall and Floor Penetrations:
  - 1. Install cast-iron pipe sleeves with integral waterstops. Size sleeves to allow for 1 inch (25 mm) annular clear space between raceway or cable and sleeve for installing sleeveseal system. Install sleeve during construction of floor or wall.
- 3.2 INSTALLATION OF SLEEVE-SEAL SYSTEMS
  - A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
  - B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- 3.3 INSTALLATION OF RECTANGULAR SLEEVES AND SLEEVE SEALS
  - A. Install sleeves in existing walls without compromising structural integrity of walls. Do not cut structural elements without reinforcing the wall to maintain the designed weight bearing and wall stiffness.
  - B. Install conduits and cable with no crossings within the sleeve.
  - C. Fill opening around conduits and cables with expanding foam without leaving voids.
  - D. Provide metal sheet covering at both wall surfaces and finish to match surrounding surfaces. Metal sheet must be same material as sleeve.

#### SECTION 260553 IDENTIFICATION FOR ELECTRICAL SYSTEMS

## PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Labels.
  - 2. Bands and tubes.
  - 3. Tapes and stencils.
  - 4. Tags.
  - 5. Signs.
  - 6. Cable ties.
  - 7. Miscellaneous identification products.
- B. Related Requirements:
  - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
  - 2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, windload, acoustical, and other field conditions applicable to Work specified in this Section.
- 1.2 ACTION SUBMITTALS
  - A. Product Data:
    - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

## PART 2 - PRODUCTS

- 2.1 PERFORMANCE REQUIREMENTS
  - A. Comply with ASME A13.1.
  - B. Comply with 29 CFR 1910.144 for color identification of hazards; 29 CFR 1910.145 for danger, caution, warning, and safety instruction signs and tags; and the following:
    - 1. Fire-protection and fire-alarm equipment, including raceways, must be finished, painted, or suitably marked safety red.
    - 2. Ceiling-mounted hangers, supports, cable trays, and raceways must be finished, painted, or suitably marked safety yellow where less than 7.7 ft (2.3 m) above finished floor.
  - C. Signs, labels, and tags required for personnel safety must comply with the following standards:
    - 1. Safety Colors: NEMA Z535.1.
    - 2. Facility Safety Signs: NEMA Z535.2.
    - 3. Safety Symbols: NEMA Z535.3.
    - 4. Product Safety Signs and Labels: NEMA Z535.4.
    - 5. Safety Tags and Barricade Tapes for Temporary Hazards: NEMA Z535.5.
  - D. Comply with NFPA 70E and Section 260573.19 "Arc-Flash Hazard Analysis" requirements for arc-flash warning labels.
  - E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, must comply with UL 969.
  - F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
    - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- 2.2 COLOR AND LEGEND REQUIREMENTS
  - A. Raceways and Cables Carrying Circuits at 1000 V or Less:
    - 1. Black letters on orange field.
    - 2. Legend: Indicate voltage and system or service type.

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- B. Color-Coding for Phase- and Voltage-Level Identification, 1000 V or Less: Use colors listed below for ungrounded feeder and branch-circuit conductors.
  - 1. Color must be factory applied or field applied for sizes larger than 8 AWG if authorities having jurisdiction permit.
  - 2. Colors for 208Y/120 V Circuits:
    - a. Phase A: Black.
    - b. Phase B: Red.
    - c. Phase C: Blue.
  - 3. Colors for 480Y/277 V Circuits:
    - a. Phase A: Brown.
    - b. Phase B: Orange.
    - c. Phase C: Yellow.
  - 4. Color for Neutral: White.
  - 5. Color for Equipment Grounds: Green with yellow stripe.
  - 6. Colors for Isolated Grounds: Green with two or more yellow stripes.
- C. Warning Label Colors:
  - 1. Identify system voltage with black letters on orange background.
  - Warning labels and signs must include, but are not limited to, the following legends:
    - 1. Multiple Power Source Warning: "DANGER ELECTRICAL SHOCK HAZARD EQUIPMENT HAS MULTIPLE POWER SOURCES."
    - 2. Workspace Clearance Warning: "WARNING OSHA REGULATION AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 3 FEET MINIMUM."
    - 3. Arc Flash
- E. Equipment Identification Labels:
  - 1. Normal power: Black letters on white field.
  - 2. Emergency power: Black letters on red field.
  - 3. Transformers
  - 4. Panelboards
  - 5. Disconnects
  - 6. VFDs
- 2.3 LABELS

D.

- A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Brady Corporation.
    - b. Champion America.
    - c. Panduit Corp.
    - d. Seton Identification Products; a Brady Corporation company.
- B. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Brady Corporation.
    - b. Panduit Corp.
- C. Self-Adhesive Wraparound Labels: Preprinted, 3 mil (0.08 mm) thick, polyester flexible label with acrylic pressure-sensitive adhesive.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Brady Corporation.
- b. Panduit Corp.
- c. Seton Identification Products; a Brady Corporation company.
- 2. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over legend. Labels sized such that clear shield overlaps entire printed legend.
- 3. Marker for Labels:
  - a. Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.
- D. Self-Adhesive Labels: Polyester, thermal, transfer-printed, 3 mil (0.08 mm) thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Marking Services Inc.
    - b. Panduit Corp.
  - 2. Minimum Nominal Size:
    - a. 1-1/2 by 6 inch (37 by 150 mm) for raceway and conductors.
    - b. 3-1/2 by 5 inch (76 by 127 mm) for equipment.
    - c. As required by authorities having jurisdiction.
- E. Panel labels to include:
  - 1. Name
  - 2. Voltage
  - 3. Phases
  - 4. Wires
  - 5. Fed from
- 2.4 BANDS AND TUBES
  - A. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inch (50 mm) long, with diameters sized to suit diameters and that stay in place by gripping action.
    - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - a. Brady Corporation.
      - b. Panduit Corp.
  - B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameter and shrunk to fit firmly. Full shrink recovery occurs at maximum of 200 deg F (93 deg C). Comply with UL 224.
    - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - a. Brady Corporation.
      - b. Panduit Corp.
- 2.5 TAPES AND STENCILS
  - A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
    - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - a. Champion America.
      - b. Marking Services Inc.

- c. Panduit Corp.
- B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mil (0.08 mm) thick by 1 to 2 inch (25 to 50 mm) wide; compounded for outdoor use.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Brady Corporation.
    - b. Marking Services Inc.
- C. Tape and Stencil: 4 inch (100 mm) wide black stripes on 10 inch (250 mm) centers placed diagonally over orange background and are 12 inch (300 mm) wide. Stop stripes at legends.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Marking Services Inc.
    - b. Seton Identification Products; a Brady Corporation company.
- D. Floor Marking Tape: 2 inch (50 mm) wide, 5 mil (0.125 mm) pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Seton Identification Products; a Brady Corporation company.
- E. Underground-Line Warning Tape:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Seton Identification Products; a Brady Corporation company.
  - 2. Tape:
    - a. Recommended by manufacturer for method of installation and suitable to identify and locate underground electrical and communications utility lines.
    - b. Printing on tape must be permanent and may not be damaged by burial operations.
    - c. Tape material and ink must be chemically inert and not be subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
  - 3. Color and Printing:
    - a. Comply with APWA Uniform Color Code using NEMA Z535.1 safety colors.
    - b. Inscriptions for Red Tapes: "CAUTION BURIED ELECTRIC LINE BELOW".
    - c. Inscriptions for Orange Tapes: "CAUTION BURIED FIBER OPTIC LINE BELOW" and "CAUTION BURIED COMMUNICATION LINE BELOW".

Insert drawing designation in four tape subparagraphs below. Use these designations on Drawings to identify each product.

First two subparagraphs are generally standard- and extra-strength nonconducting protective tapes. Third and fourth subparagraphs are conductive tapes suitable for conductive or inductive tracing to locate and identify underground utility; sequence is for standard- and extra-strength tapes. Specified weight, width, thickness, and strength of tapes are for generally available stock.

- 4. Tape Type I on E2.02:
  - a. Pigmented polyolefin, bright colored, continuous-printed on one side with inscription of utility, compounded for direct-burial service.
  - b. Width: 3 inch (75 mm).
  - c. Thickness: 4 mil (0.1 mm).

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- d. Weight: 18.5 lb/1000 sq. ft (9.0 kg/100 sq. m).
- e. Tensile in accordance with ASTM D882: 30 lbf (133.4 N) and 2500 psi (17.2 MPa).
- 5. Tape Type ID on T1.01:
  - a. Detectable three-layer laminate, consisting of printed pigmented polyolefin film, solid aluminum-foil core, and clear protective film that allows inspection of continuity of conductive core; bright colored, continuous-printed on one side with inscription of utility, compounded for direct-burial service.
  - b. Width: 3 inch (75 mm).
  - c. Overall Thickness: 5 mil (0.125 mm).
  - d. Foil Core Thickness: 0.35 mil (8.9 µm).
  - e. Weight: 28 lb/1000 sq. ft (13.7 kg/100 sq. m).
  - f. Tensile in accordance with ASTM D882: 70 lbf (311.3 N) and 4600 psi (31.7 MPa).
- 2.6 TAGS
  - A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking cable tie fastener.
    - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - a. Brady Corporation.
      - b. Marking Services Inc.
      - c. Seton Identification Products; a Brady Corporation company.
  - B. Nonmetallic Preprinted Tags: Polyethylene tags, 0.015 inch (0.38 mm) thick, color-coded for phase and voltage level, with factory printed permanent designations; punched for use with self-locking cable tie fastener.
    - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - a. Brady Corporation.
      - b. Panduit Corp.
      - c. Seton Identification Products; a Brady Corporation company.

## 2.7 SIGNS

- A. Baked-Enamel Signs:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Champion America.
  - 2. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
  - 3. 1/4 inch (6.4 mm) grommets in corners for mounting.
  - 4. Nominal Size: 7 by 10 inch (180 by 250 mm).
- B. Metal-Backed Butyrate Signs:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Champion America.
  - 2. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396 inch (1 mm) galvanized-steel backing, punched and drilled for fasteners, and with colors, legend, and size required for application.
  - 3. 1/4 inch (6.4 mm) grommets in corners for mounting.
  - 4. Nominal Size: 10 by 14 inch (250 by 360 mm).
- C. Laminated Acrylic or Melamine Plastic Signs:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Champion America.
- 2. Engraved legend.
- 3. Thickness:
  - a. For signs up to 20 sq. inch (129 sq. cm), minimum 1/16 inch (1.6 mm) thick.
  - b. For signs larger than 20 sq. inch (129 sq. cm), 1/8 inch (3.2 mm) thick.
  - c. Engraved legend with black letters on white face white letters on dark gray background.
  - d. Self-adhesive.
  - e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
- 2.8 CABLE TIES
  - A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

# 1. <Insert manufacturer's name>.

- B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
  - 1. Minimum Width: 3/16 inch (5 mm).
  - 2. Tensile Strength at 73 deg F (23 deg C) in accordance with ASTM D638: 12,000 psi (82.7 MPa).
  - 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
  - 4. Color: Black, except where used for color-coding.
- C. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
  - 1. Minimum Width: 3/16 inch (5 mm).
  - 2. Tensile Strength at 73 deg F (23 deg C) in accordance with ASTM D638: 12,000 psi (82.7 MPa).
  - 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
  - 4. Color: Black.
- D. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.
  - 1. Minimum Width: 3/16 inch (5 mm).
  - 2. Tensile Strength at 73 deg F (23 deg C) in accordance with ASTM D638: 7000 psi (48.2 MPa).
  - 3. UL 94 Flame Rating: 94V-0.
  - 4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
  - 5. Color: Black.

# 2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless steel screws or stainless steel machine screws with nuts and flat and lock washers.

## PART 3 - EXECUTION

## 3.1 PREPARATION

A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

#### 3.2 INSTALLATION

- Verify and coordinate identification names, abbreviations, colors, and other features with Α. requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- Install identifying devices before installing acoustical ceilings and similar concealment. Β.
- Verify identity of item before installing identification products. C.
- Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation D. and maintenance manual.
- Apply identification devices to surfaces that require finish after completing finish work. Ε.
- F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
- G. System Identification for Raceways and Cables under 1000 V: Identification must completely encircle cable or conduit. Place identification of two-color markings in contact, side by side. 1.
  - Secure tight to surface of conductor, cable, or raceway.
- Η. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
- ١. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from floor.
- J. Accessible Fittings for Raceways: Identify cover of junction and pull box of the following systems with wiring system legend and system voltage. System legends must be as follows: "POWER." 1.
- K. Vinyl Wraparound Labels:
  - Secure tight to surface of raceway or cable at location with high visibility and accessibility. 1.
  - 2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to location and substrate.
- Snap-Around Labels: Secure tight to surface at location with high visibility and accessibility. 1
- Self-Adhesive Wraparound Labels: Secure tight to surface at location with high visibility and Μ. accessibility.
- Self-Adhesive Labels: N.
  - Install unique designation label that is consistent with wiring diagrams, schedules, and 1. operation and maintenance manual.
  - 2. Unless otherwise indicated, provide single line of text with 1/2 inch (13 mm) high letters on 1-1/2 inch (38 mm) high label; where two lines of text are required, use labels 2 inch (50 mm) high.
- О. Snap-Around Color-Coding Bands: Secure tight to surface at location with high visibility and accessibility.
- Ρ. Heat-Shrink, Preprinted Tubes: Secure tight to surface at location with high visibility and accessibility.
- C Marker Tapes: Secure tight to surface at location with high visibility and accessibility.
- R. Self-Adhesive Vinyl Tape: Secure tight to surface at location with high visibility and accessibility.
  - Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for minimum 1. distance of 6 inch (150 mm) where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.
- Tape and Stencil: Comply with requirements in painting Sections for surface preparation and S. paint application.
- Τ. Underground Line Warning Tape:
  - During backfilling of trenches, install continuous underground-line warning tape directly 1. above cable or raceway at 6 to 8 inch (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in common trench or concrete envelope exceeds 16 inch (400 mm) overall.
  - Install underground-line warning tape for direct-buried cables and cables in raceways. 2.
- U. Metal Tags:
  - 1. Place in location with high visibility and accessibility.
  - Secure using general-purpose cable ties. 2.
- V. Nonmetallic Preprinted Tags:

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- 1. Place in location with high visibility and accessibility.
- 2. Secure using general-purpose cable ties.
- W. Write-on Tags:
  - 1. Place in location with high visibility and accessibility.
  - 2. Secure using general-purpose cable ties.
- X. Baked-Enamel Signs:
  - 1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.
  - 2. Unless otherwise indicated, provide single line of text with 1/2 inch (13 mm) high letters on minimum 1-1/2 inch (38 mm) high sign; where two lines of text are required, use signs minimum 2 inch (50 mm) high.
- Y. Metal-Backed Butyrate Signs:
  - 1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.
  - Unless otherwise indicated, provide single line of text with 1/2 inch (13 mm) high letters on 1-1/2 inch (38 mm) high sign; where two lines of text are required, use labels 2 inch (50 mm) high.
- Z. Laminated Acrylic or Melamine Plastic Signs:
  - 1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.
  - Unless otherwise indicated, provide single line of text with 1/2 inch (13 mm) high letters on 1-1/2 inch (38 mm) high sign; where two lines of text are required, use labels 2 inch (50 mm) high.
- AA. Cable Ties: General purpose, for attaching tags, except as listed below:
  - 1. Outdoors: UV-stabilized nylon.
  - 2. In Spaces Handling Environmental Air: Plenum rated.
- 3.3 IDENTIFICATION SCHEDULE
  - A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
  - B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.
  - C. Concealed Raceways, Duct Banks, Less Than 1000 V, within Buildings: Tape and stencil. Stencil legend "DANGER - CONCEALED VOLTAGE WIRING" with 3 inch (75 mm) high, black letters on 20 inch (500 mm) centers.
    - 1. Locate identification at changes in direction, at penetrations of walls and floors, and at 10 ft (3 m) maximum intervals.
  - D. Accessible Fittings for Raceways and Cables within Buildings: Identify cover of junction and pull box of the following systems with self-adhesive labels containing wiring system legend and system voltage. System legends must be as follows:
    - 1. "POWER."
  - E. Power-Circuit Conductor Identification, 1000 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use self-adhesive wraparound labels or snap-around labels or snap-around color-coding bands to identify phase.
    - 1. Locate identification at changes in direction, at penetrations of walls and floors, at 50 ft (15 m) maximum intervals in straight runs, and at 25 ft (7.6 m) maximum intervals in congested areas.
  - F. Power-Circuit Conductor Identification, More Than 1000 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use nonmetallic preprinted tags colored and marked to indicate phase, and separate tag with circuit designation.
  - G. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive labels with conductor or cable designation, origin, and destination.
  - H. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive labels with conductor designation.

- I. Auxiliary Electrical Systems Conductor Identification: Self-adhesive vinyl tape that is uniform and consistent with system used by manufacturer for factory-installed connections.
  - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
- J. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
- K. Instructional Signs: Self-adhesive labels, including color code for grounded and ungrounded conductors.
- L. Workspace Indication: Apply floor marking tape or tape and stencil to finished surfaces. Show working clearances in direction of access to live parts. Workspace must comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- M. Instructional Signs: Self-adhesive labels, including color code for grounded and ungrounded conductors.
- N. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Selfadhesive labels or Baked-enamel warning signs or Metal-backed, butyrate warning signs.
  - 1. Apply to exterior of door, cover, or other access.
  - 2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
    - a. Power-transfer switches.
    - b. Controls with external control power connections.
- O. Arc Flash Warning Labeling: Self-adhesive labels.
- P. Operating Instruction Signs: Self-adhesive labels.
- Q. Emergency Operating Instruction Signs: Self-adhesive labels with white legend on red background with minimum 3/8 inch (10 mm) high letters for emergency instructions at equipment used for.
- R. Equipment Identification Labels:
  - 1. Indoor Equipment: Self-adhesive label or Baked-enamel signs or Metal-backed butyrate signs or Laminated acrylic or melamine plastic sign.
  - 2. Outdoor Equipment: Laminated acrylic or melamine sign or Stenciled legend 4 inch (100 mm) high.
  - 3. Equipment to Be Labeled:
    - a. Panelboards: Typewritten directory of circuits in location provided by panelboard manufacturer. Panelboard identification must be in form of self-adhesive, engraved, laminated acrylic or melamine label.
    - b. Enclosures and electrical cabinets.
    - c. Access doors and panels for concealed electrical items.
    - d. Transformers: Label that includes tag designation indicated on Drawings for transformer, feeder, and panelboards or equipment supplied by secondary.
    - e. Enclosed circuit breakers.
    - f. Enclosed controllers.
    - g. Variable-speed controllers.
    - h. Remote-controlled switches, dimmer modules, and control devices.

# END OF SECTION 260553

#### SECTION 260573.19 ARC-FLASH HAZARD ANALYSIS

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section Includes:
  - 1. Computer-based, arc-flash study to determine arc-flash hazard distance and incident energy to which personnel could be exposed during work on or near electrical equipment.
- B. Related Requirements:
  - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
  - 2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, windload, acoustical, and other field conditions applicable to Work specified in this Section.
- 1.2 DEFINITIONS
  - A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.
  - B. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.
  - C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.
  - D. p.u.: Per unit. The reference unit, established as a calculating convenience, for expressing all power system electrical parameters on a common reference base.
  - E. SCCR: Short-circuit current rating.
  - F. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.
  - G. Single-Line Diagram: See "One-Line Diagram."
- 1.3 ACTION SUBMITTALS
  - A. Product Data:
    - 1. For power system analysis software to be used for studies.
  - B. Study Submittals:
    - 1. Submit the following after approval of system protective devices submittals. Submittals must be in digital form:
      - a. Arc-flash study input data, including completed computer program input data sheets.
      - b. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.
      - c. Revised one-line diagram, reflecting field investigation results and results of arc-flash study.
- 1.4 INFORMATIONAL SUBMITTALS
- A. Product Certificates: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.
- 1.5 QUALITY ASSURANCE
  - A. Study must be performed using commercially developed and distributed software designed specifically for power system analysis.
  - B. Software algorithms must comply with requirements of standards and guides specified in this Section.
  - C. Manual calculations are unacceptable.

## 1.6 REGULATORY AGENCY APPROVALS

- A. Submittals for arc-flash hazard analysis requiring approval by authorities having jurisdiction must be signed and sealed by qualified electrical professional engineer responsible for their preparation. Submit for action by Architect prior to submitting for approval by authorities having jurisdiction.
- B. Submittals for arc-flash hazard analysis require action by Architect prior to submitting for approval by authorities having jurisdiction.

## PART 2 - PRODUCTS

- 2.1 COMPUTER SOFTWARE
  - A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1. EDSA Micro Corporation.
    - 2. Power Analytics, Corporation.
    - 3. SKM Systems Analysis, Inc
  - B. Comply with IEEE 1584 and NFPA 70E.
  - C. Analytical features of device coordination study computer software program must have capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.
  - D. Computer program must be designed to perform arc-flash analysis or have function, component, or add-on module designed to perform arc-flash analysis.
  - E. Computer program must be developed under supervision of licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.
- 2.2 ARC-FLASH STUDY REPORT CONTENT
  - A. Executive summary of study findings.
  - B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.
  - C. One-line diagram, showing the following:
    - 1. Protective device designations and ampere ratings.
    - 2. Conductor types, sizes, and lengths.
    - 3. Transformer kVA and voltage ratings, including derating factors and environmental conditions.
    - 4. panelboard designations, and ratings.
  - D. Study Input Data: As described in "Power System Data" Article.
  - E. Arc-Flash Study Output Reports:
    - 1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each equipment location included in report:
      - a. Voltage.
      - b. Calculated symmetrical fault-current magnitude and angle.
      - c. Fault-point X/R ratio.
      - d. No AC Decrement (NACD) ratio.
      - e. Equivalent impedance.
      - f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on symmetrical basis.
      - g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on total basis.
    - Incident Energy and Flash Protection Boundary Calculations:
      - 1. Arcing fault magnitude.
      - 2. Protective device clearing time.
      - 3. Duration of arc.

F.

- 4. Arc-flash boundary.
- 5. Restricted approach boundary.
- 6. Limited approach boundary.
- 7. Working distance.

- 8. Incident energy.
- 9. Hazard risk category.
- 10. Recommendations for arc-flash energy reduction.
- G. Fault study input data, case descriptions, and fault-current calculations including definition of terms and guide for interpretation of computer printout.
- 2.3 ARC-FLASH WARNING LABELS
  - A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for selfadhesive equipment labels. Produce 3.5 by 5 inch (76 by 127 mm) self-adhesive equipment label for each work location included in analysis.
  - B. Label must have orange header with wording, "WARNING, ARC-FLASH HAZARD," and must include the following information taken directly from arc-flash hazard analysis:
    - 1. Location designation.
    - 2. Nominal voltage.
    - 3. Protection boundaries.
      - a. Arc-flash boundary.
      - b. Restricted approach boundary.
      - c. Limited approach boundary.
    - 4. Arc flash PPE category.
    - 5. Required minimum arc rating of PPE in Cal/cm squared.
    - 6. Available incident energy.
    - 7. Working distance.
    - 8. Engineering report number, revision number, and issue date.
  - C. Labels must be machine printed, with no field-applied markings.

# PART 3 - EXECUTION

- 3.1 EXAMINATION
  - A. Examine Project overcurrent protective device submittals. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.
- 3.2 ARC-FLASH HAZARD ANALYSIS
  - A. Comply with NFPA 70E and its Annex D for hazard analysis study.
  - B. Calculate maximum and minimum contributions of fault-current size.
    - 1. Maximum calculation must assume maximum contribution from utility and must assume motors to be operating under full-load conditions.
    - 2. Calculate arc-flash energy at 85 percent of maximum short-circuit current in accordance with IEEE 1584 recommendations.
    - 3. Calculate arc-flash energy with utility contribution at minimum and assume no motor contribution.
  - C. Calculate arc-flash protection boundary and incident energy at locations in electrical distribution system where personnel could perform work on energized parts.
  - D. Include medium- and low-voltage equipment locations, except equipment fed from transformers smaller than 75 kVA.
  - E. Calculate limited, restricted, and prohibited approach boundaries for each location.
  - F. Incident energy calculations must consider accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations must take into account changing current contributions, as sources are interrupted or decremented with time. Fault contribution from motors and generators must be decremented as follows:
    - 1. Fault contribution from induction motors must not be considered beyond three to five cycles.
    - 2. Fault contribution from synchronous motors and generators must be decayed to match actual decrement of each as closely as possible (for example, contributions from permanent magnet generators will typically decay from 10 p.u. to 3 p.u. after 10 cycles).

- G. Arc-flash energy must generally be reported for maximum of line or load side of circuit breaker. However, arc-flash computation must be performed and reported for both line and load side of circuit breaker as follows:
  - 1. When circuit breaker is in separate enclosure.
  - When line terminals of circuit breaker are separate from work location. 2
- Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum Η. clearing time at two seconds based on IEEE 1584, Section B.1.2.

#### 3.3 POWER SYSTEM DATA

- Α. Obtain data necessary for conduct of arc-flash hazard analysis.
  - Verify completeness of data supplied on one-line diagram on Drawings and under 1. "Preparatory Studies" Paragraph in "Arc-Flash Hazard Analysis" Article. Call discrepancies to Architect's attention.
  - 2. For new equipment, use characteristics from approved submittals under provisions of action submittals and information submittals for this Project.
  - For existing equipment, whether or not relocated, obtain required electrical distribution 3. system data by field investigation and surveys conducted by gualified technicians and engineers.
- Β. Electrical Survey Data: Gather and tabulate the following input data to support study. Comply with recommendations in IEEE 1584 and NFPA 70E as to amount of detail that is required to be acquired in field. Field data gathering must be under direct supervision and control of engineer in charge of performing study, and must be by, or under supervision of, qualified electrical professional engineer. Data include, but are not limited to, the following:
  - Product Data for overcurrent protective devices specified in other Sections and involved 1. in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
  - 2. Obtain electrical power utility impedance or available short circuit current at service.
  - Power sources and ties. 3.
  - 4. Short-circuit current at each system bus (three phase and line to ground).
  - Full-load current of loads. 5.
  - Voltage level at each bus. 6.
  - For transformers, include kVA, primary and secondary voltages, connection type, 7. impedance, X/R ratio, taps measured in percent, and phase shift.
  - 8. For reactors, provide manufacturer and model designation, voltage rating and impedance.
  - For circuit breakers and fuses, provide manufacturer and model designation. List type of 9. breaker, type of trip and available range of settings, SCCR, current rating, and breaker settinas.
  - 10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
  - 11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
  - 12. Busway manufacturer and model designation, current rating, impedance, lengths, size, and conductor material.
  - Motor horsepower and NEMA MG 1 code letter designation. 13.
  - Low-voltage conductor sizes, lengths, number, conductor material and conduit material 14. (magnetic or nonmagnetic).
  - 15. Medium-voltage conductor sizes, lengths, conductor material, conductor construction and metallic shield performance parameters, and conduit material (magnetic or nonmagnetic).

#### 3.4 LABELING

- Apply one arc-flash label on front cover of each section of equipment for each equipment Α. included in study. Base arc-flash label data on highest values calculated at each location. Β.
  - Each piece of equipment listed below must have arc-flash label applied to it:
    - Panelboards. 1.
    - 2. Low voltage transformers.

- C. Note on record Drawings location of equipment where personnel could be exposed to arc-flash hazard during their work.
  - 1. Indicate arc-flash energy.

3.5

- 2. Indicate protection level required.
- APPLICATION OF WARNING LABELS
- A. Install arc-flash warning labels under direct supervision and control of qualified electrical professional engineer.

## END OF SECTION 260573.19

#### SECTION 262213 LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

# PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section Includes:
  - 1. Distribution, dry-type transformers with nominal primary and secondary rating of 600 V and less, with capacities up to 1500 kVA.
- B. Related Requirements:
  - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
  - 2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, windload, acoustical, and other field conditions applicable to Work specified in this Section.
- 1.2 ACTION SUBMITTALS
  - A. Product Data:
    - 1. For each type of product.
      - a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type and size of transformer.
      - b. Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer.
  - B. Shop Drawings:
    - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of field connections.
    - 2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.
    - 3. Include diagrams for power, signal, and control wiring.
  - C. Field Quality-Control Submittals:
  - 1. Field quality-control reports.
- 1.3 INFORMATIONAL SUBMITTALS
  - A. Manufacturers' Published Instructions: Record copy of official installation instructions issued to Installer by manufacturer for the following:
    - 1. Transformer temporary heating, working clearances, anchoring, torque values, and insulation-resistance testing.
- B. Source quality-control reports.
- 1.4 DELIVERY, STORAGE, AND HANDLING
  - A. Inspection: On receipt, inspect for and note shipping damage to packaging and transformer.
    - 1. If manufacturer packaging is removed for inspection, and transformer will be stored after inspection, re-package transformer using original or new packaging materials that provide protection equivalent to manufacturer's packaging.
  - B. Storage: Store in warm, dry, and temperature-stable location in original shipping packaging.
  - C. Temporary Heating: Apply temporary heat in accordance with manufacturer's published instructions within enclosure of ventilated-type units, throughout periods during which equipment is not energized and when transformer is not in space that is continuously under normal control of temperature and humidity.
  - D. Handling: Follow manufacturer's instructions for lifting and transporting transformers.

# **PART 2 - PRODUCTS**

#### 2.1 MANUFACTURERS

- Α. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - ABB, Electrification Business. 1.
  - 2. Square D; Schneider Electric USA.
- Β. Manufacturer:
  - 1. Schneider Electric
  - 2. General Electric
- Source Limitations: Obtain each type of transformer from single source from single C. manufacturer.
- GENERAL TRANSFORMER REQUIREMENTS 2.2
  - Description: Factory-assembled and -tested, air-cooled units for 60 Hz service. Α.
  - Β. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
  - C. Transformers Rated 15 kVA and Larger:
    - Comply with 10 CFR 431 (DOE 2016) efficiency levels. 1.
    - Marked as compliant with DOE 2016 efficiency levels by gualified electrical testing 2. laboratory recognized by authorities having jurisdiction.
  - Shipping Restraints: Paint or otherwise color-code bolts, wedges, blocks, and other restraints D. that are to be removed after installation and before energizing. Use fluorescent colors that are easily identifiable inside transformer enclosure.
- DISTRIBUTION TRANSFORMERS 2.3
  - Comply with NFPA 70, and list and label as complying with UL 1561. Α.
  - Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses. Β.
    - One leg per phase. 1.
    - 2. Core volume must allow efficient transformer operation at 10 percent above nominal tap voltage.
    - 3. Grounded to enclosure.
  - Coils: Continuous windings except for taps. C.
    - Coil Material: Aluminum. 1.
    - 2. Internal Coil Connections: Brazed or pressure type.
    - 3. Terminal Connections: Welded or Bolted.
  - Enclosure: Ventilated. D.
    - Core and coil must be encapsulated within resin compound to seal out moisture and air. 1.
    - KVA Ratings: Based on convection cooling only and not relying on auxiliary fans. 2.
    - Wiring Compartment: Sized for conduit entry and wiring installation. 3.
    - 4. **Environmental Protection:** 
      - Outdoor: UL 50E, Type 3R. a.
    - Finish Color: Gray weather-resistant enamel. 5.
  - Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below E. normal full capacity.
  - F. Insulation Class, Smaller Than 30 kVA: 180 deg C, UL-component-recognized insulation system with maximum of 115 deg C rise above 40 deg C ambient temperature. G.
    - Grounding: Provide ground-bar kit or ground bar installed on inside of transformer enclosure.
      - Unit must comply with requirements of DOE 2016 efficiency levels when tested in 1. accordance with NEMA TP 2 with K-factor equal to one.

Shielding in "Electrostatic Shielding" Paragraph below reduces conducted, common-mode, highfrequency transient noise to sensitive loads. See the Evaluations for discussion of shielding.

Electrostatic Shielding: Windings must have independent, single, full-width copper electrostatic Η. shield arranged to minimize interwinding capacitance.

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- 1. Arrange coil leads and terminal strips to minimize capacitive coupling between input and output terminals.
- 2. Include special terminal for grounding shield.
- I. Low-Sound-Level Requirements: Maximum sound levels when factory tested in accordance with IEEE C57.12.91, as follows:
  - 1. 9.01 to 30.00 kVA: 45 dB(A-weighted).
- 2.4 IDENTIFICATION
- A. Nameplates:
  - 1. Engraved, laminated-acrylic or melamine plastic signs for distribution transformers, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553 "Identification for Electrical Systems."
- 2.5 SOURCE QUALITY CONTROL
  - A. Testing Administrant: Engage qualified electrical testing agency to evaluate transformer.
  - B. Factory Tests and Inspections: Test and inspect assembled system, by, or under supervision of, qualified electrical testing laboratory recognized by authorities having jurisdiction, in accordance with IEEE C57.12.01 and IEEE C57.12.91 before delivering to site. Affix label with name and date of manufacturer's certification of system compliance on control units.
    - 1. Resistance measurements of windings at rated voltage connections and at tap connections.
    - 2. Ratio tests at rated voltage connections and at tap connections.
    - 3. Phase relation and polarity tests at rated voltage connections.
    - 4. No load losses, and excitation current and rated voltage at rated voltage connections.
    - 5. Impedance and load losses at rated current and rated frequency at rated voltage connections.
    - 6. Applied and induced tensile tests.
    - 7. Regulation and efficiency at rated load and voltage.
      - Insulation-Resistance Tests:
        - a. Line-side to ground.
        - b. Load-side to ground.
        - c. Line-side to load-side.
    - 9. Temperature tests.
    - 10. Factory Sound-Level Tests: Conduct prototype sound-level tests on production-line products.
  - C. Nonconforming Work:
    - 1. System equipment that does not pass tests and inspections will be considered defective.
  - D. Prepare test and inspection reports.

# PART 3 - EXECUTION

8.

- 3.1 EXAMINATION
  - A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for transformers.
  - B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's published instructions.
  - C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.
  - D. Verify that ground connections are in place and requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance must be 5  $\Omega$  at location of transformer.
  - E. Environment: Enclosures must be rated for environment in which they are located. Covers for UL 50E, Type 4X enclosures may not cause accessibility problems.
  - F. Proceed with installation only after unsatisfactory conditions have been corrected.
- 3.2 INSTALLATION
  - A. Install wall-mounted transformers level and plumb with wall brackets fabricated from design drawings signed and sealed by qualified structural professional engineer.

- 1. Coordinate installation of wall-mounted and structure-hanging supports with actual transformer provided.
- B. Install transformers level and plumb on concrete base with vibration-dampening supports. Locate transformers away from corners and not parallel to adjacent wall surface.
- C. Construct concrete bases and anchor floor-mounted transformers in accordance with manufacturer's published instructions and requirements in Section 260529 "Hangers and Supports for Electrical Systems."
  - 1. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
- D. Secure transformer to concrete base in accordance with manufacturer's published instructions.
- E. Secure covers to enclosure and tighten bolts to manufacturer-recommended torques to reduce noise generation.
- F. Remove shipping bolts, blocking, and wedges.

# 3.3 CONNECTIONS

- A. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Tighten electrical connectors and terminals in accordance with manufacturer's published torquetightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- D. Provide flexible connections at conduit and conductor terminations and supports to eliminate sound and vibration transmission to building structure.
- 3.4 FIELD QUALITY CONTROL
  - A. Acceptance Testing Preparation:

# 1. <Insert requirements>.

- B. Field tests and inspections must be witnessed by Architect and authorities having jurisdiction.
- C. Tests and Inspections:
  - 1. Small (Up to 167 kVA Single-Phase or 500 kVA Three-Phase) Dry-Type Transformer Field Tests:
    - a. Visual and Mechanical Inspection.
      - 1) Inspect physical and mechanical condition.
      - 2) Inspect anchorage, alignment, and grounding.
      - 3) Verify that resilient mounts are free and that shipping brackets have been removed.
      - 4) Verify that unit is clean.
      - 5) Perform specific inspections and mechanical tests recommended by manufacturer.
      - 6) Verify that as-left tap connections are as specified.
      - 7) Verify presence of surge arresters and that their ratings are as specified.
    - b. Electrical Tests:
      - 1) Measure resistance at windings, taps, and bolted connections.
      - 2) Perform insulation-resistance tests winding-to-winding and windings-toground. Apply voltage in accordance with manufacturer's published data. In absence of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index: value of index may not be less than 1.0.
      - 3) Perform turns-ratio tests at tap positions. Test results may not deviate by more than one-half percent from either adjacent coils or calculated ratio. If test fails, replace transformer.
      - 4) Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.
- D. Test Labeling: On completion of satisfactory testing of units, attach dated and signed "Satisfactory Test" label to tested components.
- E. Nonconforming Work:

- 1. Transformer will be considered defective if it does not pass tests and inspections.
- 2. Remove and replace units that do not pass tests or inspections and retest as specified above.
- F. Assemble and submit test and inspection reports.
- G. Manufacturer Services:
  - 1. Engage factory-authorized service representative to support field tests and inspections.

3.5 ADJUSTING

- A. Record transformer secondary voltage at unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 5 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.
- B. Output Settings Report: Prepare written report recording output voltages and tap settings.

# 3.6 CLÉANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

3.7 MAINTENANCE

- A. Infrared Scanning: Two months after Substantial Completion, perform infrared scan of transformer connections.
  - 1. Use infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
  - 2. Perform two follow-up infrared scans of transformers, one at four months and another at 11 months after Substantial Completion.
  - 3. Prepare certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial actions taken, and scanning observations after remedial action.

# END OF SECTION 262213

#### SECTION 262416 PANELBOARDS

# PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Lighting and appliance branch-circuit panelboards.
  - 2. Electronic-grade panelboards.
  - 3. Disconnecting and overcurrent protective devices.
- B. Related Requirements:
  - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
  - 2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, windload, acoustical, and other field conditions applicable to Work specified in this Section.
- 1.2 DEFINITIONS
  - A. GFEP: Ground-fault equipment protection.
  - B. MCCB: Molded-case circuit breaker.
  - C. VPR: Voltage protection rating.
- 1.3 ACTION SUBMITTALS

#### A. Product Data:

- 1. Lighting and appliance branch-circuit panelboards.
- 2. Electronic-grade panelboards.
- 3. Disconnecting and overcurrent protective devices.
- 4. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.
- 5. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
  - 1. Include dimensioned plans, elevations, sections, and details.
  - 2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
  - 3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
  - 4. Detail bus configuration, current, and voltage ratings.
  - 5. Short-circuit current rating of panelboards and overcurrent protective devices.
  - 6. Include evidence of listing, by qualified electrical testing laboratory recognized by authorities having jurisdiction, for SPD as installed in panelboard.
  - 7. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
  - 8. Include wiring diagrams for power, signal, and control wiring.
  - 9. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device. Include Internet link for electronic access to downloadable PDF of coordination curves.
- C. Field Quality-Control Submittals:
- 1. Field quality-control reports.
- 1.4 INFORMATIONAL SUBMITTALS
  - A. Panelboard Schedules: For installation in panelboards.
  - B. Manufacturers' Published Instructions: Record copy of official installation instructions issued to Installer by manufacturer for the following:
    - 1. Recommended procedures for installing panelboards.
    - 2. Recommended torque settings for bolted connections on panelboards.

- 3. Recommended temperature range for energizing panelboards.
- C. Sample warranties.
- 1.5 CLOSEOUT SUBMITTALS
- A. Warranty documentation.
- 1.6 MAINTENANCE MATERIAL SUBMITTALS
  - A. Spare Parts: Furnish to Owner spare parts, for repairing panelboards, that are packaged with protective covering for storage on-site and identified with labels describing contents. Include the following:
    - 1. Keys: Two spares for each type of panelboard cabinet lock.
    - 2. Circuit Breakers Including GFCI and GFEP Types: Two spares for each panelboard.
  - B. Special Tools: Furnish to Owner proprietary equipment, and keys to operate, maintain, repair, adjust, or implement future changes to panelboards, that are packaged with protective covering for storage on-site and identified with labels describing contents. Include the following:
    - 1. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- 1.7 DELIVERY, STORAGE, AND HANDLING
  - A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
  - B. Handle and prepare panelboards for installation in accordance with NEMA PB 1.

# 1.8 WARRANTY

- A. Special Installer Extended Warranty: Installer warrants that fabricated and installed panelboards perform in accordance with specified requirements and agrees to repair or replace components or products that fail to perform as specified within extended-warranty period.
  - 1. Extended-Warranty Period: Two years from date of Substantial Completion; full coverage for labor, materials, and equipment.
- B. Special Manufacturer Extended Warranty: Manufacturer warrants that panelboards perform in accordance with specified requirements and agrees to provide repair or replacement of components or products that fail to perform as specified within extended-warranty period.
  - 1. Initial Extended-Warranty Period: Three years from date of Substantial Completion; full coverage for labor, materials, and equipment.
  - 2. Follow-On Extended-Warranty Period: Five years from date of Substantial Completion; full coverage for materials only, free on board origin, freight prepaid.

# PART 2 - PRODUCTS

## 2.1 PANELBOARDS AND LOAD CENTERS COMMON REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70, by qualified electrical testing agency recognized by authorities having jurisdiction, and marked for intended location and application.
- B. Comply with NEMA PB 1.
- C. Comply with NFPA 70.
- D. Enclosures: Surface-mounted, dead-front cabinets.
  - 1. Rated for environmental conditions at installed location.
    - a. Outdoor Locations: UL 50E, Type 3R.
  - 2. Height: 7 ft (2.13 m) maximum.
  - 3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims must cover live parts and may have no exposed hardware.
  - 4. Finishes:
    - a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    - b. Back Boxes: Same finish as panels and trim.
- E. Incoming Mains:
  - 1. Location: Top,Bottom, or Convertible between top and bottom.

- 2. Main Breaker: Main lug interiors up to 400 A must be field convertible to main breaker.
- F. Phase, Neutral, and Ground Buses:
  - 1. Material: Tin-plated aluminum.
    - a. Plating must run entire length of bus.
    - b. Bus must be fully rated for entire length.
  - 2. Interiors must be factory assembled into unit. Replacing switching and protective devices may not disturb adjacent units or require removing main bus connectors.
  - 3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
  - 4. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure.
- G. Conductor Connectors: Suitable for use with conductor material and sizes.
  - 1. Material: Hard-drawn copper, 98 percent conductivity.
  - 2. Terminations must allow use of 75 deg C rated conductors without derating.
  - 3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
  - 4. Main and Neutral Lugs: Compression type, with lug on neutral bar for each pole in panelboard.
  - 5. Ground Lugs and Bus-Configured Terminators: Compression type, with lug on bar for each pole in panelboard.
- H. Future Devices: Panelboards or load centers must have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
  - 1. Percentage of Future Space Capacity:25 percent.
- I. Panelboard Short-Circuit Current Rating:
  - 1. Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed, by qualified electrical testing laboratory recognized by authorities having jurisdiction, for 100 percent interrupting capacity.
    - a. Panelboards and overcurrent protective devices rated 240 V or less must have short-circuit ratings as shown on Drawings, but not less than 10 000 A(rms) symmetrical.
    - b. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V must have short-circuit ratings as shown on Drawings, but not less than 14 000 A(rms) symmetrical.
- J. Surge Suppression: Factory installed as integral part of indicated panelboards, complying with UL 1449 SPD Type 2.
- 2.2 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS
  - A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1. Schneider Electric USA, Inc.
    - 2. General Electric.
  - B. Listing Criteria: NEMA PB 1, lighting and appliance branch-circuit type.
  - C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
  - D. Doors: Door-in-door construction with concealed hinges; secured with flush latch with tumbler lock; keyed alike. Outer door must permit full access to panel interior. Inner door must permit access to breaker operating handles and labeling, but current carrying terminals and bus must remain concealed.

## 2.3 ELECTRONIC-GRADE PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Schneider Electric USA, Inc.
  - 2. General Electric.
- B. Listing Criteria: NEMA PB 1; UL 67; and UL 1449 after installing SPD.
- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
- D. Main Overcurrent Protective Devices: Bolt-on thermal-magnetic circuit breakers.
- E. Branch Overcurrent Protective Devices: Bolt-on thermal-magnetic circuit breakers.

- F. Factory-Installed, Integral SPD:
  - 1. Peak Surge Current Rating: Minimum single-pulse surge current withstand rating per phase may not be less than 100 kA. Peak surge current rating must be arithmetic sum of ratings of individual MOVs in given mode.
  - 2. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V or 208Y/120 V, three-phase, four-wire circuits may not exceed the following:
    - a. Line to Neutral: 1200 V for 480Y/277 V or 700 V for 208Y/120 V.
    - b. Line to Ground: 1200 V for 480Y/277 V or 700 V for 208Y/120 V.
    - c. Neutral to Ground: 1200 V for 480Y/277 V or 700 V for 208Y/120 V.
    - d. Line to Line: 2000 V for 480Y/277 V or 1200 V for 208Y/120 V.
  - 3. SCCR: Equal to SCCR of panelboard in which installed.
  - 4. Nominal Rating: 10 kA.
- 2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES
- 2.5 Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Schneider Electric USA, Inc.
  - 2. General Electric.
  - B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.
    - 1. Thermal-Magnetic Circuit Breakers:
      - a. Inverse time-current element for low-level overloads.
      - b. Instantaneous magnetic trip element for short circuits.
      - c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
    - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with frontmounted, field-adjustable trip setting.
    - 3. Electronic Trip Circuit Breakers:
      - a. RMS sensing.
      - b. Field-replaceable rating plug or electronic trip.
      - c. Digital display of settings, trip targets, and indicated metering displays.
      - d. Multi-button keypad to access programmable functions and monitored data.
      - e. Ten-event, trip-history log. Each trip event must be recorded with type, phase, and magnitude of fault that caused trip.
      - f. Integral test jack for connection to portable test set or laptop computer.
      - g. Field-Adjustable Settings:
        - 1) Instantaneous trip.
        - 2) Long- and short-time pickup levels.
        - 3) Long and short time adjustments.
        - 4) Ground-fault pickup level, time delay, and I squared T response.
    - 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
    - 5. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6 mA trip).
    - 6. GFEP Circuit Breakers: Class B ground-fault protection (30 mA trip).
    - 7. Arc-Fault Circuit Interrupter Circuit Breakers: Comply with UL 1699; 120/240 V, single-pole configuration.
    - 8. Subfeed Circuit Breakers: Vertically mounted.
    - 9. MCCB Features and Accessories:
      - a. Standard frame sizes, trip ratings, and number of poles.
      - b. Breaker handle indicates tripped status.
      - c. UL listed for reverse connection without restrictive line or load ratings.
      - d. Lugs: Compression style, suitable for number, size, trip ratings, and conductor materials.
      - e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.
      - f. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in off position.
      - g. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

- h. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional with field-adjustable 0.1- to 0.6-second time delay.
- i. Rating Plugs: Three-pole breakers with ampere ratings greater than 150 A must have interchangeable rating plugs or electronic adjustable trip units.
- j. Auxiliary Contacts: One, SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
- k. Multipole units enclosed in single housing with single handle or factory assembled to operate as single unit.

# **PART 3 - EXECUTION**

## 3.1 EXAMINATION

- A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.
- B. Receive, inspect, handle, and store panelboards in accordance with NEMA PB 1.1.
- C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.
- D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

# 3.2 INSTALLATION

2.

- A. Comply with manufacturer's published instructions.
- B. Reference Standards:
  - 1. Panelboards: Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NEMA PB 1.1.
- C. Special Techniques:
  - 1. Equipment Mounting:
    - a. Attach panelboard to vertical finished or structural surface behind panelboard.
    - b. Mount surface-mounted panelboards to steel slotted supports 1-1/4 inch (32 mm) in depth. Orient steel slotted supports vertically.
    - Mount top of trim 7.5 ft (2.3 m) above finished floor unless otherwise indicated.
  - 3. Mount panelboard cabinet plumb and rigid without distortion of box.
  - 4. Install overcurrent protective devices and controllers not already factory installed.
    - a. Set field-adjustable, circuit-breaker trip ranges.
    - b. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver in accordance with manufacturer's published instructions.
  - 5. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.
  - 6. Install filler plates in unused spaces.
- D. Interfaces with Other Work:
  - 1. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

## 3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."
- B. Panelboard Nameplates: Label each panelboard with nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

- C. Device Nameplates: Label each branch circuit device in power panelboards with nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- D. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.
- E. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles must be located on interior of panelboard door.
- F. Breaker Labels: Faceplate must list current rating, UL and IEC certification standards, and AIC rating.
- G. Circuit Directory:
  - 1. Provide directory card inside panelboard door, mounted in metal frame with transparent protective cover.
    - a. Circuit directory must identify specific purpose with detail sufficient to distinguish it from other circuits.
  - 2. Provide computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.
    - a. Circuit directory must identify specific purpose with detail sufficient to distinguish it from other circuits.
  - 3. Create directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.
- 3.4 FIELD QUALITY CONTROL
  - A. Acceptance Testing Preparation:
    - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
    - 2. Test continuity of each circuit.
  - B. Field tests and inspections must be witnessed by Architect and Owner.
  - C. Tests and Inspections:
    - 1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers and low-voltage surge arrestors stated in NETA ATS, Paragraph 7.6 Circuit Breakers and Paragraph 7.19.1 Surge Arrestors, Low-Voltage. Perform optional tests. Certify compliance with test parameters.
    - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
    - 3. Perform the following infrared scan tests and inspections and prepare reports:
      - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
      - b. Follow-up Infrared Scanning: Perform additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
      - c. Instruments and Equipment:
        - 1) Use infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
  - D. Nonconforming Work:
    - 1. Panelboards will be considered defective if they do not pass tests and inspections.
    - 2. Remove and replace defective units and retest.
  - E. Collect, assemble, and submit test and inspection reports, including certified report that identifies panelboards included and that describes scanning results, with comparisons of two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

1. Engage factory-authorized service representative to support field tests and inspections.

- 3.5 ADJUSTING
  - A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
  - B. Set field-adjustable circuit-breaker trip ranges as indicated.

## 3.6 PROTECTION

A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature in accordance with manufacturer's published instructions.

# END OF SECTION 262416

#### SECTION 262726 WIRING DEVICES

## PART 1 - GENERAL

# 1.1 SUMMARY

- A. Section Includes:
  - 1. Receptacles with arc-fault and ground-fault protective devices.
  - 2. Special-purpose power outlet assemblies.
  - 3. Connectors, cords, and plugs.
- B. Related Requirements:
  - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
  - 2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, windload, acoustical, and other field conditions applicable to Work specified in this Section.
  - 3. Section 013100 "Project Management and Coordination" for preinstallation conference procedures.
  - 4. Section 260923 "Lighting Control Devices" for occupancy sensors, timers, control-voltage switches, and control-voltage dimmers.
  - 5. Section 260936 "Modular Dimming Controls" for multiscene and multipreset dimming controls.

## 1.2 ACTION SUBMITTALS

A. Product Data:

1.3

- 1. Receptacles with GFCI device.
- 2. Cord connectors.
- B. Field Quality-Control Submittals:
  - 1. Field quality-control reports.
  - INFORMATIONAL SUBMITTALS
- A. Manufacturers' Instructions: Record copy of official installation instructions issued to Installer by manufacturer for the following:
  - 1. Receptacles with GFCI device.
  - 2. Locking receptacles.
- B. Sample warranties.
- 1.4 MAINTENANCE MATERIAL SUBMITTALS
  - A. Extra Stock Items: Furnish extra materials to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
    - 1. SPD Receptacles: Equal to 10 percent of quantity installed for each kind specified, but no fewer than one units.
    - 2. Cord Connectors: One of each kind.
  - B. Special Tools:
    - 1. Proprietary equipment and software required to maintain, repair, adjust, or implement future changes to controlled receptacles.
    - 2. Proprietary equipment required to maintain, repair, adjust, or implement future changes to cord connectors.
- 1.5 WARRANTY FOR DEVICES
  - A. Special Manufacturer Extended Warranty: Manufacturer warrants thatdevices perform in accordance with specified requirements and agrees to provide repair or replacement of devices that fail to perform as specified within extended warranty period.
    - 1. Extended Warranty Period: Three years from date of Substantial Completion; full coverage for labor, materials, and equipment.
    - 2. Follow-On Extended Warranty Period: Eight years from date of Substantial Completion; full coverage for materials only, free on board destination, freight prepaid.

# PART 2 - PRODUCTS

2.1 PRODUCTS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

- 1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
- 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
- 3. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).
- 2.2 RECEPTACLES WITH ARC-FAULT AND GROUND-FAULT PROTECTIVE DEVICES
  A. General-Grade, Weather-Resistant, Tamper-Resistant Duplex Straight-Blade Receptacle with GFCI Device drawings:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
    - b. Leviton Manufacturing Co., Inc.
    - c. Pass & Seymour; Legrand North America, LLC.
  - 2. Regulatory Requirements:
    - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
  - 3. General Characteristics:
    - a. Reference Standards: UL CCN KCXS, UL 498, and UL 943.
  - 4. Options:
    - a. Device Color: White, unless note otherwise on drawings.
    - b. Configuration: Heavy-duty, NEMA 5-20R.
  - 5. Accessories:
    - a. Cover Plate: 0.060 inch (1.5 mm) thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device; from same manufacturer as wiring device.
    - b. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Receptacles:
  - 1. Verify that receptacles to be procured and installed for Owner-furnished equipment are compatible with mating attachment plugs on equipment.
- 3.2 SELECTION OF GFCI RECEPTACLES
- A. Healthcare Facilities: Unless protection of downstream branch-circuit wiring, cord sets, and power-supply cords is required by NFPA 70 or NFPA 99, provide non-feed-through GFCI receptacles.
- 3.3 INSTALLATION OF STRAIGHT-BLADE RECEPTACLES
- A. Comply with manufacturer's instructions.
  - B. Reference Standards:
    - 1. Unless more stringent requirements are specified in Contract Documents or manufacturers' instructions, comply with installation instructions in NECA NEIS 130.
    - 2. Mounting Heights: Unless otherwise indicated in Contract Documents, comply with mounting heights recommended in NECA NEIS 1.
    - 3. Receptacle Orientation: Unless otherwise indicated in Contract Documents, orient receptacle to match configuration diagram in NEMA WD 6.
    - 4. Consult Architect for resolution of conflicting requirements.

- C. Identification:
  - 1. Identify cover or cover plate for device with panelboard identification and circuit number in accordance with Section 260553 "Identification for Electrical Systems."
- D. Interfaces with Other Work:
  - 1. Do not install Type 3 SPD, including surge-protected relocatable taps and power strips, on branch circuit downstream of GFCI device.
- 3.4 FIELD QUALITY CONTROL OF STRAIGHT-BLADE RECEPTACLES
  - A. Acceptance Testing Preparation:
    - B. Field tests and inspections must be witnessed by Architect and Owner.
    - C. Tests and Inspections:
      - 1. Insert and remove test plug to verify that device is securely mounted.
      - 2. Verify polarity of hot and neutral pins.
      - 3. Measure line voltage.
      - 4. Measure percent voltage drop.
      - 5. Measure grounding circuit continuity; impedance must be not greater than 2 ohms.
      - 6. Healthcare Facilities: Test straight-blade receptacles in patient care spaces with receptacle pin tension test instrument in accordance with NFPA 99. Retention force of ground pin must be not less than 115 g (4 oz).
      - 7. Perform additional installation and maintenance inspections and diagnostic tests in accordance with NECA NEIS 130 and manufacturers' instructions.
    - D. Nonconforming Work:
      - 1. Device will be considered defective if it does not pass tests and inspections.
      - 2. Remove and replace defective units and retest.
      - Assemble and submit test and inspection reports.
    - F. Manufacturer Services:
      - 1. Engage factory-authorized service representative to support field tests and inspections.
- 3.5 PROTECTION
- A. Devices:

Ε.

- 1. Schedule and sequence installation to minimize risk of contamination of wires and cables, devices, device boxes, outlet boxes, covers, and cover plates by plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other materials.
- 2. After installation, protect wires and cables, devices, device boxes, outlet boxes, covers, and cover plates from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.
- B. Connectors, Cords, and Plugs:
  - 1. After installation, protect connectors, cords, and plugs from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

# END OF SECTION 262726

#### **SECTION 264313** SURGE PROTECTIVE DEVICES FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

# **PART 1 - GENERAL**

#### SUMMARY 1.1

- Section Includes: Α.
  - Type 2 surge protective devices. 1.
  - 2. Enclosures.
    - 3. Conductors and cables.
- Β. **Related Requirements:** 
  - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, gualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
  - 2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, windload, acoustical, and other field conditions applicable to Work specified in this Section.
  - 3. Section 262416 "Panelboards" for integral SPDs installed by panelboard manufacturer.
  - Section 262726 "Wiring Devices" for integral SPDs installed by receptacle manufacturer. 4

#### DEFINITIONS 1.2

- In: Nominal discharge current. A.
- Maximum Continuous Operating Voltage (MCOV): The maximum designated RMS value of the Β. power frequency voltage that may be continuously applied to the mode of protection of an SPD.
- Metal-Oxide Varistor (MOV): An electronic component with a significant bidirectional, nonlinear C. current-voltage characteristic.
- D. Mode(s), Modes of Protection, or Protection Modes: Electrical paths where the SPD offers defense against transient overvoltages. Examples include: line to neutral (L-N), line to ground (L-G), line to line (L-L), and neutral to ground (N-G).
- Ε. SCCR: Short-circuit current rating.
- F. Type 2 SPDs: Permanently connected SPDs intended for installation on the load side of the service disconnect overcurrent device, including SPDs located at the branch panel.
- G. Type 3 SPDs: Point of utilization SPDs.
- Type 4 SPDs: Component SPDs, including discrete components, as well as assemblies. Η.
- Type 5 SPDs; Discrete component surge suppressors, such as MOVs that may be mounted on Ι. a printed wiring board, connected by its leads or provided within an enclosure with mounting means and wiring terminations.
- Voltage Protection Rating (VPR): A rating selected from UL 1449 list of preferred values J. assigned to each mode of protection. 1.3
  - **ACTION SUBMITTALS**
- Product Data: Α.
  - For each type of product. 1.
    - Include electrical characteristics, specialties, and accessories for SPDs. a.
    - b. Certification of compliance with UL 1449 by gualified electrical testing laboratory recognized by authorities having jurisdiction including the following information:
      - Tested values for VPRs. 1)
      - 2) In ratings.
      - MCOV, type designations. 3)
      - OCPD requirements. 4)
      - 5) Manufacturer's model number.
      - System voltage. 6)
      - 7) Modes of protection.
- Β. Field quality-control reports.
- INFORMATIONAL SUBMITTALS 1.4
  - Sample Warranty: For manufacturer's special warranty. Α.

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- 1.5 WARRANTY
  - A. Special Manufacturer Extended Warranty: Manufacturer warrants that SPDs perform in accordance with specified requirements and agrees to provide repair or replacement of SPDs that fail to perform as specified within extended warranty period.
    - 1. Initial Extended Warranty Period: Five year(s) from date of Substantial Completion, for labor, materials, and equipment.
    - 2. Follow-On Extended Warranty Period: 10 year(s) from date of Substantial Completion, for materials only, f.o.b. the nearest shipping point to Project site.

# PART 2 - PRODUCTS

- 2.1 TYPE 2 SURGE PROTECTIVE DEVICES (SPDs)
  - 1. Schneider Electric USA, Inc.
  - 2. General Electric.
  - B. Source Limitations: Obtain devices from single source from single manufacturer.
  - C. General Characteristics:
    - 1. Reference Standards: UL 1449, Type 2; UL 1283.
    - 2. MCOV: Not less than 125 percent of nominal system voltage for 208Y/120 V and 120/240 V power systems, and not less than 115 percent of nominal system voltage for 480Y/277 V power systems.
    - 3. Peak Surge Current Rating: Minimum single-pulse surge current withstand rating per phase must not be less than 100 kA. Peak surge current rating must be arithmetic sum of the ratings of individual MOVs in a given mode.
    - 4. Protection modes and UL 1449 VPR for grounded wye circuits with 208Y/120 V, threephase, four-wire circuits must not exceed the following:
      - a. Line to Neutral: 700 V for 208Y/120 V.
      - b. Line to Ground: 700 V for 208Y/120 V.
      - c. Neutral to Ground: 700 V for 208Y/120 V.
      - d. Line to Line: 1200 V for 208Y/120 V.
    - 5. SCCR: Equal or exceed 100 kA.
    - 6.  $I_n$  Rating: 10 kA.
  - D. Options:
    - 1. Include LED indicator lights for power and protection status.
    - 2. Include internal thermal protection that disconnects the SPD before damaging internal suppressor components.
    - 3. Include NEMA ICS 5, dry Form C contacts rated at 2 A and 24 V(ac) for remote monitoring of protection status.
    - 4. Include surge counter.
- 2.2 TYPE 3, TYPE 4, AND TYPE 5 SURGE PROTECTIVE DEVICES (SPDs)
- A. Type 3, Type 4, and Type 5 SPDs are not approved for field installation. See "Related Requirements" Paragraph in "Summary" Article for products with manufacturer-installed Type 3, Type 4, and Type 5 SPDs.
- 2.3 ENCLOSURES
  - A. Indoor Enclosures: Type 1.
  - B. Outdoor Enclosures: Type 3R.
- 2.4 CONDUCTORS AND CABLES

Retain this article when SPD listing and specific manufacturer's instruction permit lead adjustment in the field. Control cable specifications are not included in this Section because accessories include only dry contacts for remote status indication.

A. Power Wiring: Same size as SPD leads, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

# PART 3 - EXECUTION

- 3.1 INSTALLATION
  - A. Provide OCPD and disconnect for installation of SPD in accordance with UL 1449 and manufacturer's instructions.
  - B. Install leads between disconnects and SPDs short, straight, twisted, and in accordance with manufacturer's instructions. Comply with wiring methods in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
    - 1. Do not splice and extend SPD leads unless specifically permitted by manufacturer.
    - 2. Do not exceed manufacturer's recommended lead length.
    - 3. Do not bond neutral and ground.
  - C. Use crimped connectors and splices only. Wire nuts are unacceptable.
- 3.2 FIELD QUALITY CONTROL
  - A. Field tests and inspections must be witnessed by Architect and authorities having jurisdiction.
  - B. Tests and Inspections:
    - 1. Compare equipment nameplate data for compliance with Drawings and the Specifications.
    - 2. Inspect anchorage, alignment, grounding, and clearances.
    - 3. Verify that electrical wiring installation complies with manufacturer's installation requirements.
    - C. Nonconforming Work:
      - 1. SPDs that do not pass tests and inspections will be considered defective.
      - 2. Remove and replace defective units and retest.
    - D. Prepare test and inspection reports.
    - E. Manufacturer Services:
      - 1. Engage factory-authorized service representative to support field tests and inspections.
- 3.3 STARTUP SERVICE
  - A. Complete startup checks in accordance with manufacturer's instructions.
  - B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests; reconnect them immediately after the testing is over.
  - C. Energize SPDs after power system has been energized, stabilized, and tested.

## END OF SECTION 264313

#### SECTION 265619 LED EXTERIOR LIGHTING

## PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS
  - A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- 1.2 SUMMARY
  - A. Section Includes:
    - 1. Luminaire-mounted photoelectric relays.
    - 2. Luminaire types.
    - 3. Materials.
    - 4. Finishes.
    - 5. Luminaire support components.
- 1.3 DEFINITIONS
  - A. CCT: Correlated color temperature.
  - B. CRI: Color rendering index.
  - C. Fixture: See "Luminaire."
  - D. IP: International Protection or Ingress Protection Rating.
  - E. Lumen: Measured output of lamp and luminaire, or both.
  - F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.
- 1.4 ACTION SUBMITTALS
  - A. Product Data: For each type of luminaire.
    - 1. Arrange in order of luminaire designation.
    - 2. Include data on features, accessories, and finishes.
    - 3. Include physical description and dimensions of luminaire.
    - 4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.
    - 5. Photometric data and adjustment factors based on laboratory tests, complying with IES Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project.
      - a. Manufacturer's Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products.
    - 6. Wiring diagrams for power, control, and signal wiring.
    - 7. Photoelectric relays.
    - 8. Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.
  - B. Shop Drawings: For nonstandard or custom luminaires.
    - 1. Include plans, elevations, sections, and mounting and attachment details.
    - 2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
    - 3. Include diagrams for power, signal, and control wiring.
  - C. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.
  - D. Delegated-Design Submittal: For luminaire supports.
  - 1. Include design calculations for luminaire supports.
- 1.5 INFORMATIONAL SUBMITTALS
  - A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
    - 1. Luminaires.
    - 2. Structural members to which luminaires will be attached.
    - 3. Underground utilities and structures.

- 4. Existing underground utilities and structures.
- 5. Above-grade utilities and structures.
- 6. Existing above-grade utilities and structures.
- 7. Building features.
- 8. Vertical and horizontal information.
- B. Qualification Data: For testing laboratory providing photometric data for luminaires.
- C. Product Certificates: For each type of the following:
  - 1. Luminaire.
- D. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.
- E. Source quality-control reports.
- F. Sample warranty.
- 1.6 CLOSEOUT SUBMITTALS
  - A. Operation and Maintenance Data: For luminaires to include in operation and maintenance manuals.
    - 1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.
    - 2. Provide a list of all photoelectric relay types used on Project; use manufacturers' codes.
- 1.7 MAINTENANCE MATERIAL SUBMITTALS
  - A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
    - 1. LEDs: Ten for every 100 of each type and rating installed. Furnish at least one of each type.
- 1.8 QUALITY ASSURANCE
  - A. Luminaire Photometric Data Testing Laboratory Qualifications:
    - 1. Luminaire manufacturers' laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
  - B. Provide luminaires from a single manufacturer for each luminaire type.
  - C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.
  - D. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- 1.9 DELIVERY, STORAGE, AND HANDLING
  - A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.
- 1.10 FIELD CONDITIONS
  - A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.
  - B. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.
- 1.11 WARRANTY
  - A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
    - 1. Failures include, but are not limited to, the following:
      - a. Structural failures, including luminaire support components.
      - b. Faulty operation of luminaires and accessories.
      - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
    - 2. Warranty Period: 2 year(s) from date of Substantial Completion.

# PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

## 2.2 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. UL Compliance: Comply with UL 1598 and listed for wet location.

- C. Lamp base complying with ANSI C81.61 or IEC 60061-1.
- D. Bulb shape complying with ANSI C79.1.
- E. CRI of minimum 80. CCT of 5000 K.
- F. L70 lamp life of 50,000 hours.
- G. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- H. Internal driver.
- I. Nominal Operating Voltage: 120 V ac.
- J. Lamp Rating: Lamp marked for outdoor use.
- K. Source Limitations:
  - 1. Obtain luminaires from single source from a single manufacturer.
  - LUMINAIRE TYPES
- A. Area and Site:

2.3

- 1. Manufacturers: Basis of design is Lithonia Lighting; Acuity Brands Lighting, Inc. Subject to compliance with requirements, provide products by one of the following:
- 2. Architectural Area Lighting; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
- 3. Cooper Lighting Solutions; Signify North America Corp.
- 4. Gallium Lighting, LLC.
- 5. H.E. Williams.
- 6. Kim Lighting; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
- 7. Lithonia Lighting; Acuity Brands Lighting, Inc.
- 8. OSRAM SYLVANIA.
- 9. Philips; Signify North America; Signify Holding.
- 10. RAB Lighting.
- 11. Selux Corporation.
- 12. Luminaire Shape: Refer to light fixture schedule.
- 13. Mounting: Premanufactured netting pole.
- 14. Luminaire-Mounting Height: Refer to light fixture schedule.
- 15. Distribution: Refer to light fixture schedule.
- 2.4 MATERIALS
  - A. Metal Parts: Free of burrs and sharp corners and edges.
  - B. Sheet Metal Components: Corrosion-resistant aluminum. Form and support to prevent warping and sagging.
  - C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.
  - D. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
    - Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:
      - 1. White Surfaces: 85 percent.
      - 2. Specular Surfaces: 83 percent.
      - 3. Diffusing Specular Surfaces: 75 percent.
  - F. Housings:

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- 1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
- 2. Provide filter/breather for enclosed luminaires.
- G. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
  - 1. Label shall include the following lamp characteristics:
    - a. "USE ONLY" and include specific lamp type.
    - b. Lamp diameter, shape, size, wattage and coating.
    - c. CCT and CRI for all luminaires.

## 2.5 FINISHES

- 2.6 LUMINAIRE SUPPORT COMPONENTS
  - A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.
- C. Examine poles for suitable conditions where luminaires will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.
- 3.2 TEMPORARY LIGHTING
  - A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is substantially complete, clean luminaires used for temporary lighting and install new lamps.

# 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Comply with NECA 1.
- B. Install lamps in each luminaire.
- C. Fasten luminaire to structural support.
- D. Supports:
  - 1. Sized and rated for luminaire weight.
  - 2. Able to maintain luminaire position after cleaning and relamping.
  - 3. Support luminaires without causing deflection of finished surface.
  - 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.
- E. Wiring Method: Install cables in raceways. Exposed raceways and cables.
- F. Install luminaires level, plumb, and square with finished grade unless otherwise indicated. Install luminaires at height and aiming angle as indicated on Drawings.
- G. Coordinate layout and installation of luminaires with other construction.
- H. Adjust luminaires that require field adjustment or aiming.
- I. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and Section 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.
- 3.4 INSTALLATION OF BOLLARD LUMINAIRES
- A. Align units for optimum directional alignment of light distribution.
- 3.5 INSTALLATION OF INDIVIDUAL GROUND-MOUNTED LUMINAIRES
- A. Aim as indicated on Drawings.
- 3.6 CORROSION PREVENTION
  - A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
  - B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.
- 3.7 IDENTIFICATION
  - A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- 3.8 FIELD QUALITY CONTROL
  - A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.
  - B. Perform the following tests and inspections:
    - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
    - 2. Verify operation of photoelectric controls.
  - C. Illumination Tests:

- Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IES testing guide(s):
  a. IES LM-72.
- Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
- D. Luminaire will be considered defective if it does not pass tests and inspections.
- Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.
- 3.9 DEMONSTRATION
- A. Train Owner's maintenance personnel to adjust, operate, and maintain luminaires.

# 3.10 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
  - 1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
  - 2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
  - 3. Adjust the aim of luminaires in the presence of the Architect.

# END OF SECTION 265619
#### SECTION 270010 SUPPLEMENTAL REQUIREMENTS FOR COMMUNICATIONS

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section Includes:
  - 1. Supplemental requirements generally applicable to the Work specified in Division 27.
- B. Related Requirements:
  - 1. Division 01 "General Requirements" for additional requirements.
  - 2. Section 260010 "Supplemental Requirements for Electrical" for abbreviations and acronyms for electrical terms and units of measure, abbreviations and acronyms for electrical raceway types, abbreviations and acronyms for electrical cable types, and additional coordination drawing submittal requirements.
- 1.2 REFERENCES
  - A. Abbreviations and Acronyms for Communications:
    - 1. LAN: Local area network.
    - 2. PoE: Power over Ethernet.
    - 3. TCP/IP: Transmission control protocol/Internet protocol.
    - 4. WAN: Wide area network.
  - B. Definitions for Communications:
    - 1. Voice over Internet Protocol (VoIP): Digital telephone packet technology that uses the internet for its transmission medium.
- 1.3 COORDINATION
  - A. Interruption of Existing Telephone Service: Do not interrupt telephone service to facilities occupied by Owner or others unless permitted under the following conditions:
    - 1. Notify Architect and Construction Manager no fewer than seven days in advance of proposed interruption of telephone service.
    - 2. Do not proceed with interruption of telephone service without Architect's and Construction Manager's written permission.
  - B. Interruption of Existing Internet Service: Do not interrupt internet service to facilities occupied by Owner or others unless permitted under the following conditions:
    - 1. Notify Architect and Construction Manager no fewer than seven days in advance of proposed interruption of internet service.
    - 2. Do not proceed with interruption of internet service without Architect's and Construction Manager's written permission.
- 1.4 PREINSTALLATION MEETINGS
  - A. Communications Preconstruction Conference: Schedule conference with Architect and Owner not later than 10 days after notice to proceed. Agenda topics include, but are not limited to, the following:
    - 1. Installation schedule for communications systems.
    - 2. Value analysis proposals and requests for substitution of communications equipment.
    - 3. Commissioning activities.
- 1.5 ACTION SUBMITTALS
- A. Coordination Drawings: Submit multidiscipline coordination drawings depicting communications equipment, devices, cabling, conduit, and duct banks in accordance with requirements specified in Section 260010 "Supplemental Requirements for Electrical."
- 1.6 INFORMATIONAL SUBMITTALS
  - A. Installation Schedule for Communications Systems: At preconstruction meeting, and periodically thereafter as dates change, provide schedule for installation of communications Work to Owner and Architect including, but not limited to, milestone dates for the following activities:
    - 1. Submission of specified coordination drawings.
    - 2. Submission of action submittals specified in Division 27.

- 3. Orders placed for major equipment.
- 4. Arrival of major equipment on-site.
- 5. Preinstallation meetings specified in Division 27.
- 6. Telephone and internet service outages.
- 7. Telephone and internet service inspection and activation.
- 8. Mockup reviews.
- 9. Closing of walls and ceilings containing communications Work.
- 10. System startup, testing, and commissioning activities for communications equipment.
- 11. System startup, testing, and commissioning activities for Work specified in other divisions that depends on Work specified in Division 27.
- 12. Requests for special inspections.
- 13. Requests for inspections by authorities having jurisdiction.
- B. Qualification Statements:
  - 1. For communications design professional.
  - 2. For communications cable Installer.
  - 3. For communications testing agency and on-site communications testing supervisor.
  - CLOSEOUT SUBMITTALS
- A. Maintenance Data:

1.7

- 1. Provide preventive maintenance manuals for each system, equipment, and device listed below:
  - a. Fiber Optic Cabling
  - b. Copper Cabling
- 2. Include the following information:
  - a. Manufacturer's operating specifications.
  - b. Schedule of maintenance material items recommended to be stored at Project site.
- 1.8 QUALIFICATIONS
  - A. Communications Design Professional: Design professional possessing active qualifications specified in Section 014000 "Quality Requirements" and the following:
    - 1. Expertise in design of communications infrastructure and distribution equipment.
    - 2. BICSI Registered Communications Distribution Designer (RCDD) certification.
  - B. Communications Cable Installer: Entity possessing active qualifications specified in Section 014000 "Quality Requirements" and the following:
    - 1. Training and manufacturer certification to install, splice, and terminate communications cabling.
    - 2. Installation Supervisor: BICSI Technician (TECH) certification.
    - 3. Copper Installers: 30 percent of employees possess BICSI Copper Installer 2 (INSTC) certification. Remaining employees possess BICSI Installer 1 (INST1) certification.
    - 4. Fiber Installers: 30 percent of employees possess BICSI Optical Fiber Installer 2 (INSTF) certification. Remaining employees possess BICSI Installer 1 (INST1) certification.
  - C. Communications Testing Agency: Entity possessing active credentials from a qualified electrical testing laboratory recognized by authorities having jurisdiction.
    - 1. On-site communications testing supervisor must have BICSI Technician (TECH) certification and documented training, and be experienced with testing communications equipment in accordance with BICSI testing standards.
- 1.9 FIELD CONDITIONS
  - A. Modeling, analysis, product selection, installation, and quality control for Work specified in Division 27 must comply with requirements specified in Section 260011 "Facility Performance Requirements for Electrical."

# PART 2 - PRODUCTS

- 2.1 SUBSTITUTION LIMITATIONS FOR COMMUNICATIONS EQUIPMENT
- A. Substitution requests for communications equipment will be entertained under the following conditions:

- 1. Conform to the general requirements and procedure outlined in Division 01 in the Request for Substitution.
- 2. Substitutions to be approved though B&H Engineers.
- 3. Substitution requests may be submitted for consideration prior to the Communications Preconstruction Conference if accompanied by value analysis data indicating that substitution will comply with Project performance requirements while significantly increasing value for Owner throughout life of facility.
- 4. Where products are noted as "or equal", a product of equivalent design, construction, and performance will be considered. Submit product data catalog cuts, product information, and pertinent test data –required to substantiate that the product is in fact equivalent to that specified. The burden of proof that the substituted product is equivalent to the specified product rests with the Contractor. Whenever material, process or equipment is specified in accordance with an industry specification (ANSI, TIA, etc), UL rating, or other association standard, present an affidavit from the manufacturer certifying that the product complies with the particular standard specification. When requested by the Engineer, submit supporting test data to substantiate compliance.
- 5. Manufacturers' names and model numbers used in conjunction with materials, processes or equipment included in the Contract Documents are used to establish standards of quality, utility and appearance. Materials, processes or equipment that, in the opinion of the Engineer, are equivalent in quality, utility and appearance will be approved as substitutions to that specified when "or equal" follows the manufacturers' names or model number(s).
- 6. When the Engineer accepts a substitution in writing, it is with the understanding that the Contractor guarantees the substituted product, component, article, or material to be equivalent to the one specified and dimensioned to fit within the construction according to contract documents. Do not provide substituted material, processes, or equipment without written authorization from the Engineer. Assumptions on the acceptability of a proposed substitution, prior to acceptance by the Engineer, are at the sole risk of the Contractor.
- 7. Approved substitutions shall not relieve the Contractor of responsibilities for the proper execution of the work, or from provisions of the specifications.
- 8. Pay expenses, without additional charge to the Owner, in connection with substitution materials, processes and equipment, including the effect of substitution on self, subcontractor's or other Contractor's work.
- 9. Contractor is responsible for sequencing and scheduling equipment procurement. After the Communications Preconstruction Conference, insufficient lead time for equipment delivery may not be considered a valid reason for substitution.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Verification of Conditions:
  - 1. Verify existing conditions, stated under other sections, are acceptable for installation in accordance with manufacturer's instructions.
- 3.2 PREPARATION
  - A. Protection of In-Place Conditions:
    - 1. Protect In-Place all existing cabling.
- 3.3 INSTALLATION OF COMMUNICATIONS WORK
  - A. Unless more stringent requirements are specified in the Contract Documents or manufacturers' instructions, comply with NFPA 70, NECA NEIS 1, and BICSI N1 for installation of Work specified in Division 27. Consult Architect for resolution of conflicting requirements.
- 3.4 SYSTEM STARTUP
  - A. Commissioning Activities:
    - 1. Test all permanent links point-to-point to verify signal flow.

- 2. Inspect installation to confirm all terminations are properly made.
- 3. Document open items and create an accurate punchlist that can be assigned to the specific parties responsible.
- 4. Markup installation drawings so that accurate as-built drawings can be created once the system has been completed.
- 5. A print showing each communication outlet per floor will be placed in each IT room on a wall showing the label port number. This print will be laminated. Any added cable during construction will be added to these prints and labeled. A copy of this print is to be sent to UNT ITSS 4 weeks before the network is brought up.
- 3.5 FIELD QUALITY CONTROL
  - A. Administrant for Communications Tests and Inspections:
    - 1. Administer and perform tests and inspections with assistance of factory-authorized service representative.

### 3.6 CLEANING

- A. Waste Management:
  - 1. Contractor is responsible for the removal and disposal of all installation and construction debris created in the process of the job.
  - 2. All work areas will be cleaned at the conclusion of the project and no tools or materials shall be left in a manner as to pose a safety hazard.
  - 3. Projects are not considered finished and will not be paid by UNT until all debris, dust, etc. has been cleaned and removed to the satisfaction of UNT FPD&C.
  - 4. Contractor shall remove all abandoned cable per Article 800 of the National Electrical Code and per TIA and BICSI standards, recycling these materials where possible. Removal of orphaned cable is mandatory. Contractors shall consider this when placing bids.

## 3.7 CLOSEOUT ACTIVITIES

- A. Demonstration:
  - 1. Demonstrate to end users and ITSS staff how to operate all installed systems.
  - 2. Allow Owner to record demonstrations.
- B. Training:
  - 1. Train end users and ITSS staff on all installed systems.
  - 2. Allow Owner to record training sessions.

#### SECTION 270526 GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

### PART 1 - GENERAL

### 1.1 SUMMARY

- A. Section Includes:
  - 1. Selection and installation of communications busbars.
  - 2. Selection and installation of communications bonding conductors.
- B. Related Requirements:
  - 1. Section 270010 "Supplemental Requirements for Communications" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

#### 1.2 DEFINITIONS

- A. BBC: Backbone bonding conductor, for connecting multiple TBBs serving the same floor.
- B. PBB: Primary bonding busbar, located in main distribution frame room, ideally near electrical service entrance.
- C. RBB: Rack bonding busbar, located in equipment cabinets and racks.
- D. SBB: Secondary bonding busbar, located in intermediate distribution frame rooms.
- E. TBB: Telecommunications bonding backbone, for connecting SBBs to PBB.
- F. TBC: Telecommunications bonding conductor, for connecting PBB to intersystem bonding termination device or busbar at electrical service entrance.
- G. TEBC: Telecommunications equipment bonding conductor, for connecting RBBs to SBBs or PBB.
- H. UBC: Unit bonding conductor, for connecting individual communications equipment to RBBs or SBBs.

### 1.3 ACTION SUBMITTALS

A. Shop Drawings:

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- 1. For communications equipment room signal reference grid.
- 2. Include plans, elevations, sections, details, and attachments to other work.
- Field Quality-Control Submittals:
- 1. Field quality-control reports.
- 1.4 INFORMATIONAL SUBMITTALS
  - A. Manufacturers' Published Instructions: Record copy of official installation and testing instructions issued to Installer by manufacturer for the following:
    - 1. Installing wire connector on conductor.
    - 2. Recommended torque values.
- 1.5 CLOSEOUT SUBMITTALS
- A. Record Documentation: Project record documents in accordance with Section 017839 "Project Record Documents" must include locations of PBB and SBBs, and routing of TBC, TBBs, and BBCs.

### PART 2 - PRODUCTS (Not Used)

#### PART 3 - EXECUTION

- 3.1 EXAMINATION
  - A. Examine facility's grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of electrical system.
  - B. Inspect test results of grounding system measured at point of TBC connection.

- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with connection of TBC only after unsatisfactory conditions have been corrected.
- 3.2 SELECTION OF COMMUNICATIONS BUSBARS
  - A. Unless otherwise indicated in this Section or on Drawings, provide products specified in Section 260526 "Grounding and Bonding for Electrical Systems."
  - B. PBB:
    - 1. Dimensions: 1/4 inch thick by 4 inch high.
    - 2. Stand-Off Distance Minimum: 2 inch.
  - C. SBB:
    - 1. Dimensions: 1/4 inch thick by 4 inch high.
    - 2. Stand-Off Distance Minimum: 2 inch.
- 3.3 SELECTION OF COMMUNICATIONS BONDING CONDUCTORS
  - A. Unless otherwise indicated in this Section or on Drawings, provide products specified in Section 260526 "Grounding and Bonding for Electrical Systems."
  - B. Communications Busbar Connections:
    - 1. TBC: Not smaller than 1/0 AWG and no smaller than largest TBB.
    - 2. TBB: Not smaller than 2 kcmil per linear ft of conductor length, but not larger than 750 kcmil, unless otherwise indicated on Drawings.
    - 3. BBC: Not smaller than largest TBB to which it is connected unless otherwise indicated on Drawings.
    - 4. TEBC: Not smaller than 2 AWG unless otherwise indicated on Drawings. Provide bolted connectors.
    - 5. UBC: Not smaller than 6 AWG unless otherwise indicated on Drawings. Provide bolted connectors.
    - 6. Bonding Conductors to Structural Steel: Not smaller than 6 AWG unless otherwise indicated on Drawings. Provide bolted clamp connectors.
  - C. Cable Tray Connections:
    - 1. Cable Tray Equipment Grounding Conductor: 8 AWG.
  - D. Underground Connections: Not smaller than 2 AWG. Provide welded connectors, except bolted connectors may be used in handholes or manholes and as otherwise indicated on Drawings.
- 3.4 INSTALLATION OF BONDING FOR COMMUNICATIONS
  - A. Comply with manufacturer's published instructions.
  - B. Reference Standards:
    - 1. Bonding of Communications: Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with BICSI N3.
    - 2. Consult Architect for resolution of conflicting requirements.
  - C. Special Techniques:
    - 1. Busbars:
      - a. Indicate locations of grounding busbars on Drawings. Install busbars horizontally, on insulated spacers 12 inch above finished floor unless otherwise indicated.
      - b. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.
    - 2. Conductors:
      - a. Stacking of conductors under a single bolt is not permitted when connecting to busbars.
      - b. Assemble wire connector to conductor, complying with manufacturer's published instructions and as follows:
        - 1) Use crimping tool and die specific to connector.
        - 2) Pretwist conductor.
        - 3) Apply antioxidant compound to bolted and compression connections.
      - c. Install in straightest and shortest route between origination and termination point, and no longer than required. Bend radius must not be smaller than 10 times diameter of conductor. No single bend may exceed 90 degrees.
      - d. Install without splices.
      - e. Support conductors at not more than 36 inch intervals.

- f. Outside telecommunications rooms, install conductors in metric designator 21 (trade size 3/4) PVC-80 conduit until conduit enters telecommunications room. Install bonding conductors in EMT-A or EMT-SS when routed through plenum. Do not install bonding conductors in EMT-S unless otherwise indicated on Drawings.
  - 1) If bonding conductor must be installed in EMT-S or other ferrous metallic raceway, bond conductor to raceway using grounding bushing that complies with Section 270528 "Pathways for Communications Systems," and bond both ends of raceway to SBB.
- 3. Provide TBC and terminate ends to PBB and intersystem bonding termination device at electrical service entrance in accordance with Section 250.94, "Bonding for Communication Systems," of NFPA 70.
- 4. Busbar Interconnections: Bond SBBs to PBB with TBBs. If more than one TBB is installed, bond TBBs together BBCs where required by TIA-607.
- 5. Structural Steel: Where structural steel of steel frame building is readily accessible within room or space, bond each SBB and PBB to vertical steel of building frame.
- 6. Communications Enclosures: Bond metallic enclosures of telecommunications equipment with UBCs to nearest SBB or PBB.
- 7. Equipment Racks: Bond metallic components of enclosures to RBB using UBCs. Provide top-mounted or vertically mounted RBB if not provided by enclosure or rack manufacturer. Bond RBB to SBB with TEBC. Power connection must comply with NFPA 70; equipment grounding conductor in power cord of cord- and plug-connected equipment must be considered supplemental to bonding requirements in this Section.
- 8. Shielded Cable: Bond shield of shielded cable to SBB in communications rooms and spaces. Comply with TIA-568.1 and TIA-568.2 when grounding shielded balanced twisted-pair cables.
- 9. Primary Protector: Bond to PBB with insulated bonding conductor.
- 10. Electrical Power Panelboards: Where electrical panelboards for communications equipment are located in same room or space, bond each ground bar of panelboard to SBB.
- 11. Cable Trays: Provide continuous electrical path by installing bonding clips and jumpers. Bond each end to nearest SBB.
- 12. Ladder Racks: Provide continuous electrical path by installing bonding clips and jumpers. Bond each end to nearest SBB.
- 13. Access Floors: Bond metal parts of access floors to SBB.
- 3.5 IDENTIFICATION
  - A. Comply with Section 270553 "Identification for Communications Systems."
  - B. Labels must be preprinted or computer-printed type.
    - 1. Label PBB(s) with "ts-PBB," where "ts" is telecommunications space identifier for location of PBB.
    - 2. Label SBB(s) with "ts-SBB," where "ts" is telecommunications space identifier for location of SBB.
    - 3. Label TBC, TBBs, and BBCs at attachment points with legend: "WARNING! COMMUNICATIONS BONDING CONDUCTOR. DO NOT REMOVE OR DISCONNECT!"

## 3.6 FIELD QUALITY CONTROL

- A. Field tests and inspections must be witnessed and name and title of witnesses must be provided in closeout documents.
- B. Tests and Inspections:
  - 1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with calibrated torque wrench according to manufacturer's published instructions.
  - 2. Test bonding connections of system using AC earth ground-resistance tester, taking twopoint bonding measurements in each telecommunications equipment room containing PBB or SBB, using process recommended by BICSI N1. Conduct tests with facility in operation.
    - a. Measure resistance between PBB and electrical service intersystem termination point. Maximum acceptable value is 100 mΩ.

- If measured resistance from electrical service equipment to ground exceeds 5 Ω, notify Architect and include recommendations to reduce resistance to ground.
- b. Measure resistance between SBBs and PBB. Maximum acceptable value is 100 m $\Omega$ .
- 3. Test for ground loop currents using digital clamp-on ammeter, with full scale not more than 10 A, displaying current in increments of 0.01 A at accuracy of plus or minus 2.0 percent.
  - a. With grounding infrastructure completed and communications system electronics operating, measure current in bonding conductors connected to PBB and to SBBs. Maximum acceptable AC current level is 1 A.
- C. Nonconforming Work:
  - 1. Communications bonding will be considered defective if it does not pass tests and inspections.
  - 2. Remove and replace defective units and retest.
- D. Collect, assemble, and submit test and inspection reports.

#### SECTION 270528 PATHWAYS FOR COMMUNICATIONS SYSTEMS

## PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Metal conduits and fittings.
  - 2. Nonmetallic conduits and fittings.
  - 3. Optical-fiber-cable pathways and fittings.
  - 4. Metal wireways and auxiliary gutters.
  - 5. Nonmetallic wireways and auxiliary gutters.
  - 6. Metallic surface pathways.
  - 7. Nonmetallic surface pathways.
  - 8. Hooks.
  - 9. Boxes, enclosures, and cabinets.
  - 10. Polymer-concrete handholes and boxes for exterior underground cabling.
- 1.2 ACTION SUBMITTALS
  - A. Product data for each type of product.
- 1.3 INFORMATIONAL SUBMITTALS
  - A. Coordination Drawings: Pathway routing plans, drawn to scale and coordinated with each other, using input from installers of items involved.

### PART 2 - PRODUCTS

- 2.1 METAL CONDUITS AND FITTINGS
  - A. Description: Metal raceway of circular cross section with manufacturer-fabricated fittings.
  - B. Manufacturers:
    - 1. Alflex Corp
    - 2. Allied Tube and Conduit Co
    - 3. Anaconda
    - 4. Appleton Electric Co
    - 5. Occidental Coating Co. (OCAL)
    - 6. OZ/Gedney
    - 7. Spring City Electrical Manufacturing Co
    - 8. Thomas & Betts Corp
    - 9. Triangle PWC, Inc
    - 10. Western Tube and Conduit Corp
    - 11. Or equal
  - C. General Requirements for Metal Conduits and Fittings:
    - 1. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.
    - 2. Comply with TIA-569-D.
  - D. GRC: Comply with ANSI C80.1 and UL 6.
  - E. IMC: Comply with ANSI C80.6 and UL 1242.
  - F. PVC-Coated Steel Conduit: PVC-coated GRC or IMC.
    - 1. Comply with NEMA RN 1.
    - 2. Coating Thickness: 0.040 inch, minimum.
  - G. EMT: Comply with ANSI C80.3 and UL 797.
  - H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
    - 1. Fittings for EMT:
      - a. Material: Steel or die cast.

- b Type: Compression.
- 2. Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.
- 3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.
- Joint Compound for IMC or GRC: Approved, as defined in NFPA 70, by authorities having L. jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.
- 2.2 NONMETALLIC CONDUITS AND FITTINGS
  - Description: Nonmetallic raceway of circular section with manufacturer-fabricated fittings. Α.
    - Β. Manufacturers:
      - Thomas & Betts 1.
      - 2. Dura-line
      - Robroy 3.
      - Prime Conduit 4.
      - 5. Cal-Bond
      - 6. Endot Industries
      - 7. Cantex
      - 8. Ipex USA
      - 9. Premier Conduit
      - 10. **Blue Diamond Industries**
      - 11. Commscope
      - 12. Or Equal
    - C. General Requirements for Nonmetallic Conduits and Fittings:
      - Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location 1. and application.
      - Comply with TIA-569-D. 2.
    - D. RNC: Type EPC-80-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
    - E. Rigid HDPE: Comply with UL 651A.
    - Continuous HDPE: Comply with UL 651A. F.
    - G. RTRC: Comply with UL 2515A and NEMA TC 14.
      - Fittings: Comply with NEMA TC 3; match to conduit or tubing type and material. 1.
    - Solvents and Adhesives: As recommended by conduit manufacturer. Η.
      - <Double click to insert sustainable design text for solvents and adhesives.> 1
- 2.3 OPTICAL-FIBER-CABLE PATHWAYS AND FITTINGS
  - Description: Comply with UL 2024: flexible-type pathway with a circular cross section, approved Α. for plenum, riser, general-use, or metallic as required unless otherwise indicated. Β.
    - Manufactuers.
      - 1. Anixter
      - 2. Or Equal
  - C. General Requirements for Optical-Fiber-Cable Pathways and Fittings
    - Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location 1. and application.
    - 2. Comply with TIA-569-D.
- 2.4 METAL WIREWAYS AND AUXILIARY GUTTERS
  - Description: Sheet metal trough of rectangular cross section fabricated to required size and Α. shape, without holes or knockouts, and with hinged or removable covers.
  - Β. Manufacturers:
    - 1. The Austin Company
    - Hammond Manufacturing 2.
    - nVent Electric 3.
    - 4. Pentair, Inc.
    - 5. Schneider Electric
    - 6. Wiegmann
    - Legrand AV 7.
    - 8. Eaton

- 9. Or Equal
- C. General Requirements for Metal Wireways and Auxiliary Gutters:
  - 1. Comply with UL 870 and NEMÁ 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.
  - 2. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
  - 3. Comply with TIA-569-D.
- D. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- 2.5 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS
  - A. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.
  - B. <u>Manufacturers:</u>
    - 1. Hoffman
    - 2. Carlon
    - 3. Legrand
    - 4. Or Equal
  - C. General Requirements for Nonmetallic Wireways and Auxiliary Gutters:
    - 1. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
    - 2. Comply with TIA-569-D.
  - D. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.
  - E. Solvents and Adhesives: As recommended by conduit manufacturer.
  - 1. <a><br/>
    </a>
    Solution of the second state of
- 2.6 SURFACE METAL PATHWAYS
  - A. Description: Galvanized steel with snap-on covers, complying with UL 5.
  - B. <u>Manufacturers:</u>
    - 1. Johnson Brothers
    - 2. High-Tec Fasteners
    - 3. Or Equal
  - C. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
  - D. Comply with TIA-569-D.
- 2.7 SURFACE NONMETALLIC PATHWAYS:
  - A. Description: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC.
    - B. <u>Manufacturers:</u>
      - 1. Techspan
      - 2. Colonial Teltech
      - 3. Crescent Plastics
      - 4. Or Equal
    - C. Finish: Texture and color selected by Architect from manufacturer's standard colors.
  - D. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
  - E. Comply with TIA-569-D.
- 2.8 HOOKS
  - A. Description: Prefabricated sheet metal cable supports for telecommunications cable.
  - B. <u>Manufacturers:</u>
    - 1. Panduit: JP131W-L20
    - 2. Or Equal
  - C. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
  - D. Comply with TIA-569-D.

- E. Galvanized steel.
- F. J or U shape.
- 2.9 BOXES, ENCLOSURES, AND CABINETS
  - A. Description: Enclosures for communications.
  - B. <u>Manufacturers:</u>
    - 1. Legrand
    - 2. Wiegmann
    - 3. Hoffman
    - 4. nVent
    - 5. Carlon
    - 6. Or Equal
  - C. General Requirements for Boxes, Enclosures, and Cabinets:
    - 1. Comply with TIA-569-D.
    - 2. Boxes, enclosures, and cabinets installed in wet locations shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for use in wet locations.
    - 3. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
    - 4. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.
    - 5. Gangable boxes are prohibited.
  - D. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
  - E. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy or aluminum, Type FD, with gasketed cover.
  - F. Metal Floor Boxes:
    - 1. Material: Cast metal.
    - 2. Type: Fully adjustable.
    - 3. Shape: Rectangular.
    - 4. Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - G. Nonmetallic Floor Boxes: Nonadjustable, round or rectangular.
    - 1. Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
  - I. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum or galvanized, cast iron, as appropriate, with gasketed cover.
  - J. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
  - K. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1, with continuous-hinge cover with flush latch unless otherwise indicated.
    - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
    - 2. Nonmetallic Enclosures:
      - a. Material: Plastic.
    - 3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
  - L. Cabinets:
    - 1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
    - 2. Hinged door in front cover with flush latch and concealed hinge.
    - 3. Key latch to match panelboards.
    - 4. Metal barriers to separate wiring of different systems and voltage.
    - 5. Accessory feet where required for freestanding equipment.
    - 6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- 2.10 POLYMER-CONCRETE HANDHOLES
  - A. Description: Molded of sand and aggregate; bound together with polymer resin; and reinforced with steel, fiberglass, or a combination of the two.
  - B. General Requirements for Polymer Concrete Handholes:
    - 1. Boxes and handholes for use in underground systems shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

- 2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- 3. Comply with TIA-569-D and SCTE 77.
- C. Configuration: Designed for flush burial with integral closed bottom unless otherwise indicated.
- D. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
  - 1. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
  - 2. Cover Legend: Molded lettering, "COMMUNICATIONS".

# PART 3 - EXECUTION

- 3.1 PATHWAY APPLICATION
  - A. Minimum Pathway Size: 3/4-inch trade size for copper and aluminum cables, and 1 inch for optical-fiber cables.
  - B. Reccommended Pathway Size: 1-1/4-inch trade size for copper and aluminum cables, and 1 inch for optical-fiber cables.
  - C. Pathway Fittings: Compatible with pathways and suitable for use and location.
  - D. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
  - E. Install surface pathways only where indicated on Drawings.
  - F. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.
- 3.2 INSTALLATION
  - A. Comply with the following standards for installation requirements except where requirements on Drawings or in this Section are stricter:
    - 1. ŇECA 1.
    - 2. NECA/BICSI 568.
    - 3. TIA-569-D.
    - 4. NECA 101
    - 5. NECA 102.
    - 6. NECA 105.
    - 7. NECA 111.
  - B. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.
  - C. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
  - D. Comply with requirements in Section 270529 "Hangers and Supports for Communications Systems" for hangers and supports.
  - E. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling" for sleeves and sleeve seals for communications.
  - F. Keep pathways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.
  - G. Complete pathway installation before starting conductor installation.
  - H. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches of changes in direction. Utilize long radius ells for all optical-fiber cables.
  - I. Conceal rigid conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
  - J. Support conduit within 12 inches of enclosures to which attached.
  - K. Pathways Embedded in Slabs:
    - 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot intervals.
    - 2. Arrange pathways to cross building expansion joints at right angles with expansion fittings. Comply with requirements for expansion joints specified in this article.
    - 3. Arrange pathways to keep a minimum of 1 inch of concrete cover in all directions.

- 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
- L. Stub-ups to Above Recessed Ceilings:
  - 1. Use EMT, IMC, or RMC for pathways.
  - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- M. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.
- N. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.
- O. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure, to assure a continuous ground path.
- P. Cut conduit perpendicular to the length. For conduits of 2-inch trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.
- Q. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Secure pull wire, so it cannot fall into conduit. Cap pathways designated as spare alongside pathways in use.
- R. Surface Pathways:
  - 1. Install surface pathway for surface telecommunications outlet boxes only where indicated on Drawings.
  - 2. Install surface pathway with a minimum 2-inch radius control at bend points.
  - 3. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight pathway section. Support surface pathway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- S. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:
  - 1. 3/4-Inch Trade Size and Smaller: Install pathways in maximum lengths of 50 feet.
  - 2. 1-Inch Trade Size and Larger: Install pathways in maximum lengths of 75 feet.
  - 3. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- T. Install pathway-sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway-sealing fittings according to NFPA 70.
- U. Install devices to seal pathway interiors at accessible locations. Locate seals, so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:
  - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
  - 2. Where an underground service pathway enters a building or structure.
  - 3. Where otherwise required by NFPA 70.
- V. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.
- W. Expansion-Joint Fittings:
  - 1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT that is located where environmental temperature change may exceed 100 deg F, and that has straight-run length that exceeds 100 feet.
  - 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
    - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.

- b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
- c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
- d. Attics: 135 deg F temperature change.
- 3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
- 4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
- 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- X. Hooks:
  - 1. Size to allow a minimum of 25 percent future capacity without exceeding design capacity limits.
  - 2. Shall be supported by dedicated support wires. Do not use ceiling grid support wire or support rods.
  - 3. Hook spacing shall allow no more than 6 inches of slack. The lowest point of the cables shall be no less than 6 inches adjacent to ceilings, mechanical ductwork and fittings, luminaires, power conduits, power and telecommunications outlets, and other electrical and communications equipment.
  - 4. Space hooks no more than 5 feet o.c.
  - 5. Provide a hook at each change in direction.
- Y. Mount boxes at heights indicated on Drawings. Install boxes with height measured to center of box unless otherwise indicated.
- Z. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- AA. Horizontally separate boxes mounted on opposite sides of walls, so they are not in the same vertical channel.
- BB. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- CC. Set metal floor boxes level and flush with finished floor surface.
- DD. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

### 3.3 INSTALLATION OF UNDERGROUND CONDUIT

### A. Direct-Buried Conduit:

- 1. Excavate trench bottom to provide firm and uniform support for conduit. Install backfill.
- 2. After installing conduit, backfill and compact.
- 3. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
  - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete around conduit for a minimum of 12 inches on each side of the coupling.
  - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
- 4. Underground Warning Tape: Comply with requirements in Section 270553 "Identification for Communications Systems."

### 3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.
- D. Field cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.
- 3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR COMMUNICATIONS PENETRATIONS
  - A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

## 3.6 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

## 3.7 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage or deterioration.
  - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

#### SECTION 270529 HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

## PART 1 - GENERAL

### 1.1 SUMMARY

- A. Section Includes:
  - 1. Steel slotted support systems for communication raceways.
  - 2. Conduit and cable support devices.
  - 3. Support for conductors in vertical conduit.
  - 4. Structural steel for fabricated supports and restraints.
  - 5. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
  - 6. Fabricated metal equipment support assemblies.
- 1.2 ACTION SUBMITTALS
  - A. Product Data: For each type of product.
  - B. Shop Drawings: Signed and sealed by a qualified professional engineer. For fabrication and installation details for communications hangers and support systems.
    - 1. Trapeze hangers. Include product data for components.
    - 2. Steel slotted-channel systems.
    - 3. Aluminum slotted-channel systems.
    - 4. Nonmetallic slotted-channel systems.
    - 5. Equipment supports.
    - 6. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
    - Delegated-Design Submittal: For hangers and supports for communications systems.
    - 1. Include design calculations and details of trapeze hangers.
- 1.3 INFORMATIONAL SUBMITTALS
  - A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, shown and coordinated with each other, using input from installers of the items involved.

### PART 2 - PRODUCTS

C.

- 2.1 PERFORMANCE REQUIREMENTS
  - A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design hanger and support system.
  - B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
    - 1. Flame Rating: Class 1.
    - 2. Self-extinguishing according to ASTM D635.
- 2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS
  - A. Steel Slotted Support Systems: Preformed steel channels and angles, with minimum 13/32inch-diameter holes at a maximum of 8 inches o.c. in at least one surface.
    - 1. Manufacturers:
      - a. ABB, Electrification Business
      - b. Gripple Inc.
      - c. Robroy Industries
      - d. Or Equal
    - 2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
    - 3. Material for Channel, Fittings, and Accessories: Galvanized steel or Plain steel.

- 4. Channel Width: 1-5/8 inches.
- 5. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
- 6. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
- 7. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
- 8. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- 9. Channel Dimensions: Selected for applicable load criteria.
- B. Conduit and Cable Support Devices: Steel and malleable-iron clamps, hangers, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored communications conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A36/A36M steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
  - 1. Powder-Actuated Fasteners: Threaded-steel stud for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
    - Manufacturers:

a.

- 1) Hilti
- 2) Or Equal
- 2. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
  - a. Manufacturers:
    - 1) Fast-Rite
    - 2) Engineered Source
    - 3) Benchmark Fasteners
    - 4) R.P. Crawford Co.
    - 5) Or Equal
- 3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
- 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
- 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F3125/F3125M, Grade A325.
- 6. Toggle Bolts: Stainless-steel springhead type.
- 7. Hanger Rods: Threaded steel.

### PART 3 - EXECUTION

- 3.1 APPLICATION
  - A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:
    - 1. NECA 1.
    - 2. NECA/BICSI 568.
    - 3. TIA-569-C.
    - 4. NECA 101.
    - 5. NECA 102.

- 6. NECA 105.
- 7. NECA 111.
- B. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- C. Comply with requirements for pathways specified in Section 270528 "Pathways for Communications Systems."
- D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as scheduled in NECA 1, where its Table 1 lists maximum spacings that are less than those stated in NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  - 1. Secure raceways and cables to these supports with two-bolt conduit clamps.
- F. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

### 3.2 SUPPORT INSTALLATION

- A. Raceway Support Methods: In addition to methods described in NECA 1, EMT IMC and RMC may be supported by openings through structure members, according to NFPA 70.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten communications items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  - 1. To Wood: Fasten with lag screws or through bolts.
  - 2. To New Concrete: Bolt to concrete inserts.
  - 3. To Masonry: Use approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  - 4. To Existing Concrete: Use expansion anchor fasteners.
  - 5. Instead of expansion anchors, powder-actuated-driven threaded studs, provided with lock washers and nuts, may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
  - 6. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
  - 7. To Light Steel: Sheet metal screws.
  - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that comply with seismic-restraint strength and anchorage requirements.
- D. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A780.

#### SECTION 270536 CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

## PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Ladder cable tray.
  - 2. Wire-mesh cable tray.
  - 3. Cable tray accessories.
  - 4. Warning signs.
- B. Related Requirements:
  - 1. Section 260536 "Cable Trays for Electrical Systems" for cable trays and accessories serving electrical systems.
- **1.2 ACTION SUBMITTALS** 
  - A. Product Data: For each type of product.
  - B. Shop Drawings: For each type of cable tray.
- 1.3 INFORMATIONAL SUBMITTALS
  - A. Field quality-control reports.

### PART 2 - PRODUCTS

- 2.1 MANUFACTURERS
  - A. Legrand
  - B. Eaton
  - C. Chatsworth
  - D. Panduit
  - E. CommScope
  - F. Thomas & Betts
  - G. Or Equal
- 2.2 GENERAL REQUIREMENTS FOR CABLE TRAYS
  - A. Cable Trays and Accessories: Identified as defined in NFPA 70 and marked for intended location, application, and grounding.
  - B. Sizes and Configurations: See the Cable Tray Schedule on Drawings for specific requirements for types, materials, sizes, and configurations.
  - C. Structural Performance: See articles on individual cable tray types for specific values for uniform load distribution, concentrated load, and load and safety factor parameters.
- 2.3 LADDER CABLE TRAY
  - A. Description:
    - 1. Configuration: Two longitudinal side rails with transverse rungs swaged or welded to side rails, complying with NEMA VE 1.
    - 2. Width: 24 inches unless otherwise indicated on Drawings.
    - 3. Minimum Usable Load Depth: 3 inches.
    - 4. Straight Section Lengths: 10 feet, except where shorter lengths are required to facilitate tray assembly.
    - 5. Rung Spacing: 9 inches o.c.
    - 6. Radius-Fitting Rung Spacing: 9 inches at center of tray's width.
    - 7. Minimum Cable-Bearing Surface for Rungs: 7/8-inch width with radius edges.
    - 8. No portion of the rungs shall protrude below the bottom plane of side rails.
    - 9. Structural Performance of Each Rung: Capable of supporting a maximum cable load, with a safety factor of 1.5, plus a 200-lb concentrated load, when tested according to NEMA VE 1.

- 10. Fitting Minimum Radius: 24 inches.
- 11. Class Designation: Comply with NEMA VE 1, Class 5A.
- 12. Splicing Assemblies: Bolted type using serrated flange locknuts.
- 13. Splice-Plate Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.
- B. Materials and Finishes:
  - 1. Steel:
    - a. Straight Section and Fitting Side Rails and Rungs: Steel complies with the minimum mechanical properties of ASTM A1011/A1011M, SS, Grade 33.
    - b. Steel Tray Splice Plates: ASTM A1011/A1011M, HSLAS, Grade 50, Class 1.
    - c. Fasteners: Steel complies with the minimum mechanical properties of ASTM A510/A510M, Grade 1008.
    - d. Finish: Epoxy-resin or Powder-coat enamel paint.
      - 1) Powder-Coat Enamel: Cable tray manufacturer's recommended primer and corrosion-inhibiting treatment, with factory-applied powder-coat paint.
      - 2) Epoxy-Resin Prime Coat: Cold-curing epoxy primer, MPI# 101.
      - 3) Epoxy-Resin Topcoat: Epoxy, cold-cured gloss, MPI# 77.
      - 4) Hardware: Chromium-zinc plated, ASTM F1136.
- 2.4 WIRE-MESH CABLE TRAY
  - A. <u>Manufacturer:</u>

1.

- Panduit: WG18BL10
- B. Description:
  - 1. Configuration: Galvanized- steel wire mesh, complying with NEMA VE 1.
  - 2. Width: 18 inches unless otherwise indicated on Drawings.
  - 3. Minimum Usable Load Depth: 2 inches.
  - 4. Straight Section Lengths: 10 feet, except where shorter lengths are required to facilitate tray assembly.
  - 5. Structural Performance: Capable of supporting a maximum cable load, with a safety factor of 1.5, plus a 200-lb concentrated load, when tested according to NEMA VE 1.
  - 6. Class Designation: Comply with NEMA VE 1, Class 5A.
  - 7. Splicing Assemblies: Bolted type using serrated flange locknuts.
  - 8. Splice-Plate Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.
- C. Materials and Finishes:
  - 1. Steel:
    - a. Straight Sections and Fittings: Steel complies with the minimum mechanical properties of ASTM A1011/A1011M, SS, Grade 33.
    - b. Steel Tray Splice Plates: ASTM A1011/A1011M, HSLAS, Grade 50, Class 1.
    - c. Fasteners: Steel complies with the minimum mechanical properties of ASTM A510/A510M, Grade 1008.
    - d. Finish: Epoxy-resin or Powder-coat enamel paint.
      - 1) Powder-Coat Enamel: Cable tray manufacturer's recommended primer and corrosion-inhibiting treatment, with factory-applied powder-coat paint.
      - 2) Epoxy-Resin Prime Coat: Cold-curing epoxy primer, MPI# 101.
      - 3) Epoxy-Resin Topcoat: Epoxy, cold-cured gloss, MPI# 77.
      - 4) Hardware: Chromium-zinc plated, ASTM F1136.

### 2.5 CABLE TRAY ACCESSORIES

- A. Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, of same materials and finishes as cable tray.
- B. Barrier Strips: Same materials and finishes as for cable tray.
- C. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

### 2.6 WARNING SIGNS

A. Comply with requirements for identification in Section 270553 "Identification for Communications Systems."

B. Lettering: 1-1/2-inch- high, black letters on yellow background with legend "Warning! Not To Be Used as Walkway, Ladder, or Support for Ladders or Personnel."

## 2.7 SOURCE QUALITY CONTROL

A. Testing: Test and inspect cable trays according to NEMA VE 1.

## PART 3 - EXECUTION

#### 3.1 CABLE TRAY INSTALLATION

- A. Install cable trays according to NEMA VE 2.
- B. Install cable trays as a complete system, including fasteners, hold-down clips, support systems, barrier strips, adjustable horizontal and vertical splice plates, elbows, reducers, tees, crosses, cable dropouts, adapters, covers, and bonding.
- C. Install cable trays with 12 inches of clearance above, below, and to each side of the tray.
- D. Fasten cable tray supports to building structure.
- E. Design fasteners and supports to carry cable tray, the cables, and a concentrated load of 200 lb. Comply with requirements in Section 270529 "Hangers and Supports for Communications Systems."
- F. Support wire-basket cable trays with center support hangers, trapeze hangers, or wall brackets.
- G. Seal penetrations through fire and smoke barriers. Comply with requirements in Section 078413 "Penetration Firestopping."
- H. Install capped metal sleeves for future cables through firestop-sealed cable tray penetrations of fire and smoke barriers.
- I. Install warning signs in visible locations on or near cable trays after cable tray installation.

### 3.2 CABLE TRAY GROUNDING

- A. Ground cable trays according to NFPA 70 unless additional grounding is specified. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems."
- B. Cable trays with shall be bonded together with splice plates listed for grounding purposes or with listed bonding jumpers.
- C. Bond cable trays to power source for cables contained within with bonding conductors sized according to NFPA 70, Article 250.122, "Size of Equipment Grounding Conductors."

### 3.3 CABLE INSTALLATION

- A. Install cables only when each cable tray run has been completed and inspected.
- B. Fasten cables on vertical runs to cable trays every 18 inches.
- C. Fasten and support cables that pass from one cable tray to another or drop from cable trays to equipment enclosures. Fasten cables to the cable tray at the point of exit and support cables independent of the enclosure. The cable length between cable trays or between cable tray and enclosure shall be no more than 72 inches.

### D. In existing construction, remove inactive or dead cables from cable trays.

### 3.4 CONNECTIONS

A. Connect raceways to cable trays according to requirements in NEMA VE 2 and NEMA FG 1. 3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. After installing cable trays and after electrical circuitry has been energized, survey for compliance with requirements.
  - 2. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable trays, vibrations, and thermal expansion and contraction conditions, which may cause or have caused damage.
  - 3. Verify that the number, size, and voltage of cables in cable trays do not exceed that permitted by NFPA 70. Verify that communications or data-processing circuits are separated from power circuits by barriers or are installed in separate cable trays.
  - 4. Verify that there are no intruding items such as pipes, hangers, or other equipment in the cable tray.

- 5. Remove dust deposits, industrial process materials, trash of any description, and any blockage of tray ventilation.
- 6. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and retorque in suspect areas.
- 7. Check for missing, incorrect, or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.
- 8. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable trays. Test entire cable tray system for continuity. Maximum allowable resistance is 1 ohm.
- B. Prepare test and inspection reports.

### 3.6 PROTECTION

A. Protect installed cable trays and cables.

### SECTION 270543

### UNDERGROUND DUCTS AND RACEWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 -

PART 2 - GENERAL

2.1

- 2.2 SUMMARY
  - A. Products Installed, but Not Furnished, under This Section:
    - 1. See Section 260533 "Raceway and Boxes for Electrical Systems" for the following:
      - a. Type ENT raceways and fittings.
      - b. Type EPEC raceways and fittings.
      - c. Type ERMC-S raceways, elbows, couplings, and nipples.
      - d. Type IMC raceways.
      - e. Type PVC raceways and fittings.
      - f. Type RTRC-AG raceways and fittings.
      - g. Type RTRC-BG raceways and fittings.
      - h. Fittings for conduit, tubing, and cable.
      - i. Threaded metal joint compound.
      - j. Solvent cements.
    - 2. See Section 260543 "Underground Ducts and Raceways for Electrical Systems" for the following:
      - a. Handholes and boxes for exterior underground wiring.
      - b. Manholes for exterior underground wiring.
      - c. Utility structure accessories.
  - B. Related Requirements:
    - 1. Section 270010 "Supplemental Requirements for Communications" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
    - 2. [Section 013100 "Project Management and Coordination"] <Insert Section number and title> for preinstallation conference procedures.

### 2.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference atTBD.
- B. Preinstallation Coordination Meeting(s): For underground ducts and raceways. Conduct meeting(s) TBD
- C.

PART 3 - PRODUCTS (Not Used)

3.1

PART 4 - EXECUTION

4.1

- 4.2 SELECTION OF UNDERGROUND DUCTS AND ACCESSORIES FOR COMMUNICATIONS
  - A. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NFPA 70 for selection of underground ducts and accessories. Consult Architect for resolution of conflicting requirements.
  - B. Direct Buried: PVC-80.
  - C. Concrete Encased Not in Trench: PVC-80.
  - D. Concrete Encased in Trench: PVC-40.
  - E. Raceway Fittings: Select fittings in accordance with NEMA FB 2.10 guidelines.
    - 1. ERMC and IMC: Provide threaded-type fittings unless otherwise indicated.
  - F. Stub-ups: Concrete encased, PVC-80.
  - G. Communication Innerducts: EPEC-40.
  - H. Underground-Line Warning Tape: In accordance with Section 270553 "Identification for Communications Systems."
- 4.3 SELECTION OF HANDHOLES AND BOXES FOR COMMUNICATIONS
  - A. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NFPA 70 for selection of boxes and enclosures. Consult Architect for resolution of conflicting requirements.
  - B. Provide handholes and boxes in accordance with Section 260543 "Underground Ducts and Raceways for Electrical Systems," except for the following:
    - 1. Cover Legend: "COMM".
    - 2. Color: Green.
    - 3. Degree of Protection for Boxes:
      - a. Locations in-Ground or Exposed to Corrosive Agents: Type 4X or Type 3RX as required.
      - b. Locations in-Ground or Exposed to Corrosive Agents Where Mechanism Must Operate When Ice Covered: Type 3SX.
- 4.4 SELECTION OF UNDERGROUND STRUCTURES AND ACCESSORIES FOR COMMUNICATIONS
  - A. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NFPA 70 for selection of underground structures and accessories. Consult Architect for resolution of conflicting requirements.

- B. Provide underground structures and accessories in accordance with requirements specified in Section 260543 "Underground Ducts and Raceways for Electrical Systems," except for the following:
  - 1. Cover Legend: "COMM".
- 4.5 INSTALLATION
  - A. Earthwork: Comply with Section 260543 "Underground Ducts and Raceways for Electrical Systems."
  - B. Installation of Structures: Comply with Section 260543 "Underground Ducts and Raceways for Electrical Systems."
- 4.6 FIELD QUALITY CONTROL
  - A. Comply with Section 260543 "Underground Ducts and Raceways for Electrical Systems."
  - Β.

### **SECTION 270544**

## SLEEVES AND SLEEVE SEALS FOR COMMUNICATIONS PATHWAYS AND CABLING

### PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS
  - A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- 1.2 SUMMARY
  - A. Section Includes:
    - 1. Round sleeves.
    - 2. Rectangular sleeves.
    - 3. Sleeve seal systems.
    - 4. Grout.
    - 5. Pourable sealants.
    - 6. Foam sealants.
    - ACTION SUBMITTALS
  - A. Product Data: For each type of product.

## PART 2 - PRODUCTS

- 2.1 MANUFACTURERS
  - A. STI

1.3

- B. Or Equal
- 2.2 ROUND SLEEVES
  - A. Wall Sleeves, Steel:
    - 1. Description: ASTM A53/A53M, Type E, Grade B, Schedule 40, zinc coated, plain ends and integral waterstop.
- 2.3 RECTANGULAR SLEEVES
  - A. Sheet Metal Sleeves, Galvanized Steel, Rectangular:
    - 1. Description:
      - a. Material: Galvanized sheet steel.
      - b. Minimum Metal Thickness:
        - 1) For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness must be 0.052 inch.
        - 2) For sleeve cross-section rectangle perimeter not less than 50 inches or with one or more sides larger than 16 inches, thickness must be 0.138 inch.

## 2.4 SLEEVE SEAL SYSTEMS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and pathway or cable or between pathway and cable.
  - 1. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 2. Pressure Plates: Carbon steel.
  - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.
- 2.5 GROUT
  - A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
    - 1. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
    - 2. Design Mix: 5000-psi, 28-day compressive strength.
    - 3. Packaging: Premixed and factory packaged.

### 2.6 POURABLE SEALANTS

- A. Description: Single-component, neutral-curing elastomeric sealants of grade indicated below.
  - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
- 2.7 FOAM SEALANTS
  - A. Description: Multicomponent, liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam. Foam expansion must not damage cables or crack penetrated structure.

### PART 3 - EXECUTION

- 3.1 INSTALLATION OF SLEEVES FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS A. Comply with NECA 1.
  - B. Sleeves for Conduits Penetrating Above-Grade, Non-Fire-Rated, Concrete and Masonry-Unit Floors and Walls:
    - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
      - a. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall or floor so no voids remain. Tool exposed surfaces smooth; protect material while curing.
      - b. Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
    - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
    - 3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and pathway or cable, unless sleeve seal system is to be installed.
    - 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
    - 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.
  - C. Sleeves for Conduits Penetrating Non-Fire-Rated Wall Assemblies:
    - 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
    - 2. Seal space outside of sleeves with approved joint compound for wall assemblies.
  - D. Roof-Penetration Sleeves: Seal penetration of individual pathways and cables with flexible boottype flashing units applied in coordination with roofing work.
  - E. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seal systems. Size sleeves to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
  - F. Underground, Exterior-Wall and Floor Penetrations:
    - 1. Install steel pipe sleeves. Size sleeves to allow for 1-inch annular clear space between pathway or cable and sleeve for installing sleeve seal system. Grout sleeve into wall or floor opening.

#### 3.2 INSTALLATION OF RECTANGULAR SLEEVES AND SLEEVE SEALS

- A. Install sleeves in existing walls without compromising structural integrity of walls. Do not cut structural elements without reinforcing the wall to maintain the designed weight bearing and wall stiffness.
- B. Install conduits and cable with no crossings within the sleeve.
- C. Fill opening around conduits and cables with expanding foam without leaving voids.
- D. Provide metal sheet covering at both wall surfaces and finish to match surrounding surfaces. Metal sheet must be same material as sleeve.
- 3.3 INSTALLATION OF SLEEVE SEAL SYSTEMS
  - A. Install sleeve seal systems in sleeves in exterior concrete walls and slabs-on-grade at pathway entries into building.

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

#### SECTION 270553 IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

## PART 1 - GENERAL

### 1.1 SUMMARY

- A. Section Includes:
  - 1. Underground-line warning tape.
  - 2. Bands and tubes.
  - 3. Cable ties.
  - 4. Miscellaneous identification products.
- 5. Labels.
- 1.2 ACTION SUBMITTALS
  - A. Product Data: For each type of product.
  - B. Identification Schedule:
    - 1. Outlets: Scaled drawings indicating location and proposed designation.
    - 2. Backbone Cabling: Riser diagram showing each communications room, backbone cable, and proposed backbone cable designation.
    - 3. Racks: Scaled drawings indicating location and proposed designation.
    - 4. Patch Panels: Enlarged scaled drawings showing rack row, number, and proposed designations.

### PART 2 - PRODUCTS

- 2.1 PERFORMANCE REQUIREMENTS
  - A. Comply with NFPA 70 and TIA 606-B.
  - B. Comply with ANSI Z535.4 for safety signs and labels.
  - C. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.
  - D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
    - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- 2.2 COLOR AND LEGEND REQUIREMENTS
  - A. Equipment Identification Labels:
    - 1. Black letters on a white field.

2.3 LABELS

- A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.
- B. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters of raceway or cable they identify, that stay in place by gripping action.
- C. Self-Adhesive Wraparound Labels: Preprinted, 3-mil-thick, flexible labels with acrylic pressuresensitive adhesive.
  - 1. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating protective shields over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
  - 2. Marker for Labels:
    - a. Machine-printed, permanent, waterproof black ink recommended by printer manufacturer.
- D. Self-Adhesive Labels: Polyester, thermal, transfer-printed, 3-mil-thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

- 1. Minimum Nominal Size:
  - a. 1-1/2 by 6 inches for raceway and conductors.
  - b. 3-1/2 by 5 inches for equipment.
  - c. As required by authorities having jurisdiction.
- 2.4 SIGNS
  - A. Baked-Enamel Signs:
    - 1. Preprinted aluminum signs, high-intensity reflective, punched or drilled for fasteners, with colors, legend, and size required for application.
    - 2. 1/4-inch grommets in corners for mounting.
    - 3. Nominal Size: 7 by 10 inches.
  - B. Laminated-Acrylic or Melamine-Plastic Signs:
    - 1. Engraved legend.
    - 2. Thickness:
      - a. For signs up to 20 sq. in., minimum 1/16 inch thick.
      - b. For signs larger than 20 sq. in., 1/8 inch thick.
      - c. Engraved legend with black letters on white face or white letters on a dark gray background as needed.
      - d. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

### 2.5 CABLE TIES

- A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
  - 1. Minimum Width: 3/16 inch.
  - 2. Tensile Strength at 73 deg F according to ASTM D638: 12,000 psi.
  - 3. Temperature Range: Minus 40 to plus 185 deg F.
  - 4. Color: Black, except where used for color-coding.
- B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
  - 1. Minimum Width: 3/16 inch.
  - 2. Tensile Strength at 73 deg F according to ASTM D638: 12,000 psi.
  - 3. Temperature Range: Minus 40 to plus 185 deg F.
  - 4. Color: Black.
- C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.
  - 1. Minimum Width: 3/16 inch.
  - 2. Tensile Strength at 73 deg F according to ASTM D638: 7000 psi.
  - 3. UL 94 Flame Rating: 94V-0.
  - 4. Temperature Range: Minus 50 to plus 284 deg F.
  - 5. Color: Black.
- 2.6 MISCELLANEOUS IDENTIFICATION PRODUCTS
  - A. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

## PART 3 - EXECUTION

- 3.1 INSTALLATION
  - A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
  - B. Verify identity of each item before installing identification products.
  - C. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
  - D. Apply identification devices to surfaces that require finish after completing finish work.

- E. Install signs with approved legend to facilitate proper identification, operation, and maintenance of communications systems and connected items.
- F. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- G. Vinyl Wraparound Labels:
  - 1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
  - 2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
  - 3. Provide label 6 inches from cable end.
- H. Snap-Around Labels:
  - 1. Secure tight to surface at a location with high visibility and accessibility.
  - 2. Provide label 6 inches from cable end.
- I. Self-Adhesive Wraparound Labels:
  - 1. Secure tight to surface at a location with high visibility and accessibility.
  - 2. Provide label 6 inches from cable end.
- J. Self-Adhesive Labels:
  - 1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
  - 2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
- K. Cable Ties: General purpose, except as listed below:
  - 1. Outdoors: UV-stabilized nylon.
  - 2. In Spaces Handling Environmental Air: Plenum rated.
- 3.2 IDENTIFICATION SCHEDULE
  - A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
  - B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations with high visibility. Identify by system and circuit designation.
  - C. Accessible Fittings for Raceways and Cables within Buildings: Identify covers of each junction and pull box with self-adhesive labels containing wiring system legend.
    - System legends shall be as follows:
      - a. Telecommunications.
  - D. Faceplates: Label individual faceplates with self-adhesive labels. Place label at top of faceplate. Each faceplate shall be labeled with its individual, sequential designation, numbered clockwise when entering room from primary egress, composed of the following, in the order listed:
    - 1. IT room designation.
    - 2. Hyphen.

1.

- 3. Port number in IT room that service the jack(s)
  - a. For plates with multiple jacks, each additional jack is added after a hyphen.
- 4. Examples:
  - a. Faceplate is serviced by port 04 from IT room 1A: 1A-04
  - b. Faceplate is serviced by ports 02 and 03 from IT room 2B: 2B-02-03
- E. Equipment Room Labeling:
  - 1. Racks, Frames, and Enclosures: Identify front and rear of each with self-adhesive labels containing equipment designation.
  - 2. Patch Panels: Label individual rows in each rack, starting at the bottom and working up, with self-adhesive label.
  - 3. Data Outlets: Label each outlet with a self-adhesive label indicating the following, in the order listed:
    - a. Room number being served.
    - b. Colon.
    - c. Faceplate number.

- F. Backbone Cables: Label each cable with a self-adhesive wraparound label indicating the location of the far or other end of the backbone cable. Patch panel or punch down block where cable is terminated should be labeled identically.
- G. Horizontal Cables: Label each cable with a self-adhesive wraparound label indicating the following, in the order listed:
  - 1. Room number.
  - 2. Colon.
  - 3. Faceplate number.
- H. Instructional Signs: Self-adhesive labels.
- Warning Labels for Indoor Cabinets, Boxes, and Enclosures: Baked-enamel warning signs.
  Apply to exterior of door, cover, or other access.
- J. Equipment Identification Labels:
  - 1. Indoor Equipment: Laminated-acrylic or melamine-plastic sign.
  - 2. Outdoor Equipment: Laminated-acrylic or melamine-plastic sign.
  - 3. Equipment to Be Labeled:
    - a. Communications cabinets.
    - b. Uninterruptible power supplies.
    - c. Computer room air conditioners.
    - d. Fire-alarm and suppression equipment.
    - e. Egress points.
    - f. Power distribution components.

#### SECTION 271100 COMMUNICATIONS EQUIPMENT ROOM FITTINGS

## PART 1 - GENERAL

### 1.1 SUMMARY

- A. Section Includes:
  - 1. Backboards.
  - 2. Boxes, enclosures, and cabinets.
  - 3. Power strips.
- B. Related Requirements:
  - 1. Section 270536 "Cable Trays for Communications Systems" for cable trays and accessories.
  - 2. Section 271323 "Communications Optical Fiber Backbone Cabling" for optical-fiber data cabling associated with system panels and devices.
  - 3. Section 271513 "Communications Copper Horizontal Cabling" for copper data cabling associated with system panels and devices.

### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 2. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
  - 3. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.

### PART 2 - PRODUCTS

- 2.1 BACKBOARDS
  - A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches.
  - B. Backboard Paint: Pre-painted or Light-colored fire-retardant paint.
- 2.2 BOXES, ENCLOSURES, AND CABINETS
  - A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets shall be listed and labeled for intended location and use.
  - B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
  - C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, Type FD, aluminum, with gasketed cover.
  - D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
  - E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
  - F. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
  - G. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
  - H. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.
  - I. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.
    - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
    - 2. Nonmetallic Enclosures: Plastic.
    - 3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

### 2.3 POWER STRIPS

- A. Power Strips: Comply with UL 1363.
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 2. Rack mounting, with integral flanges.
  - 3. Height: 1 RU.
  - 4. Housing: Metal.
  - 5. Six or more, 15-A, 120-V ac, NEMA WD 6, Configuration 5-15R receptacles.
  - 6. Rear-facing receptacles.
  - 7. LED indicator lights for power and protection status.
  - 8. LED indicator lights for reverse polarity and open outlet ground.
  - 9. Circuit Breaker and Thermal Fusing: When protection is lost, circuit opens and can be reset.
  - 10. Cord connected with 15-foot line cord or other length as appropriate.
  - 11. Rocker-type on-off switch, illuminated when in on position.
  - 12. Surge Protection: UL 1449, Type 3.
    - a. Maximum Surge Current, Line to Neutral: 27 kA.
    - b. Protection modes shall be line to neutral, line to ground, and neutral to ground.
    - c. UL 1449 Voltage Protection Rating for line to neutral and line to ground shall be 600 V and 500 V. for neutral to ground.

### PART 3 - EXECUTION

- 3.1 INSTALLATION
  - A. Comply with NECA 1.
  - B. Comply with BICSI's "Telecommunications Distribution Methods Manual" for layout of communications equipment spaces.
  - C. Comply with BICSI's "Information Technology Systems Installation Methods Manual" for installation of equipment in communications equipment spaces.
  - D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
  - E. Coordinate layout and installation of communications equipment in racks and in room. Coordinate service entrance configuration with service provider.
  - F. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.
  - G. Backboards:
    - 1. Install from 6 inches to 8 feet, 6 inches above finished floor. If plywood is fire rated, ensure that fire-rating stamp is visible after installation.
    - 2. Paint all sides of backboard with two coats of paint, leaving fire rating stamp visible.
    - 3. Comply with requirements for backboard installation in BICSI's "Information Technology Systems Installation Methods Manual" and TIA-569-D.

### 3.2 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

- B. Comply with TIA-569-D, Annex A, "Firestopping."
- C. Comply with BICSI's "Information Technology Systems Installation Methods Manual", "Firestopping Practices" Ch.

#### SECTION 271116 COMMUNICATIONS RACKS, FRAMES, AND ENCLOSURES

## PART 1 - GENERAL

### 1.1 SUMMARY

- A. Section Includes:
  - 1. 19-inch wall-mounted equipment cabinets.
  - 2. Power strips.
  - 3. Grounding.
  - 4. Labeling.
- 1.2 DEFINITIONS
  - A. Access Provider: An operator that provides a circuit path or facility between the service provider and user. An access provider can also be a service provider.
  - B. Service Provider: The operator of a telecommunications transmission service delivered through access provider facilities.
- 1.3 ACTION SUBMITTALS
  - A. Product Data: For each type of product.
  - B. Shop Drawings: For communications racks, frames, and enclosures. Include plans, elevations, sections, details, and attachments to other work.
    - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
    - 2. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
    - 3. Grounding: Indicate location of TGB and its mounting detail showing standoff insulators and wall-mounting brackets.
- 1.4 INFORMATIONAL SUBMITTALS
  - A. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.
  - B. Seismic Qualification Data: Certificates, from manufacturer.
- 1.5 QUALITY ASSURANCE
  - A. Installer Qualifications: Cabling installer must have personnel certified by BICSI on staff.
    - 1. Layout Responsibility: Preparation of Shop Drawings shall be under direct supervision of RCDD.
    - 2. Installation Supervision: Installation shall be under direct supervision of Technician, who shall be present at all times when Work of this Section is performed at Project site.
    - 3. Field Inspector: Currently registered by BICSI as RCDD to perform on-site inspection.

## PART 2 - PRODUCTS

- 2.1 PERFORMANCE REQUIREMENTS
  - A. UL listed.
  - B. RoHS compliant.
  - C. Compliant with requirements of the Payment Card Industry Data Security Standard.
- 2.2 19-INCH EQUIPMENT CABINETS
  - A. Description: Manufacturer-assembled enclosure with front door, designed for mounting telecommunications equipment. Width is compatible with EIA/ECIA 310-E, 19-inch equipment mounting with an opening of 17.72 inches between rails.
  - B. General Cabinet Requirements:
    - 1. Modular units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
- 2. Material: Stainless Steel.
- C. Modular Wall Cabinets:
  - 1. Height: As need to accommodate equipment.
  - 2. Depth: As needed to accommodate equipment.
  - 3. Load Rating: .
  - 4. Number of Rack Units: 18.
  - 5. Threads: 10-32.
  - 6. Lockable front doors.
  - 7. Louvered side panels.
  - 8. Cable access provisions top and bottom.
  - 9. Grounding lug.
  - 10. Rating: NĚMĂ Type 3R.
  - 11. UNT telco lock core to be installed.
  - 12. Power strip.
  - 13. All cabinets keyed alike.
- D. Cable Management:
  - 1. Metal, with integral wire retaining fingers.
  - 2. Baked-polyester powder coat finish.
  - 3. Vertical cable management panels shall have front and rear channels, with covers.
  - 4. Provide horizontal crossover cable manager at top of each relay rack, with a minimum height of two rack units each.

#### 2.3 POWER ŠTRIPS

- A. Power Strips: Comply with UL 1363.
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 2. Rack mounting, with integral flanges.
  - 3. Height: 1 RU.
  - 4. Housing: Metal.
  - 5. Six or more, as needed,, 15-A, 120-V ac, NEMA WD 6, Configuration 5-15R receptacles.
  - 6. Rear-facing receptacles.
  - 7. LED indicator lights for power and protection status.
  - 8. LED indicator lights for reverse polarity and open outlet ground.
  - 9. Circuit Breaker and Thermal Fusing: When protection is lost, circuit opens and cannot be reset.
  - 10. Circuit Breaker and Thermal Fusing: Unit continues to supply power if protection is lost.
  - 11. Cord connected with 15-foot line cord or other length as appropriate.
  - 12. Rocker-type on-off switch, illuminated when in on position.
  - 13. Surge Protection: UL 1449, Type 3.
    - a. Maximum Surge Current, Line to Neutral: 27 kA.
    - b. Protection modes shall be line to neutral, line to ground, and neutral to ground.
    - c. UL 1449 Voltage Protection Rating for line to neutral and line to ground shall be 600 V and 500 V for neutral to ground.

#### 2.4 GROUNDING

- A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.
- B. Rack and Cabinet TGBs: Rectangular bars of hard-drawn solid copper, accepting conductors ranging from No. 14 to No. 2/0 AWG, NRTL listed as complying with UL 467, and complying with TIA-606-B. Predrilling shall be with holes for use with lugs specified in this Section.
  - 1. Cabinet-Mounted TGB: Terminal block, with stainless-steel or copper-plated hardware for attachment to cabinet.
  - 2. Rack-Mounted Horizontal TGB: Designed for mounting in 19- or 23-inch equipment racks. Include a copper splice bar for transitioning to an adjoining rack, and stainless-steel or copper-plated hardware for attachment to the rack.
  - 3. Rack-Mounted Vertical TGB: 72 or 36 inches long, with stainless-steel or copper-plated hardware for attachment to rack.

#### 2.5 LABELING

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

#### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Comply with BICSI TDMM for layout of communications equipment spaces.
- C. Comply with BICSI ITSIMM for installation of communications equipment spaces.
- D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
- E. Coordinate layout and installation of communications equipment in racks and room. Coordinate service entrance configuration with service provider.
  - 1. Meet jointly with system providers, equipment suppliers, and Owner to exchange information and agree on details of equipment configurations and installation interfaces.
  - 2. Record agreements reached in meetings and distribute them to other participants.
  - 3. Adjust configurations and locations of distribution frames, cross-connects, and patch panels in equipment spaces to accommodate and optimize configuration and space requirements of telecommunications equipment.
  - 4. Adjust configurations and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in equipment room.
- F. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

#### 3.2 GROUNDING

- A. Comply with NECA/BICSI 607.
- B. Install grounding according to BICSI ITSIMM, "Bonding, Grounding (Earthing) and Electrical Protection" Ch.
- C. Locate TGB to minimize length of bonding conductors. Fasten to wall, allowing at least 2 inches of clearance behind TGB. Connect TGB with a minimum No. 4 AWG grounding electrode conductor from TGB to suitable electrical building ground. Connect rack TGB to near TGB or the TMGB.

1. Bond the shield of shielded cable to patch panel, and bond patch panel to TGB or TMGB.

#### 3.3 IDENTIFICATION

- A. Coordinate system components, wiring, and cabling complying with TIA-606-B. Comply with requirements in Section 270553 "Identification for Electrical Systems."
- B. Comply with requirements in Section 099123 "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- C. Paint and label colors for equipment identification shall comply with TIA-606-B for Class 2 level of administration.
- D. Labels shall be machine printed. Type shall be 1/4 inch in height.

#### END OF SECTION 271116

#### SECTION 271323 COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING

#### PART 1 - GENERAL

- 1.1 SUMMARY
  - A. Section Includes:
    - 1. Optical fiber cable.
    - 2. Optical fiber cable connecting hardware, patch panels, and cross-connects.
- 1.2 COORDINATION
  - A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.
- 1.3 ACTION SUBMITTALS
  - A. Product Data:
    - 1. For each type of product.
  - B. Shop Drawings:
    - 1. System Labeling Schedules:
      - a. Electronic copy of labeling schedules, in software and format selected by Owner.
      - b. Electronic copy of labeling schedules that are part of cabling and asset identification system of software.
    - 2. Cabling administration drawings and printouts.
    - 3. Wiring diagrams showing typical schematic arrangement, including the following:
      - a. Telecommunications pathways.
      - b. Telecommunications system access points.
      - c. Telecommunications grounding system.
      - d. Patch panels.
    - 4. Cross-Connect and Patch-Panel Drawings: Detail mounting assemblies and show elevations and physical relationship between installed components.
  - C. Certificates:

D.

Α.

- 1. For each type of product.
- Field Quality-Control Submittals:
  - 1. Optical fiber cable testing plan.
  - 2. Field quality-control reports.
- 1.4 INFORMATIONAL SUBMITTALS
  - A. Source Quality-Control Submittals:
    - 1. Source quality-control reports.
- 1.5 CLOSEOUT SUBMITTALS
  - A. Maintenance Data: For optical fiber cable, splices, and connectors.

#### PART 2 - PRODUCTS

- 2.1 OPTICAL FIBER CABLE
- A. All fiber to be owner furnished and contractor installed
- 2.2 OPTICAL FIBER CABLE HARDWARE
  - Manufacturer:
    - 1. Corning
      - a. CCH-02U
      - b. CCH-CP12-E4
      - c. CCH-CP12-19T
      - d. 95-050-99-X
    - e. 95-200-52
  - B. Performance Criteria:
    - 1. Fiber Optic Connector Inter-mateability Standard (FOCIS) specifications of TIA-604 series.

- 2. TIA-568.3.
- C. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.
  - 1. Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.
- D. Patch Cords: Factory-made, dual-fiber cables in 36 inch lengths.
- E. Connector Type: Type ST complying with TIA-604-2 for SM and Type LC complying with TIA-604-10 for MM.
- F. Plugs and Plug Assemblies:
  - 1. Male; color-coded modular telecommunications connector designed for termination of single optical fiber cable.
  - 2. Insertion loss not more than 0.25 dB.
  - 3. Marked to indicate transmission performance.
- G. Jacks and Jack Assemblies:
  - 1. Female; quick-connect, simplex and duplex; fixed telecommunications connector designed for termination of single optical fiber cable.
  - 2. Insertion loss not more than 0.25 dB.
  - 3. Marked to indicate transmission performance.
  - 4. Designed to snap-in to patch panel or faceplate.
  - SOURCE QUALITY CONTROL
- A. Tests and Inspections:

2.3

- 1. Test and inspect multimode optical fiber cables, by, or under supervision of, qualified electrical testing laboratory recognized by authorities having jurisdiction, in accordance with TIA-526-14 and TIA-568.3 before delivering to site. Affix label with name and date of manufacturer's certification of system compliance.
- 2. Test and inspect pre-terminated optical fiber cable assemblies, by, or under supervision of, qualified electrical testing laboratory recognized by authorities having jurisdiction, in accordance with TIA-526-14 and TIA-568.3 before delivering to site. Affix label with name and date of manufacturer's certification of system compliance.
- B. Nonconforming Work:
  - 1. Cables that do not pass tests and inspections will be considered defective.
- C. Prepare test and inspection reports.

#### PART 3 - EXECUTION

- 3.1 PREPARATION
  - A. Coordinate backbone cabling with protectors and demarcation point provided by communications service provider.
- 3.2 SELECTION OF OPTICAL FIBER TYPE
- A. Installed in Vertical Shaft or Floor-to-Floor Riser:
  - 1. Nonconductive:
    - a. Type OFNP in listed plenum communications raceway.
    - b. Type OFNP in metallic conduit.
  - B. Installed in Plenum, Duct, or Other Space Handling Environmental Air:
    - 1. Nonconductive:
      - a. Type OFNP.
      - b. Type OFNP in metallic conduit.
  - C. Installed in Location Other Than Riser or Plenum:
    - 1. Nonconductive: Type OFNG in metallic conduit.
- 3.3 INSTALLATION OF OPTICAL FIBER BACKBONE CABLES
  - A. Optical fiber backbone cabling system must provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.

- B. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters may not be used as part of backbone cabling.
- C. Comply with BICSI N1, NECA NEIS 1, and NECA NEIS 301.
- D. Backbone cabling system must comply with transmission standards in TIA-568.1.
- E. Telecommunications Pathways and Spaces: Comply with TIA-569.
- F. Wiring Methods:
  - 1. In Raceway: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.
    - a. Install plenum cable in environmental airspaces, including plenum ceilings.
    - b. Comply with requirements for pathways specified in Section 270528 "Pathways for Communications Systems."
  - 2. In 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.
- G. Optical Fiber Cabling Installation:
  - 1. Comply with TIA-568.1 and TIA-568.3.
  - 2. Comply with BICSI ITSIMM, Ch. 6, "Cable Termination Practices."
  - 3. Terminate all cables; no cable may contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
  - 4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inch and not more than 6 inch from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
  - 5. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
  - 6. Bundle, lace, and train cable to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.
  - 7. 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.
  - 8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps may not be used for heating.
  - 9. In communications equipment room, provide 10 ft long service loop on each end of cable.
  - 10. Pulling Cable: Comply with BICSI ITSIMM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
  - 11. Cable may be terminated on connecting hardware that is rack or cabinet mounted.
- H. Open-Cable Installation:
  - 1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
  - 2. Cable may not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- I. Group connecting hardware for cables into separate logical fields.

#### 3.4 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."
- B. Comply with TIA-569, Annex A, "Firestopping."
- C. Comply with BICSI ITSIMM, "Firestopping" Chapter.

#### 3.5 GROUNDING

- A. Install grounding in accordance with BICSI ITSIMM, "Grounding (Earthing), Bonding, and Electrical Protection" Chapter.
- B. Comply with TIA-607 and NECA/BICSI-607.
- C. Locate grounding bus bar to minimize length of bonding conductors. Fasten to wall allowing at least 2 inch clearance behind grounding bus bar. Connect grounding bus bar with minimum 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to grounding bus bar, using not smaller than 6 AWG equipment grounding conductor.

#### 3.6 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA-606. 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. Paint and label colors for equipment identification must comply with TIA-606 for Class 2 [level of administration.
- C. Comply with requirements in Section 271523 "Communications Optical Fiber Horizontal Cabling" for cable and asset management software.
- D. Cable Schedule: Install in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish electronic copy of final comprehensive schedules for Project.
- E. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.
- F. Cable and Wire Identification:
  - 1. Label each cable within 4 inch of each termination and tap, where it is accessible in cabinet or junction or outlet box, and elsewhere as indicated.
  - 2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
  - 3. Label each unit and field within distribution racks and frames.
  - 4. 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 different color for jacks and plugs of each service.
- G. Labels must be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA 606, for the following:
  - 1. Flexible vinyl or polyester that flexes as cables are bent.

#### 3.7 FIELD QUALITY CONTROL

- A. Field tests and inspections must be witnessed and name and title of witnesses must be provided..
- B. Tests and Inspections:
  - 1. Visually inspect optical fiber jacket materials for qualified electrical testing laboratory 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-568.1.
  - 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
  - 3. Optical Fiber Cable Tests:
    - a. Test instruments must meet or exceed applicable requirements in TIA-568.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
    - b. All fiber to be tested bi-directionally with power meter and Fluke tester.
    - c. Link End-to-End Attenuation Tests:
      - Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in one direction in accordance with TIA-526-14, Method B, One Reference Jumper.

- 2) Attenuation test results for backbone links must be less than 2.0 dB. Attenuation test results must be less than those calculated in accordance with equation in TIA-568.1.
- C. Nonconforming Work:
  - 1. Cables will be considered defective if they do not pass tests and inspections.
  - 2. Remove and replace defective cables and retest.
- D. Collect, assemble, and submit test and inspection reports.
  - 1. Data for each measurement must be documented.
  - 2. Data for field quality-control report submittals must be printed in summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from instrument to computer, saved as text files, and printed and submitted.
  - 3. Test result data also to be submitted in an electronic format
- E. Manufacturer Services:
  - 1. Engage factory-authorized service representative to support field tests and inspections.

#### END OF SECTION 271323

#### SECTION 271513 COMMUNICATIONS COPPER HORIZONTAL CABLING

#### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Category 6 twisted pair cable.
  - 2. Category 6a twisted pair cable.
  - 3. Twisted pair cable hardware, including plugs and jacks.
  - 4. Cable management system.
  - 5. Grounding provisions for twisted pair cable.
- 1.2 COPPER HORIZONTAL CABLING DESCRIPTION
  - A. Horizontal cabling system shall provide interconnections between Distributor A, Distributor B, or Distributor C, and the equipment outlet, otherwise known as "Cabling Subsystem 1," in the telecommunications cabling system structure. 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., and includes the components that extend from the equipment outlets to the station equipment.
  - C. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment or in the horizontal cross-connect.
- 1.3 ACTION SUBMITTALS
  - A. Product Data: For each type of product.
  - B. Shop Drawings: Reviewed and stamped by RCDD.
    - 1. System Labeling Schedules:
      - a. Electronic copy of labeling schedules, in software and format selected by Owner.
      - b. Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
    - 2. Cabling administration Drawings and printouts.
    - 3. Wiring diagrams and installation details of telecommunications equipment, to show location and layout of telecommunications equipment.
  - C. Twisted pair cable testing plan.
  - D. Field Quality-Control Submittals:
    - 1. Field quality-control reports.
    - INFORMATIONAL SUBMITTALS
  - A. Qualification Data: For RCDD, Installer, installation supervisor, and field inspector.
  - B. Product Certificates: For each type of product.
  - C. Source quality-control reports.
- 1.5 CLOSEOUT SUBMITTALS
  - A. Maintenance data.

1.4

- B. Software and Firmware Operational Documentation:
  - 1. Software operating and upgrade manuals.
  - 2. Program Software Backup: On USB media.
  - 3. Device address list.
  - 4. Printout of software application and graphic screens.

- 1.6 QUALITY ASSURANCE
  - A. Contractor Qualifications: Contractor to be both Panduit Gold and Corning Certified and be albe to provide their warranties.
  - B. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
    - 1. Layout Responsibility: Preparation of Shop Drawings and cabling administration Drawings by an RCDD.
    - 2. 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.

#### 1.7 COORDINATION

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

#### 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-B.
- 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:
      - a. Type CM, Type CMG, Type CMP, Type CMR, or Type CMX in metallic conduit installed according to NFPA 70, Article 300.22, "Wiring in Ducts, Plenums, and Other Air-Handling Spaces" and NFPA 70 Articles 770.110 and 770.113.
    - 2. Communications, Non-Plenum Rated:
      - a. Type CMR complying with UL 1666.
    - 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.
- 2.3 CATEGORY 6 TWISTED PAIR CABLE
  - A. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of Category 6 cable at frequencies up to 250 MHz.
  - B. Manufacturers:
    - 1. Panduit: PUP6004BU-W
  - C. Standard: Comply with NEMA WC 66/ICEA S-116-732 and TIA-568-C.2 for Category 6 cables.
  - D. Conductors: 100-ohm, 23 AWG solid copper.
  - E. Shielding/Screening: Unshielded twisted pairs (UTP).
  - F. Cable Rating: Riser, Plenum, or CMX as required.
  - G. Jacket: Blue thermoplastic.
- 2.4 CATEGORY 6a TWISTED PAIR CABLE
  - A. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of Category 6a cable at frequencies up to 500 MHz.
  - B. Manufacturers:
    - 1. Panduit: PUP6AM04BUUGA
    - 2. Or Equal
  - C. Standard: Comply with TIA-568-C.2 for Category 6a cables.
  - D. Conductors: 100-ohm, 23 AWG solid copper.
  - E. Shielding/Screening: Unshielded twisted pairs (UTP).
  - F. Cable Rating: Riser, Plenum, or CMX as required.
  - G. Jacket: Blue or Red thermoplastic.

#### 2.5 TWISTED PAIR CABLE HARDWARE

- A. Description: Hardware designed to connect, splice, and terminate twisted pair copper communications cable.
- B. Manufacturers
  - 1. Panduit
  - 2. Leviton
  - 3. Belden
  - 4. CommScope
  - 5. Or Equal
- C. General Requirements for Twisted Pair Cable Hardware:
  - 1. Comply with the performance requirements of Category 6 or 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.
- D. Source Limitations: Obtain twisted pair cable hardware from single source from single manufacturer.
- E. Connecting Blocks:
  - 1. 110-style IDC for Category 6.
  - 2. 110-style IDC for Category 6a.
  - 3. Provide blocks for the number of cables terminated on the block, plus 25 percent spare, integral with connector bodies, including plugs and jacks where indicated.
- 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. 24 or 48 ports.
  - 2. Construction: 16-gauge steel and mountable on 19-inch equipment racks.
  - 3. Number of Jacks per Field: One for each four-pair conductor group of indicated cables, plus spares and blank positions adequate to suit specified expansion criteria.
- G. Patch Cords: Factory-made, four-pair cables in lengths as indicated; terminated with an eightposition modular plug at each end.
  - 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. All patch cords to match jack colors.
  - 3. Length and Quantity:
    - a. Voice: 1 7ft. Cat6
    - b. Data and Security Cameras: 1 Cat6 14ft at outlet and 1 5ft. in IT room
    - c. WAP in classrooms with less than 100 seats: 1 Cat6 14ft at WAP and 1 5ft in IT room
    - d. WAP in classroom with 100 or more seats: 2 Cat6 14ft at WAP and 2 5ft in IT room
  - 4. Patch cords to be install at communications outlets after testing is completed or at ITSS direction
- 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.
- 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 cover plate.
  - 3. Standard: Comply with TIA-568-C.2.
  - 4. Marked to indicate transmission performance.
  - 5. Color:
    - a. Voice: International White

- b. Data: Green
- c. Security Camera: Orange
- d. WAP: Yellow
- J. Cover Plate:
  - 1. Two, Four, or Six port, vertical single gang cover plates designed to mount to single gang wall boxes as needed.
  - 2. Eight, Ten, or Twelve port, vertical double gang cover plates designed to mount to double gang wall boxes as needed.
  - 3. Metal Cover Plate: Stainless steel, complying with requirements in Section 260533 "Raceway and Boxes for Electrical Systems."
  - 4. For use with snap-in jacks accommodating any combination of twisted pair, optical fiber, and coaxial work area cords.
    - a. When fiber is at the plate use flush mounting jacks, positioning the cord at a 45degree angle.
- K. Legend:
  - 1. Machine printed, in the field, using adhesive-tape label.
  - 2. Snap-in, clear-label covers and machine-printed paper inserts.
- 2.6 CABLE MANAGEMENT SYSTEM
  - A. Description: Computer-based cable management system, with integrated database capabilities.
  - B. Document physical characteristics by recording the network, TIA details, and connections between equipment and cable.
  - C. Information shall be presented in database view.
  - D. System shall interface with the following testing and recording devices:
    - 1. Direct upload tests from circuit testing instrument into the personal computer.
      - 2. Direct download circuit labeling into labeling printer.

#### PART 3 - EXECUTION

D.

#### 3.1 INSTALLATION OF TWISTED-PAIR HORIZONTAL CABLES

- A. Comply with NECA 1 and NECA/BICSI 568.
- B. Routing: Install cables in raceways and cable trays, except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, attics, and gypsum board partitions where unenclosed wiring method may be used. 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."
- 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.
  - General Requirements for Cabling:
    - 1. Comply with TIA-568-C.1.
    - 2. Comply with BICSI's Information Transport Systems Installation Methods Manual, 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 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. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

- 7. Install lacing bars to restrain cables, prevent straining connections, and prevent bending cables to smaller radii than minimums recommended by manufacturer.
- 8. 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.
- 9. 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.
- 10. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
- 11. In the communications equipment room, install a 10-foot-long service loop on each end of cable.
- 12. 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.
- 13. All cable and jacks to be terminated with T568A pinout.
- 14. All cable to be Category 6 except for wireless access points and red inter-closet cables which are Category 6A.
- E. Group connecting hardware for cables into separate logical fields.
- F. 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.

#### 3.2 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."
- B. Comply with TIA-569-D, Annex A, "Firestopping."
- C. Comply with "Firestopping Systems" Article in BISCI's "Telecommunications Distribution Methods Manual."

#### 3.3 GROUNDING

- A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.
- B. Install grounding according to the "Grounding, Bonding, and Electrical Protection" chapter in BICSI's "Telecommunications Distribution Methods Manual."
- C. Comply with TIA-607-B and NECA/BICSI-607.
- D. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall, allowing at least a 2-inch clearance behind the grounding bus bar. Connect grounding bus bar to suitable electrical building ground, using a minimum No. 4 AWG grounding electrode conductor.
- E. Bond metallic equipment to the grounding bus bar, using not smaller than a No. 6 AWG equipment grounding conductor.

### 3.4 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."
- B. Paint and label colors for equipment identification shall comply with TIA-606-B for Class 2 level of administration.
- C. Equipment grounding conductors.
- D. Cable and Wire Identification:
  - 1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
  - 2. Each wire connected to building-mounted devices is not required to be numbered at the device if wire color is consistent with associated wire connected and numbered within panel or cabinet.
  - 3. 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 buildingmounted device, with the name and number of a particular device.
- b. Label each unit and field within distribution racks and frames.
- 4. 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-B requirements for the following:
  - 1. Cables use flexible vinyl or polyester that flexes as cables are bent.
- 3.5 FIELD QUALITY CONTROL
  - A. Field tests and inspections must be witnessed and name and title of witnesses must be provided.
  - B. 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.
    - 4. All twisted pair to be done with Fluke testers after faceplates have been installed.
  - C. 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.
  - D. Nonconforming Work:
    - 1. End-to-end cabling will be considered defective if it does not pass tests and inspections.
    - 2. Remove and replace cabling where test results indicate that they do not comply with specified requirements.
  - E. Collect, assemble, and submit test and inspection reports.
    - 1. Test results to be submitted in both hard copy and electronic copy.
  - F. Manufacturer Services:
    - 1. Engage factory-authorized service representative to support field tests and inspections.
  - G. Cabling to be completed and certified by Panduit/Corning Vendor prior to installation of network gear.

#### END OF SECTION 271513

#### **SECTION 316329**

#### DRILLED CONCRETE PIERS (CAISSONS)

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.
- B. Information concerning a sub-surface soil investigation by the Owner's Geotechnical Engineer is available and will be furnished by the Owner upon request. The contractor may use the data included therein for his general information only. The Architect/Engineer is not responsible for the accuracy or applicability of the data therein.
  - 1. Related Requirements:
  - 2. Specification 01 45 29 "Structural Testing and Inspections" for testing and inspection requirements associated with post-tensioned concrete.
  - 3. Specification 03 10 00 "Concrete Forming and Accessories" for forming associated with cast-in-place concrete.
  - 4. Specification 03 20 00 "Concrete Reinforcing" for reinforcement for cast-in-place concrete.
  - 5. Specification 03 30 00 "Cast-in-Place Concrete" for cast-in-place concrete and related products.

#### 1.2 SUMMARY

A. Definitions:

- 1. Casing: Steel cylinder used to resist earth and water pressures, to serve as concrete form, and to protect personnel.
- 2. Dry Method: A method of pier installation in which concrete is placed in the dry. Casing may or may not be used to maintain sidewall stability.
- 3. Owner's Representative: The Architect, Structural Engineer, or Geotechnical Engineer authorized to act on behalf of the Owner.
- 4. Owner's Representative Geotechnical Engineer: The Geotechnical Engineer specifically authorized to carry out the responsibilities defined in this specification.
- 5. Tremie method: Procedure for placing concrete under water or slurry using a watertight steel pipe or tube to place concrete without washing out cement fines.
- B. The Drilling Contractor shall furnish all labor, materials, services, equipment (including temporary casings and/or dewatering where required), and shall install all piers at the locations and depths shown on the drawings or as otherwise directed by the Owner's Geotechnical Engineer. Installation methods compatible with the design may be used if acceptable to the Owner's Geotechnical Engineer. Methods that are not compatible with the design shall be excluded from consideration.
- C. The Drilling Contractor shall furnish and place all reinforcing steel, dowels, and anchor bolts that are shown on the drawings to be embedded in the pier.
- D. The General Contractor shall provide all necessary excavation, sheeting and bracing or other adequate maintenance of excavation banks, suitable runways and ramps as necessary for access of pier drilling, control of ground and surface water as necessary to keep the work area sufficiently dry, suitable access roads for movement of equipment and materials to and from pier locations, field layout required for pier work including setting and maintaining a location stake for each pier and giving cut-off grades on all piers, removal and replacement of all overhead and underground obstructions as required, and coordination of all concrete ordering and delivery.

#### 1.3 REFERENCES

#### A. Reference Standards

- 1. Comply with all provisions of the following codes and specifications:
  - a. Association of Drilled Shaft Contractors, "Standards and Specifications for the Foundation Drilling Industry."

- b. AASHTO M 36 Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains; 2016.
- c. ASTM A36/A36M Standard Specification for Carbon Structural Steel; 2014.
- d. ASTM C33/C33M Standard Specification for Concrete Aggregates; 2013.
- e. ASTM C150/C150M Standard Specification for Portland Cement; 2015.
- f. ASTM A252/A252M Standard Specification for Welded and Seamless Steel Pipe Piles; 2019.
- g. ASTM A283/A283M Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.
- h. ASTM C618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2015.
- i. ASTM A929/A929M Standard Specification for Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe; 2018.
- j. ASTM C937 Standard Specification for Grout Fluidifier for Preplaced-Aggregate Concrete; 2016.
- k. ASTM D1143/D1143M Standard Test Methods for Deep Foundations Under Static Axial Compressive Load; 2007, with Editorial Revision (2018).
- I. ASTM D3689/D3689M Standard Test Method for Deep Foundations Under Static Axial Tensile Load; 2007, with Editorial Revision (2013).
- m. ASTM D3966/D3966M Standard Test Method for Deep Foundations Under Lateral Loads; 2007, with Editorial Revision (2013).
- n. ASTM D4945 Standard Test Method for High-Strain Dynamic Testing of Deep Foundations; 2017.
  - 1) ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
  - 2) ACI 301, "Specifications for Structural Concrete for Buildings."
- o. ACI 318, "Building Code Requirements of Reinforced Concrete."
- p. ACI 336.1 Specification for the Construction of Drilled Piers; 2001.
  - 1) CRSI, "Manual of Standard Practice".
  - 2) ANSI/AWS D1.1, "Structural Welding Code Steel."
  - 3) ANSI/AWS D1.4, "Structural Welding Code Reinforcing Steel."
  - 4) In addition, all applicable building code and local regulations shall be followed. In case of conflict, the strictest interpretation shall govern.

#### 1.4 ADMINISTRATIVE REQUIREMENTS

- A. The Contractor is responsible for quality control, including workmanship and materials furnished by his subcontractors and suppliers.
- B. The Drilling Contractor shall cooperate with all testing and inspection personnel employed to perform field quality control tests and inspections.
- C. Pre-installation Conference:
  - 1. At least 7 days prior to beginning pier installation, the Contractor shall conduct a meeting to review the proposed excavation, inspection, and concrete and reinforcement placement methods and procedures to produce pier construction of the required quality. Also review requirements for submittals, status of coordinating work and availability of materials. Establish work progress schedule and procedures for bearing surface inspection, materials testing, and certifications. The Contractor shall send a pre-installation conference agenda to all attendees 7 days prior to the scheduled date of the conference.
  - 2. The Contractor shall require responsible representatives of every party who is concerned with the concrete work to attend the conference, including but not limited to the following:
    - a. Contractor's Superintendent.
    - b. Laboratory responsible for field material testing.
    - c. Drilling Subcontractor.
    - d. Ready-Mix Concrete Producer.
    - e. Geotechnical Engineer.
    - f. Owner's and Architect's/Engineer's Representative.

- 3. Minutes of the meeting shall be recorded, typed and printed by the Contractor and distributed by him to all parties concerned within 5 days of the meeting. One copy of the minutes shall be transmitted to the following for information purposes:
  - a. Owner's Representative.
  - b. Architect.
  - c. Engineer-of-Record.
- 4. The Engineer shall be present at the conference. The Contractor shall notify the Engineer at least 7 days prior to the scheduled date of the conference.

#### 1.5 SUBMITTALS

- A. Concrete Mix Design: Submit concrete mix designs suitable for method of concrete placement for Engineer and Owner's Testing Laboratory approval prior to pier installation.
- B. Drilling Records: The Contractor and the Owner's Geotechnical Engineer or other authorized inspector shall each submit copies of the drilling record for each pier to the Architect/Engineer after drilling. The reports shall indicate the name of the job, name of Contractor, and name of drilling superintendent. For each pier installed, the report shall indicate the following information:
  - 1. Pier number and location.
  - 2. Pier shaft diameter.
  - 3. Bottom elevation.
  - 4. Top elevation.
  - 5. Pier length.
  - 6. Theoretical volume of concrete in pier.
  - 7. Actual volume of concrete placed.
  - 8. Reinforcing steel size and depth actually placed.
  - 9. Drilling start and finish time.
  - 10. Concreting start and finish time.
  - 11. Variation from specified tolerances including surveyed location and plumbness.
  - 12. Construction method (dry method or casing method
  - 13. Groundwater conditions (rate of water infiltration and depth of water in hole prior to concreting for dry piers; water elevation in hole for wet piers).
  - 14. Elevation of top and bottom of any casing left in place.
  - 15. Description of temporary or permanent casing (including purpose, diameter, wall thickness and length).
  - 16. Description and elevation of any obstructions encountered and whether removal was obtained.
  - 17. Description of pier bottom including amount and extent of loose material.
  - 18. Method of concrete placement.
  - 19. Any difficulties encountered in drilling or concreting operations.
  - 20. Any deviations from specifications.
  - 21. For piers founded in rock, also record elevation at which rock was encountered, depth of socket, and record of any rock core samples made.
- C. Reports prepared by the Owner's Geotechnical Engineer or authorized inspector shall be compiled and signed by a licensed professional engineer in the state where the project is located. Reports prepared by the Contractor shall be compiled and signed by the drilling superintendent.
- D. Shop Drawings:
  - 1. Reinforcing Steel: Submit shop drawings for all drilled pier and pier cap reinforcing steel.
  - 2. Installation Method: Submit detailed procedures of the installation method, including (where applicable) type and number of drilling rigs and equipment, casing size and length, casing removal method, drilling fluid type, dewatering method, concrete placement, and reinforcing steel securing and placement.
  - 3. Steel Casings: Submit shop drawings for size, wall thickness, length, and grade of permanent steel casings required. Show all splices and methods of splicing.
- E. Product Data: Submit manufacturer's product data with application and installation instructions for proprietary materials and items.
- F. Qualification Data:

- 1. Submit qualification data for firms and persons specified in the article entitled "Qualifications" to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- 2. Submit Welding Procedure Specifications (WPS) in accordance with ANSI/AWS D1.1 for all welded joints in steel casing. Submit test reports showing successful passage of qualification tests for all non-prequalified WPSs.
- 3. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests as specified in section 1.05-B. If recertification of welders is required, retesting will be at Contractor's responsibility.
- G. Alternates: The Drilling Contractor shall submit his bid based on the specifications as written without exceptions. He may submit bids for alternates to the specifications or modifications to the design, load test program, or installation specifications for consideration by the Owner's Representative and the Owner.
- H. Post Construction Survey: After completion of pier placement, the Contractor shall provide the Owner's Representative with an as-built survey showing the actual locations of the piers at the top elevations. This survey shall show the plumbness of vertical piers, and all abandoned piers and their replacements. No construction of superstructures shall commence until this survey has been reviewed and accepted by the Owner's Representative. In order to facilitate the progress of the Work, the Contractor shall submit partial pier surveys for approval as the Work proceeds.

#### 1.6 QUALITY ASSURANCE

- A. Drilled piers shall be installed by a specialty Drilling Contractor with suitable equipment, competent personnel, and a reputation of satisfactorily performing the work. The Contractor shall have a minimum of 5 years successful experience and a minimum of 5 successful installations on projects of a similar geologic conditions, size and scope to this project and of using similar installation methods as may be anticipated for this project. Evidence of compliance with this section shall be submitted to the Architect/Engineer prior to entering into a contract for the work.
- B. Codes and Standards: The Drilling Contractor shall comply with the provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:
  - ACI 301, "Specifications for Structural Concrete for Buildings."
  - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
  - 3. ACI 336.1, "Specification for the Construction of Drilled Piers."
  - 4. CRSI, "Manual of Standard Practice".
  - 5. ANSI/AWS D1.1, "Structural Welding Code Steel."
  - 6. ANSI/AWS D1.4, "Structural Welding Code Reinforcing Steel."
  - 7. In addition, all applicable building code and local regulations shall be followed. In case of conflict, the strictest interpretation shall govern.
- C. Survey Work:
  - 1. The General Contractor shall employ a qualified and licensed professional engineer/land surveyor to perform all surveys, layouts and measurements for drilled pier work including the layout of anchor rods and/or reinforcing steel dowels embedded in drilled piers. The surveyor shall conduct the layout work for each drilled pier to the lines and levels required prior to beginning excavation and shall make actual in-place measurements of each drilled pier plan location, shaft diameter, bottom and top elevations and deviations from specified tolerances.
  - 2. The surveyor shall record and submit all information pertinent to each drilled pier and cooperate with other testing and inspection personnel to provide data for all required reports.
- D. Testing Laboratory Requirements: See Testing Laboratory section of the specifications for required tests and inspections to be performed by the Testing Laboratory and Geotechnical Engineer.
  - 1. Inspection or testing by the Owner does not relieve the Contractor of his responsibility to perform the Work in accordance with the Contract Documents.

#### 1.7 JOB CONDITIONS

- A. Site Information:
  - 1. Data on indicated subsurface conditions are not intended as representations or warranties of continuity of such conditions. It is expressly understood that Owner will not be responsible for interpretations or conclusions drawn therefrom by the Contractor. The data are made available for convenience of the Contractor.
  - 2. The Contractor may make additional test borings and other exploratory operations at no additional cost to the Owner.
  - 3. The Contractor shall inspect the site prior to drilling operations and shall determine any constraints to the work presented by the existing surface conditions and report them to the Owner's Representative.
- B. Protection of Existing Structures: Locate all existing underground structures and utilities that are to remain in service during construction. Protect above-ground structures, underground utilities and other construction from damage caused by drilling operations. Report any conflicts between drilling work and underground utilities and structures to the Owner's Representative and do not proceed with the work until the conflict is resolved.
- C. Survey of Existing Structures: Record and report to Architect/Engineer surveyed elevation benchmarks on structures where directed by the Owner's Representative before commencing work, when structures are adjacent to drilling operations. Record and report elevation of each benchmark at least twice a day while drilling is in progress. Should benchmark readings indicate displacement, halt drilling operations until corrective action has been provided and is acceptable to the Owner's Representative and the Owner.

#### PART 2 - PRODUCTS

#### 2.1 CONCRETE

- A. Concrete shall be as specified in the "Cast-in-Place Concrete" section of the specifications, in the general notes, and on the drawings, with the additional requirements specified below:
- B. Maximum Aggregate Size: Provide maximum aggregate size of three quarters of minimum clear spacing between individual reinforcing bars or bundles of bars, with 1 1/2" maximum.
- C. Water Reducing Admixtures: Where required by mix design, use water-reducing admixtures in strict compliance with manufacturers directions. Admixtures to increase cement dispersion, or provide increased workability for low-slump concrete may be used at contractor's option. Use admixtures in the amounts as recommended by manufacturer for climatic conditions prevailing at time of placing concrete. Adjust quantities of admixtures as required to maintain quality control.
- D. Slump Limits: Proportion concrete to have a slump that is suitable for the placement process used. The mix must remain fluid throughout the concrete placement time and during extraction of any temporary casing. Provide a minimum 6" slump concrete with retarder for temporarily cased piers at time of pulling casing. Provide a minimum 6" slump concrete for all pier concrete.

#### 2.2 REINFORCING STEEL

- A. See "Concrete Reinforcing Steel" section of the specifications.
- B. Reinforcing Support and Positioning Devices: Devices made of non-corrosive material that support and align reinforcing steel within the shaft and that provide the appropriate side and bottom cover to the reinforcing steel. Acceptable manufacturers include:
  - 1. Pieresearch.
  - 2. Aztec, a Dayton-Superior Company.
  - 3. Foundation Technologies, Inc.
- 2.3 STEEL CASING
  - A. Steel casing shall conform to ASTM A 283, Grade C or ASTM A 36.

#### 2.4 CONCRETE MIXING

A. Ready Mix Concrete: Comply with the requirements of ASTM C 94.

- B. Hot Weather Concreting: The maximum acceptable concrete temperature at the truck discharge point shall be 95°F. Refer to Hot Weather Concreting Practices specified in "Cast-in-Place Concrete" section of the specifications for required hot weather concreting practices.
- C. Cold Weather Concreting Practices: Refer to the "Cast-in-Place Concrete" section of the specifications for cold weather concreting practices and the conditions under which they are to be followed.

#### PART 3 - EXECUTION

#### 3.1 EXCAVATION

#### A. Requirements:

- 1. Excavate holes for drilled piers to dimensions and required bearing strata or elevations as shown on the drawings unless directed otherwise in the field by the Owner's Geotechnical Engineer.
- 2. Maintain sidewall stability during drilling. If sidewall instability is encountered that the Owner's Representative considers excessive, the Contractor shall use alternate drilling methods such as temporary casing or slurry displacement method.
- 3. Excavate holes for closely spaced piers and those occurring in fragile or sand stratas only after adjacent holes are filled with concrete and allowed to set a minimum of 6 hours or longer as required for concrete to harden unless temporary casing to maintain sidewall stability is used.
- 4. Drilled pier design dimensions and depths shown on the drawings shall be considered minimums and are based on bearing and/or friction in assumed strata. If bearing stratum is not capable of maintaining the assumed capacity, the foundation system shall be revised as directed by the Owner's Geotechnical Engineer and Owner's Representative. Revisions will be paid for in accordance with contract conditions relative to changes in the work. Refer to drawings for design bearing pressures, skin friction values, or pier load capacity.
- 5. Remove loose material and free water from the bottom of the shaft. The bearing surface should be essentially flat within a tolerance of 1 vertical to 12 horizontal or with one step that is less than one-quarter of the diameter of the bearing area.
- 6. Enlarged (mushroom-shaped) top of pier in contact with surrounding soils is not permitted.
- B. Equipment:
  - 1. Provide adequate equipment so work is expedited to the fullest extent possible. Use equipment fully capable of excavating shafts to depths, diameters, and sizes indicated, and within the specified tolerances. Maintain equipment in satisfactory operating condition and provide sufficient quantity of equipment to maintain the projected schedule of the Work.
  - 2. Using bits or augers with a power-driven rotary-type rig, a shaft of a diameter specified on the drawings shall be excavated from the ground surface to a depth as specified on the drawings or as ordered by the Owner's Geotechnical Engineer.
- C. Obstructions:
  - 1. If rocks, boulders, or other unforeseen obstructions are encountered which cannot be removed by standard drilled pier excavation methods, and if such obstructions are not indicated by available sub-surface data, removal of such obstructions will be paid for in accordance with the terms of the Contract relative to changes in the Work.
  - 2. Remove such obstructions by hand labor using air-powered tools or by other safe methods recognized in the construction industry. Standard drilled pier excavation methods include the use of core barrels with pier drilling equipment.
  - 3. The work of this Section includes demolition and removal of rock, boulders, concrete, masonry, and other subsurface obstructions that are indicated by the Contract Documents, or by the available subsurface exploration data, and such work will not be considered a change in the Work.
- D. Overexcavation: No payment will be made for extra length or greater diameter of drilled piers when they are installed to a greater depth or are larger than required unless authorized by the Owner's Geotechnical Engineer. Overexcavated drilled piers will be measured and paid for in accordance with the original design or authorized design depth and diameter.
- E. Excavated Material:

1. Remove excavated material and dispose of it off site.

#### 3.2 DEWATERING

- A. Provide and maintain pumping equipment to keep excavations free of water before placing concrete. An excavation is considered dry if the water rises at a rate of less than 1/4 inch per minute and the height of water at the bottom of the pier does not exceed two inches at the time of concrete placement.
- B. Dewater in a manner that will not create subsidence or ground loss that might adversely affect the Work or existing adjacent structures. Should the dewatering system employed involve pumping inside the pier, extreme caution shall be used to prevent an unbalanced water head from causing a "blowout", bottom heave, or "quick" condition that could disturb the proposed bearing stratum or surrounding soil strata.
- C. The dewatering method shall be submitted for review and approval of the Owner's Geotechnical Engineer.
- D. Conduct water to general site run-off ditches and disposal areas with discharge lines. Provide ditching as required to conduct water to site drainage facilities.
- E. If excessive water and/or sidewall instability is encountered and drilling operations must be halted, consult with Geotechnical Engineer and Owner's Representative before using alternate methods of construction.

#### 3.3 TEMPORARY STEEL CASINGS

- A. Requirements:
  - 1. Provide temporary casing at locations as directed by the Geotechnical Engineer where the soil will not stand without support or where sloughing of the sides of shafts may seriously delay or endanger the satisfactory completion of excavation and placement of concrete. Also provide temporary casing at locations as directed by the Geotechnical Engineer to seal off the inflow of water into the excavation.
  - 2. The Contractor shall have immediately available for use on the job an ample supply of casing for each size that will be required for use in the shafts and shall provide additional amounts, as required, to ensure the orderly progress of the job.
  - 3. Such casing may be in short pieces but with jointing devices of sufficient strength that assembled sections of casing may be pulled complete as concrete is placed, or immediately thereafter. Provide casing of sufficient strength to withstand handling stresses, concrete pressure, and surrounding earth and/or fluid pressures. Make diameter of excavation in relation to diameter of casing such as to create a minimum of void space outside of casing. Provide casing with a minimum outside diameter equal to normal outside diameter of drilled foundations.
- B. Delivery, Handling, and Storage of Casing
  - 1. Deliver casing to site in undamaged condition.
  - 2. Handle and protect casing to maintain diameter within plus or minus two percent.
- C. Casing Withdrawal: Unless otherwise approved by the Owner's Representative, all temporary casing shall be removed from shafts as concrete is placed or immediately thereafter, and in such a manner as to prevent sloughing material from dropping to the bottoms of shafts or falling on top of freshly placed concrete. Casings shall be pulled in a single continuous smooth operation without sudden jerks or impact. Maintain head of concrete above the bottom of the casing that exceeds the soil and water pressure at all times during casing withdrawal. Do not vibrate concrete internally before the casing is withdrawn. A vibratory casing extractor may be used. Do not withdraw casing after the concrete has attained initial set. The casing withdrawal and concreting operations shall be observed by the Geotechnical Engineer.

#### 3.4 DRILLED PIERS IN ROCK

- A. Requirement: Provide drilled piers socketed into rock as shown on the drawings or as directed by the Owner's Geotechnical Engineer.
- B. Classification of Rock: Rock is defined as material which cannot be drilled with a conventional earth auger or underreaming tool, and requires use of special rock augers, core barrels, air tools,

blasting, or other methods of hand excavation. Earth seams, rock fragments, and voids included in rock excavation area will be considered rock for full volume of shaft from initial contact with rock for pay purposes. The work of this section includes demolition and removal of rock, boulders, concrete, masonry, and other subsurface obstructions that are clearly indicated by contract documents, or by available subsurface exploration data, and such work will not be considered a change in work.

#### 3.5 REINFORCING STEEL PLACEMENT

- A. Before placing, clean reinforcing steel and dowels of loose rust, scale, dirt, grease and other material that could reduce or destroy bond.
- B. Fabricate and erect reinforcing cages in shafts as one continuous unit using inner ring reinforcing guide. Place reinforcement accurately and symmetrically about axis of hole and hold securely in position during concrete placement. The Contractor shall verify depths of drilled piers prior to cutting and tying reinforcing steel cages. Reinforcing steel shall be delivered to the site in standard 60-foot lengths and cut as required. Splice no more than 50% of the bars at any one location, alternating spliced and unspliced bars in a symmetrical pattern. Splices shall be class B tension lap splice for columnsTension splice and mechanical end bearing compression splices for #14 and #18 bars unless noted otherwise on the drawings. See drawings for additional splice information. The Contractor shall be responsible for adding additional reinforcing steel ties or spirals as required to ensure stability of cage and maintenance of shape and configuration as required for proper lifting, handling, and placement.
- C. Provide cover to reinforcing steel of not less than 3 inches where exposed to soil and not less than 4 inches in temporarily cased piers. Provide spacer devices to maintain side and bottom cover. Devices shall be installed in accordance with manufacturer's instructions.
- D. Permissible reinforcing steel upward vertical movement during casing withdrawal shall be no greater than 6 inches. Downward movement should not exceed 6 inches for every 20 feet of shaft length.
- E. Use templates to set anchor bolts, leveling plates and other accessories furnished under work of other sections. A qualified and licensed Engineer/Land Surveyor shall determine the plan location and elevation of such devices. Provide spacers (capable of sliding on any temporary casings required), blocking and holding devices to maintain required position during concrete placement.
- F. The General Contractor shall protect exposed ends of dowels and anchor bolts from mechanical damage and exposure to weather by wrapping and taping with polyethylene or other suitable material.

#### 3.6 CONCRETE PLACEMENT

- A. General:
  - 1. Fill drilled piers with concrete immediately after inspection and approval by the Geotechnical Engineer or other authorized inspector. Use protection sheets (cut out to receive concrete) over excavation openings, extending at least 12" beyond edge. Complete the excavation and concrete placement in uncased excavations before the end of the workday unless the Architect/Engineer and Geotechnical Engineer grants permission to do otherwise in writing.
  - 2. Straight drilled shafts shall be constructed in a continuous manner and be completed within 8 hours after design penetration into gray shale.
  - 3. Place concrete continuously and in a smooth flow without segregating the mixed materials.
  - 4. Place concrete by means of bottom discharge bucket, flexible drop chute, elephant trunk hopper, concrete pump, or tremie. Free fall of concrete may be used if provided for in concrete mix design and provided it is directed through a hopper or chute such that fall is down center of shaft without hitting sides or reinforcing steel. Free fall of concrete is not permitted for depths greater than the smaller of 20 times the shaft diameter or 60 feet.
  - 5. Place concrete in-the-dry if at all possible. If water occurs, and it is impracticable to dewater drilled pier excavation, and reasonable attempts to seal off water flow have failed, allow water level to attain its normal level and place concrete by tremie method or by concrete pumping. Other methods of depositing concrete underwater may only be used if approved by Architect/Engineer.

- 6. Stop concrete placement at cut-off elevation shown, screed level, and apply a scoured, rough finish. Where cut-off elevation is above ground elevation, form top section above grade and extend shaft to required elevation.
- 7. Provide mechanical vibration for consolidation of at least top 5' of each shaft but only after any temporary casing is pulled or when casing is permanent.
- 8. Interrupted placing operations of over one hour duration will require a cold joint installation as follows. Leave resulting shaft surface approximately level. At resumption of concrete placing, clean off surface laitance, roughen as required, and slush with a 1-to-1 cement grout or commercial bonding agent before remainder of concrete is placed. Intentional cold joints will not be permitted.
- 9. Concrete shall not be placed in adjacent drilled piers located within three center-to-center shaft diameters of each other until concrete has cured a minimum of 6 hours.
- 10. Aluminum pipe or equipment shall not be used for placing concrete.
- B. Tremie Method:
  - 1. The drilled shafts shall be filled with concrete by the use of a tremie or concrete pump, sealed at the bottom, extending from above the ground surface to the bottom of the drilled shaft. Inspection of the empty tremie on the bottom may be requested of the Contractor by the Owner's authorized inspector. With the sealed tremie on the bottom of the shaft, the tube shall be filled to the top extending above the ground. The filled tremie shall be picked up approximately one (1) foot off the bottom of the shaft to allow the weight of the concrete to displace the seal at the bottom of the tremie. At no time is the tremie to be pulled to such a height as to clear the surface of the concrete already placed in the shaft. All concrete shall be poured through the now open tremie with care taken to maintain a sufficient head of concrete to completely displace all water and suspended cuttings of material and to provide sufficient pressure so as to prevent reduction in pile diameter by earth pressure on the fresh concrete. The concrete in each pile shall be carried above cut-off elevation and then dipped out while fresh to cut-off elevation.
  - 2. All concrete shall be deposited through the tremie or pumpline so as to provide a continuous flow, without aggregate segregation, from bottom to top of pile. The production and delivery of the ready-mixed concrete shall be such that not more than 45 minutes shall elapse between the depositing of successive batches of concrete to ensure a monolithic unit of concrete. No deviation from this method will be acceptable.
  - 3. Should the surface of the concrete in the shaft be breached by the tremie or pumpline, the tube shall immediately be withdrawn from the hole, re-sealed and re-lowered below the surface of the concrete, and pouring operations re-started. Should the Owner's authorized inspector deem it necessary, the Contractor shall instead retrieve the reinforcing steel cage, redrill the shaft to reopen the hole, and begin the concreting operations from the bottom of the pier shaft.
  - 4. If the Owner's authorized inspector has reason to suspect that the concrete was breached by the tremie or pumpline or that the pier, for any other reason, may contain extraneous material or otherwise fail the specifications, he may order the pier cored for inspection and/or testing. If the core recovery and/or test results indicate non-compliance with the specifications, the Contractor shall bear the expense of the investigation and/or testing and shall also, at no cost to the Owner, install proper additional construction as required by the Architect/Engineer. Should the investigation and/or testing indicate compliance with the specifications the Owner shall bear the cost of such investigation and/or testing.
- C. Hot and Cold Weather Placement: Refer to Part II.

#### 3.7 CONSTRUCTION TOLERANCES

- A. Plan Location: The tolerance on plan location for the top of the drilled pier shall not be more than 1/24 of the pier diameter or 3" in any direction, whichever is less. If the as-installed shaft is larger than required, the center of the shaft may be taken as the center of a shaft having the required area that lies wholly within the as-installed shaft.
- B. Plumbness: Permissible tolerance for plumbness shall be 1.5% of the length. The centers of the top and bottom may be taken as the center of the required area that lies wholly within the as-installed area.

- C. Bottom Area: The bottom of the pier shall be essentially horizontal within a tolerance of 1 vertical to 12 horizontal with the area of the bottom bearing not less than 98% of that specified on the drawings.
- D. Specify a tolerance for the maximum diameter of a pier if adjacent obstructions or existing construction is involved.
- E. Top Area: The Contractor shall remove excess concrete at the top of the pier beyond the limits of the pier diameter. The pier top diameter shall be the same diameter as the shaft below. Piers extending above the ground surface shall be formed.
- F. Concrete Cut-Off Elevation: Concrete cut-off elevation at the pier top shall be plus one inch to minus three inches.
- G. Battered Piers: Battered piers shall be installed within 5% of the length from the specified inclination.
- H. Anchorage Embedment Tolerance: Vertical and horizontal deviation from design location for individual anchorage components embedded in the pier shall not exceed  $\pm$  0.5 inches.
- I. If any of the above tolerances are exceeded, the Architect/Engineer shall immediately be notified to evaluate the eccentricity in the pier and recommend corrective measures. The cost of reengineering and corrective construction shall be borne by the Contractor.

#### 3.9 INSPECTIONS AND TESTS FOR DRILLED PIER EXCAVATIONS

- A. Verification of Design: Bottom elevations, bearing and/or skin friction capacities and lengths of drilled piers as shown on the drawings are estimated from available subsurface data. Actual elevations, pier lengths, and bearing and/or skin friction capacities will be determined by the Geotechnical Engineer from conditions found in the excavations.
- B. Notification of Architect/Engineer: If field conditions differ from the data and design recommendations outlined in the Geotechnical Report, the Geotechnical Engineer shall notify the Architect/Engineer immediately.
- C. Additional Tests: Additional tests may be required by the Geotechnical Engineer to determine new design criteria. Such tests shall be made as quickly as possible so as not to delay the concreting operations any longer than absolutely required.
- D. Observation Requirements: Each drilled pier shall be inspected by the authorized inspector and approved prior to placement of concrete.
- E. Cooperation with Testing and Inspection Personnel: The Contractor shall provide facilities as required to assist in the inspection and testing of the excavations, and cooperate with the inspecting and testing personnel to expedite the work.
- F. Notification of Observer: The Contractor shall notify the authorized observer at least twelve hours prior to the time the excavation will be ready for inspection. Drilled shaft installation shall not proceed without the authorized observer on site.
- G. Personnel Safety: The Contractor shall provide gas testing equipment, protective cage, or temporary casing or shoring of proper diameter, length, and thickness, and all other safety equipment required by law for inspection and testing of drilled piers and to protect workmen and inspectors during hand belling or other operations necessitating entry into shaft.

#### 3.10 APPROVAL BY THE GEOTECHNICAL ENGINEER

A. Approval by the Owner's Geotechnical Engineer is required on all pier installation criteria and his decision and judgment on pier length, rejection of piers, additional piers required, and all other pier installation and capacity questions shall be final.

#### 3.11 CONTRACT BASIS

- A. Basis of Bids: Bids shall be based on number of drilled piers, design length from top elevation to bottom of shaft and diameter of shaft, as shown on drawings. The bid price shall include cost for temporary casing of excavation that may be required.
- B. Basis for Payment: Payment for drilled piers will be made on actual net volume of drilled piers in place and accepted. The actual length and shaft diameter may vary to coincide with elevation where satisfactory bearing or friction strata is encountered, and with actual bearing value of bearing strata determined by testing services, and with stability and characteristics of soil strata.

Adjustments will be made on net variation of total quantities, based on design dimensions for shafts.

- 1. There will be no additional compensation for excavation, concrete fill, reinforcing, casings, or other costs due to unauthorized overexcavating shafts. Overexcavated piers will be measured and paid for in accordance with required design or authorized depth. No payment will be made for rejected drilled piers.
- 2. Prices quoted shall include full compensation for labor, temporary casing, materials, tools, equipment, and incidentals required for excavation, trimming, shoring, casings, dewatering, reinforcement, concrete, and other items for complete installation.
- C. Unit Prices: Unit prices for the following items, as set forth in contract conditions, will apply in event additions to or deductions from work are required and authorized by written order from Architect/Engineer to Contractor.
  - 1. Soil excavation, including temporary casing if required: cost per cu. yd.
  - 2. Soil excavation by slurry method: cost per cu. yd.
  - 3. Rock excavation: cost per cu. yd.
  - 4. Permanent steel casings, installed: cost per lin. ft.
  - 5. Reinforcing steel and dowels, installed: cost per lb.
  - 6. Concrete: cost per cu. yd.

#### END OF SECTION

#### **SECTION 321243**

#### POROUS FLEXIBLE PAVING

#### PART 1 - GENERAL

- 1.1 SECTION INCLUDES
  - A. Section includes labor, materials, services and equipment for a permeable paver system.

#### 1.2 REFERENCES

A. ASTM F1951-08 Standard Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment.

- B. ASTM D 638-10 Standard Test Method for Tensile Properties of Plastics
- C. ASTM C 33 Standard Specification for Concrete Aggregates
- D. ASTM D698 Standard Proctor Test
- E. Texas Department of Transportation Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges

#### 1.3 SYSTEM DESCRIPTION

- A. The permeable paver system provides vehicular and pedestrian load support for gravel areas and reduces erosion and rutting
- B. Major Components of the Complete System:
  - 1. Polymer grid, assembled in rolls.
  - 2. Flexible base course
  - 3. Angular aggregate fill.
- C. The plastic grid's cells, angular fill, and flexible base work together to support imposed loading.
- D. The grid's paving units contain and restrict gravel fill from lateral and vertical movement.

#### 1.4 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Shop Drawings: Submit design detail showing proper cross-section.
- C. Installation Instructions: Manufacturer's printed installation instructions. Include methods for maintaining installed products.
- D. Manufacturer's Certificates: Certify products meet specified requirements.
- E. Substitutions: Installers seeking to supply what they represent as equivalent material must submit records, data, certifications, and documentation deemed necessary by the Engineer to prove equivalency.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Protect plastic grid rolls from damage during delivery and store rolls upright under tarp to protect from sunlight when time between delivery and installation exceeds one week.

#### 1.6 PROJECT CONDITIONS

- A. Install plastic grid system when ambient temperature is at least 55 degrees F.
- B. In cold weather, do not use frozen materials or materials mixed or coated with ice or frost, and do not build on frozen base or wet, saturated or muddy subgrade.
- C. Protect partially completed porous paver system against damage from other construction traffic when work is in progress.
- D. Do not drive, park on, or use permeable paver system until grids have been properly anchored and fully filled with angular aggregate fill.

#### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Invisible Structures, Inc.; 3510 Himalaya Rd., Suite 200, Aurora, CO 80011. Phone: 303-233-8383; Website: www.invisiblestructures.com.
- B. Acceptable Manufacturer: TRUEGRID Pavers; 2500 Summer St., Suite 3225, Houston, TX 77007. Phone: 1-855-355-GRID. Email: info@truegridpaver.com Website: www.truegridpaver.com.
- C. Substitutions: Permitted with engineering approval.

#### 2.2 PRODUCTS

- A. Permeable paver system for gravel applications.
  - 1. AASHTO H20Rated.
  - 2. Manufactured in the USA.
  - 3. High density polyethylene (HDPE) with100 percent post-consumer recycled materials
  - 4. Color shall be unform throughout all sections or rolls. Color shall be carbon black with additive for long-term UV stabilization
  - 5. Pavers shall be in pre-assembled sections or rolls.
- B. Flexible Base Course: Base course aggregate shall be TXDOT Type A and meeting the gradation, durability and plasticity requirements of TXDOT Item 247 Grade 1-2. Recycled materials such as crushed concrete or crushed asphalt are NOT acceptable.
- C. Angular Aggregate Fill: Obtain clean, washed angular rock to fill the cells and any spaces between them. Gravel can be filled to the top of cells or overfilled within manufacturer's recommendations. Maximum size of stone is to be by manufacturer's recommendations and varies depending on the system chosen.

#### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Before beginning installation, verify site conditions are as indicated on the drawings. Notify the Engineer if site conditions are not acceptable. Do not begin preparation or installation until unacceptable conditions have been corrected.
- B. Ensure that adjacent hard-surfaced paving work is completed before installing permeable paver system.

#### 3.2 PREPARATION

- A. Subgrade Preparation:
  - 1. After proof rolling, the exposed subgrade beneath pavement areas should be scarified and reworked to a depth of 12 inches, moisture added or removed as required, and the subgrade soils recompacted to a minimum of 95 percent of the maximum dry density of the materials obtained in accordance with ASTM D698 (standard Proctor test) and that is at or above the material's optimum moisture content, as determined by the same test. The rework and aggregate base should extend to at least 24-inches beyond the outside edges of curbs.
  - 2. Verify subgrade is in accordance with porous paving system manufacturer's instructions.
  - 3. Excavate area allowing for unit thickness, the engineered base depth, gravel overfill and a slight recession to contain gravel.
  - 4. Provide adequate drainage from excavated area if area has potential to collect water when working with in-place soils that have poor permeability.
  - 5. Ensure in-place soil is relatively dry and free from standing water.
  - 6. Uniformely grade base.
  - 7. Level and clear base of large objects such as rocks and pieces of wood.
- B. Base Preparation:

- 1. Aggregate base material should be uniformly compacted in maximum 6-inch lifts to a minimum of 95% of the maximum standard Proctor dry density (ASTM D698) and placed at a moisture content that is sufficient to achieve density.
- 2. Field density and moisture content testing should be performed at the rate of one (1) test per lift per 100 linear feet of drive aisle, and at the rate of one (1) test per lift per 5,000 square feet in parking and other open pavement areas.
- 3.3 INSTALLATION
  - A. Install in accordance with manufacturer's instructions.

#### 3.4 PROTECTION

A. Prohibit traffic on the permeable pavement system until installation is completed. Any traffic on the unfilled or unanchored system is a safety risk and subject to irreperable damage to the system.

#### 3.5 MAINTENANCE

- A. Keep area free of and remove organic material such as soil runoff, tree leaves, fruit, and other vegetation debris.
- B. Broom or rake gravel smooth to no more than 0.25" above the rings.
- C. Refill areas with gravel aggregate where walls of the rings are more than than 0.125" exposed.
- D. When snow removal is required, keep a metal edged plow blade from coming in contact with the surface during plowing operation to avoid causing damage to the units.

#### END OF SECTION





# UNIVERSITY OF NORTH TEXAS ADVANCED AIR MOBILITY (UAAM) TEST CENTER

APPLICABLE CODES AND STANDARDS
2018 INTERNATIONAL BUILDING CODE
ASCE 7-16
ACI 318-14
AISC 360-16
ASCE 19-16
218 INTERNATIONAL ENERGY CONSERVATION CODE
NFPA 70, NATIONAL ELECTRIC CODE
ANY OTHER CODES AND STANDARDS REFERENCED
IN THE GENERAL NOTES OR SPECIFICATIONS

SHEET INDEX		
SHEET		0.07.2022 - BID SET
GU.00		^ X
C1 00		X
$C_{2,00}$	SITE PLAN	X
C3.00	GRADING PLAN	X
C8.00	EROSION CONTROL PLAN	X
C9.00	CIVIL DETAILS	X
S0.00	COVER SHEET	Х
S0.01	GENERAL NOTES	Х
S2.01	OVERALL PLAN	Х
S2.10	PLANS, SECTIONS AND DETAILS	Х
S3.01	TYPICAL FOUNDATION SECTIONS AND DETAILS	Х
E0.01	ELECTRICAL SYMBOLS	Х
E1.01	LIGHTING PLAN	Х
E2.01	POWER PLAN	Х
E3.01	ELECTRICAL RISER DIAGRAM & SCHEDULES	Х
E4.01	ELECTRICAL DETAILS	Х
Т0.00	LOW VOLTAGE SYMBOLS	Х
T1.01	LOW VOLTAGE PATHWAYS PLAN	Х
T2.01	WIRELESS ACCESS PLAN	Х

	DRAWING LEGEND
X	ISSUED FOR INFORMATION AND COORDINATION
	ISSUED FOR CONSTRUCTION
Ø	SHEET REMOVED FROM SET



Walter P. Moore and Associates, Inc. 500 N Akard Street, Suite 2300 Dallas, Texas 75201 214.740.6235 FIRM REGISTRATION NO. 1856

## UNT ADVANCED AIR MOBILITY (UAAM) TEST CENTER

Client : University of North Texas Discovery Campus 3940 N Elm Street Denton, TX 76207

Consultants / Discipline :

Keyplan :

Issues/Revisions: **BID SET** No. | Date | Description Project UNT UAV Drawn By: CML Project Number M04-22008-00 Approved By: JDD Checked By : JDD Certification Statement : TO THE BEST OF THE ENGINEER'S KNOWLEDGE, THE PLANS AND SPECIFICATIONS COMPLY WITH THE APPLICABLE MINIMUM BUILDING CODES. Seal and Signature : X JAMES D. DAVIS JR Walter P. Moore and Associates, Ir TBPE Firm Registration No. 1856 Copyright (c) 2008 by Walter P. Moore and Associates, This document and the information herein is the property of Walter P Moore and Associates, Inc. No part hereof shall be duplicated, distributed, disclosed or used to any extent whatsoever except as expressly authorized by Walter P. Moore and Associates, Inc. Any person, firm, or corporation receiving this document, however obtained, shall by virtue hereof, be deemed to have agreed to the forgoing restrictions and that this document will be held in trust and confidence subject only to the private use expressly authorized by Walter P. Moore and Associates, Inc. Drawing Title: COVER SHEET Filename : Sheet No. :

G0.00









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ASPHALT ROAD

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LIMITS OF CONSTRUCTION -





- 3. DO NOT COMMENCE SITE CLEARING OPERATIONS UNTIL TEMPORARY EROSION AND SEDIMENTATION CONTROL MEASURES ARE IN PLACE.
- 4. NOTIFY UTILITY LOCATOR SERVICE FOR AREA WHERE PROJECT IS LOCATED BEFORE SITE CLEARING.
- 5. LOCATE AND CLEARLY FLAG TREES TO REMAIN OR TO BE REMOVED. 6. KNOWN UTILITIES ARE SHOWN ON DRAWINGS. IF UTILITIES ARE DISCOVERED THAT ARE NOT SHOWN CONTACT OWNER/ENGINEER FOR DIRECTION.
- 7. THAT PORTION OF THE SITE REQUIRED FOR CONSTRUCTING THE WORK UNDER THESE SPECIFICATIONS SHALL BE CLEARED OF ALL VEGETATION TO THE LIMITS AS DEPICTED IN THE PLANS.
- AFTER THE AREA HAS BEEN CLEARED OF ALL VEGETATION, THE TOP SIX INCHES OF SOIL SHALL BE STRIPPED. ALL STRIPPED TOPSOIL SHALL BE STOCKPILED.





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## UNT ADVANCED AIR MOBILITY (UAAM) TEST CENTER

Client : University of North Texas Discovery Campus 3940 N Elm Street Denton, TX 76207

Consultants / Discipline :

Proiect

Keyplan :

Issues/Revisions: **BID SET** No. | Date | Description Project UNT UAV Drawn By: CML Project Number M04-22008-00 Approved By: JDD Checked By : JDD Certification Statement : TO THE BEST OF THE ENGINEER'S KNOWLEDGE, THE PLANS AND SPECIFICATIONS COMPLY WITH THE APPLICABLE MINIMUM BUILDING CODES. Seal and Signature JAMES D. DAVIS J Walter P. Moore and Associates, Ind TBPE Firm Registration No. 1856 Copyright (c) 2008 by Walter P. Moore and Associates, This document and the information herein is the property of Walter P Moore and Associates, Inc. No part hereof shall be duplicated, distributed, disclosed or used to any extent whatsoever except as expressly authorized by Walter P. Moore and Associates, Inc. Any person, firm, or corporation receiving this document, however obtained, shall by virtue hereof, be deemed to have agreed to the forgoing restrictions and that this document will be held in trust and confidence subject only to the private use expressly authorized by Walter P. Moore and Associates, Inc. Drawing Title: DEMOLITION PLAN Filename : Sheet No. :

C1.00







- 2. FIELD VERIFY DEPTH OF EXISTING UTILITIES AT CROSSINGS WITH PIERS AND PROPOSED UTILITIES.
- 3. LOCATION OF UTILITY PADS TO BE CONFIRMED BY ELECTRICAL ENGINEER PRIOR TO PLACING OF PADS AND DECOMPOSED GRANITE.



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10. UTILITY PADS TO BE PLACED EIGHT INCHES ABOVE FINISHED GRADE.



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C300

Sheet No. :



- REINFORCED FILTER FABRIC FENCE NOTES:



TOPOGRAPHIC INFORMATION WAS OBTAINED FROM SURVEY BY GORRONDONA & ASSOCIATES, INC. DATED MAY 20, 2022. ALL BEARINGS ARE REFERENCED TO THE TEXAS COORDINATE SYSTE, NAD 83. ALL DISTANCES AND AREAS SHOWN ARE SURFACE. TXDOT SCALE FACTOR FOR DENTON COUNTY TEXAS 1.000150639.



- CONSTRUCTION ACTIVITIES BEGIN. 2. SEDIMENT AND EROSION CONTROLS INCLUDING
- NON-STORMWATER DISCHARGES SHALL BE AS PER THE SPECIFICATIONS.

EROSION CONTROL PLAN NOTES:

- . CONTRACTOR TO FURNISH SWPPP PER TCEQ REQUIREMENTS. THE EROSION CONTROL PLAN AS CONTAINED IN THE DRAWING SET CAN BE USED IN THE STORM WATER POLLUTION PREVENTION PLAN
- 2. CONTRACTOR SHALL IMPLEMENT INLET PROTECTION DEVICES, REINFORCED FILTER FABRIC BARRIER, STABILIZED CONSTRUCTION ENTRANCES AND OTHER STORM WATER POLLUTION PREVENTION MEASURES AT LOCATIONS SHOWN ON THE PLAN(S) TO KEEP SILT AND/OR EXCAVATED MATERIALS FROM ENTERING THE STORM WATER INLETS AND DITCHES, EVENTUALLY POLLUTING THE RECEIVING STORM SYSTEM. NO HAY BALES WILL BE ALLOWED.
- 3. DURING THE EXCAVATION/FILL PHASE OF THE PROJECT, CONTRACTOR SHALL SCHEDULE THE WORK IN APPROPRIATE SEGMENTS SO THAT EXCESS MATERIAL CAN BE QUICKLY HAULED AWAY PREVENTING IT FROM STAYING UNCOLLECTED ON THE EXISTING PAVEMENT. ANY LOOSE EXCAVATED MATERIAL WHICH FALLS ON PAVEMENT OR DRIVEWAYS SHALL BE REMOVED APPROPRIATELY.
- 4. CONTRACTOR SHALL CLEAN UP THE EXISTING STREET INTERSECTIONS AND DRIVEWAYS DAILY AND ADDITIONALLY AS NECESSARY TO REMOVE EXCESS MUD, SOIL, SILT OR ROCK TRACTED FROM THE EXCAVATED AREA.
- 5. CONTRACTOR SHALL FOLLOW GOOD HOUSEKEEPING PRACTICES DURING THE CONSTRUCTION OF THE PROJECT, ALWAYS CLEANING UP DIRT AND LOOSE MATERIAL AS CONSTRUCTION PROGRESSES.
- 5. CONTRACTOR TO INSPECT AND MAINTAIN THE AREAS LISTED BELOW AT LEAST ONCE EVERY FOURTEEN (14) CALENDAR DAYS AND WITHIN 24 HOURS OF THE END OF A STORM EVENT OF 0.5 INCHES OR GREATER.
- A. DISTURBED AREAS OF THE CONSTRUCTION SITE THAT HAVE NOT BEEN FINALLY STABILIZED. B. AREAS USED FOR STORAGE OF MATERIALS THAT ARE
- EXPOSED TO PRECIPITATION C. STRUCTURAL CONTROL MEASURES.
- D. LOCATIONS WHERE VEHICLES ENTER OR EXIT THE SITE.
- . CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING EXISTING DITCHES AND/OR CULVERTS FOR UNOBSTRUCTED DRAINAGE AT ALL TIMES. WHERE SODDING IS DISTURBED BY EXCAVATION ON BACKFILLING OPERATIONS. SUCH AREAS SHALL BE REPLACED BY SEEDING OR SODDING. SLOPES STEEPER THAN 4:1 SHALL BE REPLACED BY BLOCK SODDING. SLOPES STEEPER THAN 3:1 SHALL BE STABILIZED WITH PLANT MATERIALS NOT REQUIRING MOWING FOR MAINTENANCE AND/OR GEOTEXTILE FABRICS AS REQUIRED IN THE PLANS AND SPECIFICATIONS.



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NOTE: CONTRACTOR SHALL IDENTIFY AND PROTECT ALL TREES PRIOR TO CONSTRUCTION.

CONSTRUCTION DEBRIS SHALL BE PLACED WITHIN THE PROTECTIVE FENCING.

TREE PROTECTION DETAIL

4. THE RPZ SHALL BE COVERED WITH A MIN. 4" LAYER OF MULCH TO REDUCE MOISTURE STRESS.



<u>GENERAL NOTES:</u>

OR LOWERED MORE THAN 3".

NOT TO SCALE

(4)

- 1. THE RPZ SHALL BE DETERMINED BY TREE SIZE (1 FOOT RADIUS FROM TRUNK FOR EVERY 1" DIAMETER OF TRUNK CALIPER AT 4.5' FROM GROUND)
- WITH A MINIMUM 5' FROM THE TRUNK. ROOT PROTECTION ZONES MAY OVERLAP. SEE TREE PROTECTION DETAIL THIS SHT.

- 2. A 4' CHAIN LINK, GEOTEXTILE OR ORANGE MESH FENCE BARRIER AROUND THE RPZ SHALL BE ERECTED AND MAINTAINED UNTIL CONSTRUCTION IS COMPLETE. SEE TREE PROTECTION DETAIL ON THIS SHT.

5. ANY DAMAGE DONE TO EXISTING TREE CROWNS OR ROOT SYSTEMS SHALL BE REPAIRED IMMEDIATELY. ALL WOUNDS TO LIVE OAKS SHALL BE PAINTED WITH PRUNING PAINT NO LONGER THAN 30 MINUTES AFTER THE DAMAGE. ROOTS EXPOSED DUE TO CONSTRUCTION ACTIVITY SHALL BE CUT CLEANLY.

6. THE PROPOSED FINISH GRADE AND ELEVATION OF LAND WITHIN THE ROOT PROTECTION ZONE OF ANY TREE TO BE PRESERVED SHALL NOT BE RAISED

7. PROTECT ALL EXISTING TREES NEAR AREAS TO BE STABILIZED FROM UNDERGROUND CONTAMINANTS BY PLACING A 6 MIL. (.15 mm) PLASTIC FILM BARRIER ALONG EXPOSED VERTICAL CUT EXTENDING A MINIMUM 12 INCHES INTO UNDISTURBED SUBGRADE BELOW DEPTH OF STABILIZATION.

3. THE RPZ SHALL BE SUSTAINED IN A NATURAL STATE AND SHALL BE FREE FROM ANY CONSTRUCTION ACTIVITY. NO FILL, EQUIPMENT, LIQUIDS, OR



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C900

Sheet No. :



### APPLICABLE CODES AND STANDARDS:

- 2018 INTERNATIONAL BUILDING CODE

- ANY OTHER CODES AND STANDARDS REFERENCED IN THE GENERAL NOTES OR



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214.740.6200

Project

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P	ART I - DESIGN CRITERIA	PART III - REINFORCED CON
А. В. С.	<pre>GENERAL BUILDING CODE 1. The Construction Documents are based on the requirements of the International Building Code 2018. DEAD LOADS 1. Netting Dead Loads: An allowance of 5 PSF or the actual weight of the netting, whichever is greater, has been made for partitions as a uniformly distributed dead load. LIVE LOADS</pre>	A. CLASSES OF CONCRETE 1. All concrete shall conform to the r below unless noted otherwise. Usage 28 Day comp Cond Strength (PSI) PIERS AND 5000 PIER CAPS <u>Remarks:</u> 1. In addition to minimum strength
D.	<ol> <li>UNT provided Drone Impact Load: Impact loading for a maximum 150 lbs drone traveling at maximum speed of 35 mph and maximum propeller speed of 2,000 rpm with maximum diameter of 60 cm.</li> <li>WIND LOADS</li> <li>Wind pressures are based on the provisions of the American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures, ASCE 7-16 and the following criteria:</li> </ol>	<ol> <li>In addition to minimum strength proportioned for maximum water</li> <li>B. HORIZONTAL CONSTRUCTION JOINTS IN CONCRE</li> <li>1. There shall be no horizontal constr pours unless shown on the drawings. all deviations or additional joints</li> <li>C. REINFORCING STEEL</li> </ol>
Б. Б.	<ul> <li>a. Ultimate design wind speed (Wult): 107 MPH (3 second gust)</li> <li>b. Nominal design wind speed (Wult): 80/PH (3-second gust)</li> <li>c. Building risk category: II</li> <li>d. Wind exposure category: 0</li> <li>e. Internal pressure coefficient (GGpi): 0</li> </ul> SEIGNIC DESION CHITENIA 1. The structure and components of the building code with the following privative: <ul> <li>a. 0.2 sec. Spectral Acceleration (35): 12.4%</li> <li>b. 1 sec. Spectral Acceleration (13): 5.8%</li> <li>c. 3.16 Coefficient, 1 sec. period (73): 1.3</li> <li>c. 5.16 Coefficient, 1 sec. period (73): 1.5</li> <li>d. 5.16 Coefficient, 1 sec. period (73): 1.5</li> <li>d. 5.16 Coefficient, 1 sec. period (74): 1.5</li> <li>d. 5.16 Coefficient, 1 sec. period (75): 1.6</li> <li>d. Scismic Bespone Coefficient: Not Applicable</li> <li>d. Scismic Coefficient: Not Applicable</li></ul>	<ol> <li>All Reinforcing Steel shall conform otherwise on the drawings or in the</li> <li>Reinforcing Steel: Provide reinforcing st noted on the drawings.         <ul> <li>Field welding to be done by weig for reinforcing steel. Continuu is required.</li> <li>Shop welds must be performed in shop.</li> </ul> </li> <li>Deformed Bar Anchors: 3/8" to 5/8"         <ul> <li>T.1) studs manufactured in conforma with a minimum yield strength 70,00 A706 bars of equal size with welds strength of anchor. ASTM A 615 rein for deformed bar anchors.</li> <li>Headed Stud Anchors for Embedded P1 manufactured in conformance with sp tensile strength of 61,000 PSI.</li> <li>Headed Shear Studs for Shear Reinfor minimum yield strength of 51,000 PS</li> <li>Smooth Welded Wire Reinforcement: A 65,000 PSI.</li> <li>Deformed Welded Wire Reinforcement it shall be continuous across the e interrupted by beams or girders and and 25.5.4.</li> </ul> </li> <li>REINFORCEMENT IN TOPPING SLABS         <ul> <li>Provide minimum reinforcement as no unless specified otherwise on the d a. Welded smooth wire reinforcement</li> <li>Reinforcing steel coverage shall co specified in details labeled "TYPIO S.01 unless noted otherwise on the specified shall be considered minim reinforcing steel intersects for di structural members not specified in requirements of ACI 318 unless spec reinforcing steel shall ad intersecting reinforcing steal shall not be le reinforcement in concrete slabs shal specified for the reinforcing steal heads or base rails shall not be le reinforcement in concrete slabs shal specified for the reinforcing steal heads or base rails shall not be le reinforcement in the type of member reinforcement is placed. Cover in s conform to the requirements of ACI drawings.</li> <ul> <li>WALL AND COLUMN DOWELS</li> <li>Splice Location And Type and Hooks And Walls:</li></ul></ul></li></ol>
Р А. в.	<ul> <li>ACTIONATION</li> <li>ACTIONATION</li> <li>ACTIONATION REPORT</li> <li>Sumdation design is based on the geotechnical investigation report as follows: "GEOTECHNICAL INVESTIGATION, D&amp;S ENGINEERING #6522-2040, UNT OUTDOOR TESTING FACILITY, DENTON, TX" DATED JUNE 9, 2022.</li> <li>The geotechnical report is available to the General Contractor upon request to the Owner. The information included therein may be used by reduest 10 of such data therein:</li> <li>DETE FOUNDATION TYE</li> <li>Person Contractor for their general information only. The Architect and Engineer will not be responsible for the accuracy or applicability of such data therein.</li> <li>DETILLE PERSON PERS</li></ul>	

	GENERAL STRUCTURAL NOTES	
ICRETE	PART IV - STRUCTURAL STEEL	PART VI - SUE
equirements as specified in table	<ul> <li>A. MATERIAL</li> <li>1. Hot Rolled Structural Members: All hot rolled steel plates, shapes, sheet piling, and bars shall be new steel conforming to ASTM</li> </ul>	A. SUBMITTAL LIST AND 1. The General C of all submit
Type Max Size Agg Remarks	Specification A 6. 2. ASTM Specification and Grade: Clearly mark the grade of steel on each piece, with a distinguishing mark visible from floor surfaces, for the purpose of field inspection of proper grade of steel. Unless noted	the start of kept current organized as a. Shop Draw b. Design Ca c. Product D
requirement, concrete shall be	<ul> <li>a. W- and WT-Shapes: ASTM A 992</li> <li>b. M- and S-Shapes: ASTM A 36</li> <li>c. C-Shapes: ASTM A 36</li> <li>d. L-Shapes: ASTM A 36</li> </ul>	B. SUBMITTALS TO BE F
TE POURS TE Architect/Engineer shall approve	<ul> <li>e. Round HSS: ASTM A 500, Grade B (Fy=42 kS1)</li> <li>f. Rectangular HSS: ASTM A 500, Grade B (Fy=46 ksi)</li> <li>g. Jumbo Square and Rectangular Hollow Structural Sections: Built to physical and dimensional criteria of ASTM A 500 from ASTM A572 Grade 50.</li> </ul>	provided: a. Layout of Items Att Attachmer
in writing.	<ul> <li>n. Steel Pipes: ASIM A 53 (Types E or S), Grade B.</li> <li>i. Built-Up Columns: <ol> <li>Plates to 4" thick inclusive: ASTM A 572, Grade 50.</li> <li>Built-Up Columns: <a href="https://www.sciences.static-conform">ASTM A 572</a>, Base Plates: All base plates shall conform to ASTM A 572</li> </ol> </li> </ul>	2. Deferred Subm a. The follo registere
ing steel conforming to ASTM A eel required to be welded and where	<ol> <li>Connection Material:         <ol> <li>Connection Material:                 <ol> <li>Beam Column Continuity Plates and Doubler Plates: ASTM A 572, Grade 50.</li> <li>All connection material, except as noted otherwise herein</li></ol></li></ol></li></ol>	2) Exca 3) Nett 4) Meta 5) Stru
ders certified by the LADBS bus inspection by a deputy inspector a an LADBS-licensed fabrication	stiffener plates, filler plates, angles, etc. shall conform to ASTM A 572, Grade 50 unless a higher grade of steel is required by strength and provided the resulting sizes are compatible with the connected members. m. Other Steel: Any other steel not indicated otherwise shall	Notes: (S&S) Item delegated des
diameter AWS D1.1 Type C (Table nce with specification ASTM A 1064 O PSI. 3/4" or larger diameter, ASTM to steel substrate that develop full	conform to ASTM A 992 or ASTM A 572, Grade 50, except plates and angles that shall be ASTM A 36. B. CONNECTIONS	project speci the project i (REC) Item Record Only a
forcing bars shall not be substituted ates: AWS D1.1 Type A studs ecification ASTM A 29 with a minimum	1. Connection details not completely detailed on the drawings including material grade and sizes, weld sizes, and number of bolts shall be designed by the Contractor per the specifications. Conceptual connection details with the required member design forces are shown on the drawings and are applicable to all connections not designed and	affixed. b. Documents the regis building
rcement: ASTM A 1044 with a I.	fully detailed on the drawings. The conceptual details are provided only to indicate the connection type required and may not fully represent the complexity of the connection as required by the final connection design for the forces they must resist. Additional connection elements may not be specifically shown in the conceptual details but may be required by	c. Deferred deferred official. 3. Submittals wi
STM A 1064, yield strength ASTM A 1064, yield strength	the final connection design, such as stiffener plates, doubler plates, supplement/ reinforcing plates or other connection material. The fabricator is responsible for engaging the services of a connection specialty engineer to prepare a final connection design for submission that meets the requirements of the conceptual connection details and	a. Mechanica 4. Submittal Req a. All shop by the Ge
is specified as reinforcement, ntire concrete surface and not	resists the indicated design forces. 2. Refer to the Specifications for additional requirements. 3. Reactions noted on the plans are based on factored loads and are	b. Contracto document c. The omiss by the Co Contracto
ted below in all topping slabs	intended for use with the Load and Resistance Factor design method. C. STRUCTURAL BOLTS AND THREADED FASTENERS 1. A 325 Bolts: All bolts in structural connections shall conform to	C. REPRODUCTION
rawings. it 6x6-W2.9xW2.9.	ASTM A 325 Type 1, unless indicated otherwise on the drawings. 2. A 490 Bolts: See drawings for locations requiring ASTM A 490 Type 1 bolts.	documents by material supp their accepta obligates the
nform to the requirements AL CLEAR CONCRETE COVER" on sheet drawings. Cover	a. ASTM A 36. b. ASTM A 572 Grade 50 (to 2 inches in diameter).	PART VII - MIS
ums that may require increasing where fferent member types. Cover in the details shall conform to the ified otherwise on the drawings. The just reinforcing steel cage sizes at	4. Pins: All pins in pin connected members shall conform to ASTM A 36 and ASTM A 108 for pins four inches in diameter or less, and to ASTM A 668 Class D (Fy = 37,500 PSI) for pins greater than four inches in diameter.	A. CONTRACT DOCUMENTS 1. It is the res Contract Docu
with minimum specified cover.	D. WELDING 1. Unless noted otherwise, electrodes for welding shall conform to E70XX (SMAW), F7XX-EXXX (SAW), ER70S-X (GMAW), or E7XT-X (FCAW).	all subcontra drawings, fab field. 2 The contract
se rails of headed shear stud ll conform to the requirements cover. The concrete cover for the ss than that required for the in which the headed shear stud	<ol> <li>Electrodes for Grade 60 or Grade 65 material shall conform to E80XX (SMAW), F8XX-EXX-XX (SAW), ER80S-X (GMAW), or E8XT-X (FCAW).</li> <li>E. ANCHOR RODS</li> </ol>	finished stru indicate the supervise and construction
318 unless specified otherwise on the	<ol> <li>Unless indicated otherwise in the Column Schedule or on the drawings, anchor rods shall conform to ASTM F 1554 Grade 55 (with Supplementary Requirement S1) and the size shall be 3/4" diameter and shall embed into the concrete foundation a distance of 1'-0" with a heavy hex nut at the embedded end. Strike bolt threads at the embedded end at two places below the nut.</li> </ol>	3. Openings thro and/or condui verify sizes Electrical, P subcontractor
f the specified of the specified otherwise on the drawings. All bars , unless noted otherwise.	<ul> <li>F. GROUT</li> <li>1. Grout below structural steel base plates shall be non-metallic, non-shrink grout with a minimum strength of 6,000 psi when bearing on</li> <li>2.000 psi compare on lange a strength of 2.000 psi when bearing on</li> </ul>	4. Refer to draw including: Ty depressions a required by A
For Unscheduled Beams, Slabs eams and slabs, including grade op bars lapped at midspan between	3,000 psi concrete or less, a strength of 8,000 psi when bearing on concrete between 3,000 and 4,000 psi, and, unless noted otherwise on the drawings, a strength of 8,000 psi when bearing on concrete greater than 4,000 psi.	<ol> <li>5. Where member are either lo located membe</li> <li>6. If certain fe</li> </ol>
splice. Bottom bars shall be lapped tension splice. All beam bars shall unless noted otherwise. placed on the dirt face side	PART V - SPECIAL INSPECTIONS	drawings or i same characte B. DRAWING CONFLICTS
veen supports with a Class B tension posite the dirt face side shall be Class B tension splice. Horizontal on splice.	<ul> <li>A. The Owner's testing laboratory shall provide special inspection services in accordance with the International Building Code for the following items.</li> <li>B. Special inspection perpents and a final perpent in accordance with IPC</li> </ul>	1. The General C Structural dr drawings and prior to the
	<ul> <li>Special inspection reports and a final report in accordance with fBC Section 1704.2.4 shall be submitted to the building official prior to the time that phase of the work is approved for occupancy.</li> <li>1. Steel Construction:</li> </ul>	C. CONFLICTS IN STRUC 1. Where conflic contract docu
	<ul> <li>b. High-Strength Bolting</li> <li>c. Inspection of Structural Steel, Bolting, Welding Material</li> <li>d. Welding of Structural Steel</li> </ul>	specification Engineer, sha D. EXISTING CONDITION
	<ul> <li>a. Bolts Installed in Concrete</li> <li>b. Concrete Work</li> <li>c. Continuous Inspection of Reinforcing Steel Placing</li> <li>d. Epoxy Bolts</li> <li>e. Formwork</li> </ul>	1. The General C of the existi from assumed Engineer prio
	<ul> <li>f. Reinforcing Steel Placement</li> <li>g. Welding of Reinforcing Steel</li> <li>3. Soils:</li> <li>a. Prepared Earth Fill</li> </ul>	<ol> <li>Work shown on</li> <li>Existing consideration consideration of end</li> </ol>
	<ul> <li>4. Deep Foundations:</li> <li>a. Pier Foundations</li> <li>5. Spraved Fire-Besistant Materials</li> </ul>	However, the necessarily c information. 4. Demolition, c
	<ul> <li>6. Mastic and Intumescent Fire-Resistant Coatings</li> <li>7. Wind Requirements: <ul> <li>a. Main Windforce-Resisting Systems</li> </ul> </li> </ul>	performed wit integrity of MEP members n Architect sha removal of th
	b. Roof Cladding c. Windforce-Resisting System Connections to Foundation d. Wind-Resisting Components	5. The contracto existing supp shoring metho of the contra
	<ul> <li>C. STATEMENT OF SPECIAL INSPECTIONS</li> <li>1. Special inspection is required for the items listed above. Refer to Specification Section 014529 for type and extent of each special</li> </ul>	<ol> <li>The contracto prior to the utilities tha</li> <li>The contracto</li> </ol>
	inspection and each test. The Specification also indicates whether continuous or periodic inspection is required for the items listed above additional information.	E. ADJACENT BUILDINGS
		1. The General C used will not shall include
		∠. The General C surveys and o start of and

BMITTALS	PART VII - MISCELLANEOUS (CONTINUED)		
<pre>BMITTALS ND SCHEDULE Contractor shall prepare a detailed list and schedule ttal items to be sent to the Structural Engineer prior to   construction. This list shall be updated and revised and   as the job progresses. The submittal list shall be   shown below: awings Calculations Data, Certificates, Reports, and Other Literature PROVIDED TO STRUCTURAL ENGINEER ubmittals: In addition to the submittals required by   al specifications, the following submittals shall be   of Embedded Items (Plates, Angles, Bolts, etc.) or   ttached to the Structural Frame for Building Cladding   ent or for Attachment of Other Items. mittals: lowing items are considered deferred submittals by the red design professional in responsible charge: avation Retention (Permanent) (S&amp;S) avation Retention (Temporary) (S&amp;S, REC)   ting Structural Steel, Cable, and Net (S&amp;S)   al Fabrications, Railings, and Gratings (S&amp;S)   uctural Steel Connections (S&amp;S)  ms marked thus shall have the shop drawings and   sign submittals (including calculations) sealed per the   ifications by an engineer registered in the state where   is located. </pre>	<ul> <li>PART VII - MISCELLANEOUS (CONTINUED)</li> <li>F. RESPONSIBILITY OF THE CONTRACTOR FOR STABILITY OF THE STRUCTURE DURING CONSTRUCTION</li> <li>1. All structural elements of the project have been designed by the structural Engineer to resist the required code vertical and lateral forces that could occur in the final completed structure only. The ability of the structural frame to resist the required code forces derives from the complete installation of the lateral force resisting systems and diaphragms described below. It is the responsibility of the contractor to design and provide all required bracing during construction to maintain the stability and safety of all structural elements during the construction process until the lateral-load resisting or stability-providing system is completely installed and all designated concrete elements (if any) have reached a minimum of 75% of their design strength. This includes designing for all applicable temporary, construction and environmental forces per ASCE 37 including but not limited to wind and seismic on the structure during construction. The required structural elements are: <ul> <li>a. Base Enclosure Structure</li> <li>Pier caps</li> <li>Structural steel poles</li> </ul> </li> <li>6. RESPONSIBILITY OF THE CONTRACTOR FOR CONSTRUCTION LOADS</li> </ul>		
<pre>ms marked thus shall be submitted to Englieer for and will not have the Engineer's shop drawing stamp ts for deferred submittal items shall be submitted to istered design professional and shall be forwarded to the g official. d submittal items shall not be installed until the d submittal documents have been approved by the building l. with Impact to Structure: cal Equipment Weights quirements: o drawings must be reviewed and electronically stamped General Contractor prior to submittal. tor shall provide the submittal in electronic portable t format (PDF) per the Specifications. ssion from the shop drawings of any materials required Contract Documents to be furnished shall not relieve the tor of the responsibility of furnishing and installing such ls, regardless of whether the shop drawings have been d and approved.</pre>	<ul> <li>construction loads that are in excess of the stated design loads. The Structural Engineer is not responsible to design or check the structur for loads applied to the structure for any construction activity.</li> <li>H. CONTRACTOR SUBSTITUTIONS <ol> <li>Any materials or products submitted for approval that are different from the material or products specified in the structural contract documents will be approved only if the following criteria are satisfied: <ol> <li>A cost savings to the Owner is documented and submitted with the request.</li> <li>The material or product has been approved by the International Code Council (ICC) and the ICC report is submitted with the request.</li> <li>The ICC ESR that is submitted must reference the building code under which the project is permitted.</li> </ol> </li> <li>Submittals not satisfying the above criteria will not be considered.</li> </ol></li></ul>		
<pre>lectronic files or reproductions of these contract any contractor, subcontractor, erector, fabricator, or plier in lieu of preparation of shop drawings signifies ance of all information shown hereon as correct, and emselves to any job expense, real or implied, arising due to hat may occur hereon. SCELLANEOUS TS sponsibility of the General Contractor to obtain all uments and latest addenda and to submit such documents to actors and material suppliers prior to the submittal of shop brication of any structural members, and erection in the structural drawings and specifications represent the ucture, and, except where specifically shown, do not method or means of construction. The Contractor shall d direct the work and shall be solely responsible for all means, methods, procedures, techniques, and sequence. ough floors, roofs, and walls for ducts, piping, it shall be coordinated by the contractor. Contractor shall and locations of holes and openings with the Mechanical, Plumbing, and Fire Protection drawings and the respective rs. wings other than Structural for complete information ypes of floor slab finishes and their locations, floor slab and curbs, openings in structural walls, roofs and floors Architectural and MEP features, stairs, ramps, etc. · locations are not specifically dimensioned, members ocated on columns lines or are equally spaced between ers. eatures are not fully shown or specified on the in the specifications, their construction shall be of the er as shown or specified in similar conditions.</pre>	<ul> <li>h. Michael and the superior of the Structural Engineer for verification of loads used in the design at least three weeks prior to fabrication and construction of the supporting structure.</li> <li>J. THE STRUCTURAL ENGINEER'S ROLE DURING CONSTRUCTION <ol> <li>The Engineer shall not have control nor charge of, and shall not be responsible for, construction means, methods, techniques, sequences, or procedures, for safety precautions and programs in connection with the work, for the acts or omission of the Contractor, Subcontractor, or any other persons performing any of the work, or for the failure of any of them to carry out the work in accordance with the contract documents.</li> </ol> </li> <li>Periodic site observation by field representatives of Walter P. Moore and Associtates is solely for the purpose of becoming generally familiar with the progress and quality of the Work completed and determining, in general, if the Work observed is being performed in a manner indicating that the Work, but rather periodic in an effort to keep the Owner reasonably informed about the progress and quality of the purpose of other other to keep the Owner reasonably informed about the progress and quality of the portion of the structural completed.</li> </ul> K. MAINTENANCE STATEMENT <ol> <li>All structures require periodic maintenance to extend lifespan and to ensure structural integrity from exposure to the environment. A planned program shall include such items such as but not limited to painting of structural steel, protective coating for concrete, sealants, cauked joints, expansion joints, control joints, spalls and cracks in concrete, and pressure washing of exposed structural elements exposed to a salt environment or other harsh chemicals.</li></ol>		
S Contractor shall compare the Architectural and rawings and report any discrepancy between each set of within each set of drawings to the Architect and Engineer fabrication and installation of any structural members. JCTURAL REQUIREMENTS ct exists among the various parts of the structural uments, structural drawings, general notes, and ns, the strictest requirements, as indicated by the all govern. DNS Contractor shall verify all dimensions and conditions ing building at the job site and report any discrepancies conditions shown on the drawings to the Architect and or to the fabrication and erection of any members. In the drawings is New, unless noted as Existing. struction shown on the drawings was obtained from struction documents and limited site observation. These existing construction are available for contractor use. available drawings of existing construction are not complete. The contractor shall field verify all pertinent cutting, drilling, etc. of existing work shall be th great care so as not to jeopardize the structural the existing building. If any architectural, structural, or not designated for removal interfere with the new work, the all be notified immediately and approval obtained prior to hose members. or shall safely shore existing construction wherever ports are removed to allow the installation of new work. All ods and sequencing of demolition shall be the responsibility actor and their engineer. or shall verify the location of existing utilities start of construction and take care to protect existing at are to remain in service. or shall repair all damage caused during construction materials and workmanship to restore conditions to levels o the Architect. S AND PROPERTY Contractor shall ensure that all construction methods t cause damage to the adjacent buildings and property. This e all foundation installation.	PART VIII - DRAWING INTERPRETATION A. DRAWING VIEWS LABELED AS "TYPICAL" 1. Partial plans, elevations, sections, details, or schedules labeled with "Typical" at the beginning of their title shall apply to all situations occurring on the project that are the same or similar to these specifically shown. The applicability of the content of these views to locations on the plan can be determined from the title of the views. Such views shall apply whether or nor they are keyed in a teach location. Decisions regarding applicability of these "Typical" views shall be determined by the Structural Engineer.		

ral Contractor is advised to perform all photographic and other documentation of the adjacent buildings before the and during construction.



Walter P Moore and Associates, Inc. 500 N Akard Street, Suite 2300 Dallas, Texas 75201

214.740.6200

Project :

### UNT ADVANCED AIR MOBILITY (UAAM) TEST CENTER

<sup>Client :</sup> University of North Texas Discovery Campus 3940 N Elm Street Denton, TX 76207

Consultants /

Keyplan :

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THE FOUNDATION DESIGN INCLUDED HEREIN IS BASED UPON THE FOLLOWING DESIGN BASIS FOUNDATION LOADS:											
	AXIAL (VERTICAL) (KIPS)	SHEAR (HORIZONTAL) (KIPS)	MOMENT (KIP-FEET)								
CORNER POLE BASE (4 LOCATIONS)	650 (DOWN)	50 (ANY DIRECTION)	270 (ANY DIRECTION)								
INTERIOR POLE BASE (14 LOCATIONS)	130 (DOWN)	50 (ANY DIRECTION)	270 (ANY DIRECTION)								
CORNER GUY-WIRE TIE-DOWN (8 LOCATIONS)	510 (UPLIFT)	330 (IN DIRECTION OF CABLE)	0								
INTERIOR GUY-WIRE TIE-DOWN (14 LOCATIONS)	110 (UPLIFT)	65 (IN DIRECTION OF CABLE)	0								

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	FOUNDATION LAP SPLICE LENGTHS GRADE 60 REINFORCEMENT, NORMALWEIGHT CONCRETE													
	LAP CLASS	f'c = 30	00 PSI	f'c = 40	00 PSI	f'c = 50	00 PSI	f'c = 60	00 PSI	f'c = 70	00 PSI	f'c = 8000 PSI		
BAR SIZE		S BOTTOM OTHER BOTTOM OTHER BOTTOM BARS BARS BARS		OTHER BARS	BOTTOM BARS	OTHER BARS	BOTTOM BARS	OTHER BARS	BOTTOM BARS	OTHER BARS				
#5	А	17	22	15	19	13	17	12	16	12	14	12	14	
#5	В	22	28	19	25	17	22	16	20	16	19	16	18	
#6	А	20	26	18	23	16	20	14	19	13	17	13	16	
#0	В	26	34	23	29	20	26	19	24	17	22	16	21	
<u> 47</u>	А	29	38	25	33	23	29	21	27	19	25	18	23	
#1	В	38	49	33	43	29	38	27	35	25	32	23	30	
#0	А	33	43	29	37	26	34	24	31	22	28	21	27	
#0	В	43	56	37	49	34	44	31	40	28	37	27	35	
#0	А	41	54	36	46	32	42	29	38	27	35	25	33	
#9	В	54	69	46	60	42	54	38	49	35	46	33	43	
#10	А	51	66	44	57	39	51	36	47	33	43	31	41	
#10	В	66	85	57	74	51	66	47	61	43	56	41	53	
#11	А	61	79	53	68	47	61	43	56	40	52	37	49	
#11	В	79	103	68	89	61	80	56	73	52	67	49	63	









- NOTES: 1. ALL SPLICE LENGTHS ARE IN INCHES. 2. THIS TABLE SHALL ONLY BE USED FOR FOUNDATION LAP SPLICE LENGTHS OF BARS MEETING THE REQUIREMENTS IN NOTES 3 THROUGH 5.
- 3. CENTER TO CENTER SPACING OF BARS SHALL NOT BE LESS THAN 4". 4. WHERE BAR SPACING IS LESS THAN 8", LAP SPLICES AT ALL LOCATIONS SHALL BE STAGGERED.
- 5. CONCRETE COVER TO THE SPLICED BARS SHALL NOT BE LESS THAN 2" (CLEAR). 6. A BOTTOM BAR IS DEFINED AS ANY BAR THAT DOES NOT HAVE MORE THAN 12" OF FRESH
- CONCRETE BELOW THE BAR. 7. OTHER BARS INCLUDE TOP BARS AND ALL OTHER BARS THAT HAVE MORE THAN 12" OF
- FRESH CONCRETE BELOW THE BAR. 8. FOR EPOXY-COATED BARS, MULTIPLY THE TABULATED SPLICE LENGTHS OF BOTTOM BARS BY 1.5 AND THE TABULATED SPLICE
- LENGTHS OF OTHER BARS BY 1.3. 9. WHEN LAP SPLICING BARS OF DIFFERENT SIZES, THE LAP LENGTH IS DETERMINED BY THE SMALLER BAR BUT MAY NOT BE LESS THAN THE "CLASS A" SPLICE LENGTH OF THE
- LARGER BAR. 10. FOR CONCRETE STRENGTHS IN BETWEEN THOSE TABULATED HERE, USE DEVELOPMENT AND LAP SPLICE LENGTHS OF LOWER CONCRETE STRENGTH.

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## TYPICAL FOUNDATION LAP SPLICE LENGTHS

DRILLED PIER REINFORCEMENT SCHEDULE											
PIER ID	DIAMETER (INCHES)	VERTICAL REINFORCEMENT	TIES	BATTER ANGLE FROM VERTICAL (DEGREES)							
P42	42	10-#11	#4@4"	0 (NO BATTER)							
P48	48	14-#11	#4@10"	0 (NO BATTER)							
P60	60	20-#11	#4@12"	30							

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٨٥٥			ABBREVIATIONS, SYMBULS, AND NUTES	
AC ADO AF AFC AFF AT ATS C CB,C/B,CKT BKR CKT CLG D DC DP EG ELEC E, EM EP EWC EX F FA FA FAA FACU FCU FCU FCU FL GGND GEN GFI/GFCI HP HV, H IG JB, JBOX, J-BOX LTG LV MCA MCB MCC MDP MH MLO MTD MTD MTD MTH MTO MTH MTO MTP MTH MCA MCA MCA MCA MCA MCA MCA MCA MCA MCA	REVIATIONS ALTERNATING CURRENT AUTOMATIC DOOR OPENER AMPERE FRAME ABOVE FINISHED COUNTER ABOVE FINISHED FLOOR AMPERE TRIP AUTOMATIC TRANSFER SWITCH CONDUT CIRCUIT BREAKER CIRCUIT CIRCUIT BREAKER CIRCUIT CELLING DEMOLITION DIRECT CURRENT DISTRIBUTION PANEL EQUIPMENT GROUND ELECTRIC EXSTING FUSE FIRE ALARM FIRE ALARM ANNUNCIATOR FIRE ALARM CONTROL UNIT FAN COIL UNIT FAN COIL UNIT FULL LOAD AMPS FAN TERMINAL UNIT GROUND GENERATOR GROUND FAULT CIRCUIT INTERRUPTER HORSE POWER HIGH VOLTAGE PANEL (120/2089) MINIMUM CIRCUIT BREAKER MOTOR CONTROL CENTER MAIN DISTRIBUTION PANEL MAIN USTRIBUTION PANEL MAIN DISTRIBUTION PANEL MAIN USTRIBUTION PANEL MAIN USTRIBUTION PANEL MAIN DISTRIBUTION PANEL MAIN USTRIBUTION PANEL MAIN DISTRIBUTION PANEL MAIN DISTRIBUTION PANEL MAIN USTRIBUTION PANEL MAIN DISTRIBUTION PANEL MAIN PANEL PANE PANE PANE PANE PA	LIGHT FIXTURES         UPUELLIGHT FIXTURE         UPUELLIGHT FIXTURES         UPUELLIGHT FIXTURES	ABBREVIATIONS, SYMBOLS, AND NOTES SWITCHES & MISC.	
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Walter P. Moore and Associates, Inc. 500 N Akard Street, Suite 2300 Dallas, Texas 75201 214.740.6235 FIRM REGISTRATION NO. 1856

Project :



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Consultants / Discipline :



Keyplan :



Filename : Sheet No. :

E0.01



01 LIGHTING PLAN SCALE: 1" = 30 '- 0"

	LIGHT FIXTURE SCHEDULE													
TYPE	SIZE	DESCRIPTION	FINISH	MOUNTING	CCT	LUMENS	HOURS	WATTS	UNITS	DRIVER	VOLTAGE	MANUFACTURER	CATALOG NUMBER	NOTES
		AREA SITE		20FT ON						0-10V				
S1	26" X 13"	LIGHT	BLACK	NET POLE	5000	10,466	100,000	92	EACH	DIMMING	MVOLT	LITHONIA	DSX0-LED-P4-50K-T4M-MVOLT-RPA-DBLXD	
		AREA SITE		20FT ON						0-10V				
S1L	26" X 13"	LIGHT	BLACK	NET POLE	5000	6,523	100,000	92	EACH	DIMMING	MVOLT	LITHONIA	DSX0-LED-P4-50K-LCCO-MVOLT-RPA-DBLXD	
		AREA SITE		20FT ON						0-10V				
S1R	26" X 13"	LIGHT	BLACK	NET POLE	5000	6,523	100,000	92	EACH	DIMMING	MVOLT	LITHONIA	DSX0-LED-P4-50K-RCCO-MVOLT-RPA-DBLXD	
		AREA SITE		10FT ON						0-10V				
S2	26" X 13"	LIGHT	BLACK	NET POLE	5000	4,771	100,000	38	EACH	DIMMING	MVOLT	LITHONIA	DSX0-LED-P4-50K-TFTM-MVOLT-RPA-DBLXD	
GENERA	L NOTES:													
1- ALL RE	EQUESTS F	OR SUBSTITUTIC	NS/ALTER	NATES MUST	FBE SUBM	ITTED TO E	INGINEER	7 DAYS P	RIOR TO	BID FOR AP	PROVAL. AL	L SUBMISSIONS SI	HALL INCLUDE DETAILED CUT SHEETS AND PERFORMANCE	DATA

	LIGHTING NOTES:
1.	LIGHT FIXTURES TO HAVE INTEGRAL DAYLIGHT SENSOR AND MOTION SENSOR. AFTER 15 MIN OF INACTIVITY, LIGHTS TURN OFF. LIGHTS MANUALLY TURNED ON WITH KEYED SWITCH ONLY IF <3FC.
2.	SUBMIT LIGHTING PLAN TO Facilities.GIS@unt.edu.
	LIGHTING KEYED NOTES:
1.	RUN 2#10, #10G3/4"C. TO 1P/20A CIRCUIT BREAKER CIRCUIT AS SHOWN VIA TIME CLOCK.



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Consultants / Discipline :



Keyplan :



Filename : Sheet No. : E1.01



01 **POWER PLAN** SCALE: 1' = 30' - 0"

TRUE NORTH

	POWER NOTES:
1.	MOUNT PANEL ON UNISTRUIT.
2.	ALL RECEPTACLES TO BE TR/ WP/GFI.
	POWER KEYED NOTES:
1.	ROUTE CONDUIT IN PLENUM AROUND BLAST PROOF ROOM H155.
2.	MOUNT CONDUIT TO EXTERIOR OF BUILDING AT PLENUM HEIGHT.
3.	DIRECT BURY CONDUIT UNDERGROUND WITH TOP OF CONDUIT TO BE MINIMUM OF 24" BELOW GRADE. COORDINATE WITH EXISTING UNDERGROUND UTILITIES.
4.	EXISTING CSA PANEL WITH SPARE BREAKER.
5.	PROVIDE 1500W 5G EQUIPMENT AT 3FT ABOVE GROUND ON EXTERIOR OF POLE.
6.	PROVIDE (2) DUPLEXES AT POLE MOUNTED AT 3FT AND 10FT ABOVE GROUND. TYPICAL ALL POLES WITH (2) DUPLEXES.
7.	NEW PANEL 'D' MOUNTED ON UNISRUIT. REFER TO SHEET E3.01 FOR ADDITIONAL INFORMATION.
8.	NEW TRANSFORMER 'XFR-D' SET ON TOP OF PAD 8" ABOVE FINAL GRADE. REFER TO SHEET E3.01 FOR ADDITIONAL INFORMATION. PROVIDE 3.5FT CLEAR IN FRONT OF XFR.
9.	PROVIDE 120V,1P,20A DEDICATED CIRCUIT TO DATA SWITCH.
10.	PROVIDE 120V,1P,20A DEDICATED CIRCUIT TO UPS.
11.	PROVIDE 3/4"X 10FT GROUND ROD. TIE TRANSFORMER TO GROUND ROD VIA GROUNDING CONDUCTOR.
12.	DUPLEXES MOUNTED IN LOW VOLTAGE CABINET. REFER TO T1.01 FOR EXACT LOCATION.
13.	PROVIDE INTERMATIC ET 8015C TIME CLOCK IN LOCKABLE NEMA 3R ENCLOSURE.

14. ADD ALT #1: PROVIDE (2) DUPLEXES AT POLE MOUNTED AT 3FT AND 10FT ABOVE GROUND.



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# 01 ELECTRICAL ONE-LINE DIAGRAM

	MAIN SIZE:	100	А	MAIN T	YPE:	60 MC	В					SECTI	ON 1	P	ANEL	NAME:	D			
	AIC RATING:	10	,000	MOUN	TING:	SURF/	ACE					VOLTA	AGE:	208	/120V	3PH,4\	N			
		AMPS			LOAD (	(KVA)								LOAD (	KVA)			AMPS		
	DESCRIPTION	POLE	LTG	RCPT	MTR	HEAT	KITCH	MISC				MISC	KITCH	HEAT	MTR	RCPT	LTG	POLE	DESCRIPTION	
1	POLE LIGHTS CKT W	20/1	0.40						1	А	2						0.40	20/1	POLE LIGHTS CKT E	2
3	RECEPTS. CKT SW	20/1		0.36					3	В	4					0.36		20/1	RECEPTS. CKT S	4
5	5G EQUIP	20/1		1.50					5	С	6	1.00						20/1	SWITCH	6
7	UPS	20/1						1.00	7	А	8					0.36		20/1	RECEPTS. CKT S	8
9	RECEPTS. CKT SE	20/1		0.36					9	В	10	1.00						20/1	SWITCH. CKT S	10
11	RECEPTS. CKT NE	20/1		0.36					11	С	12					0.36		20/1	RCPT-NORTH 1	12
13	RECEPTS. CKT NE	20/1		0.36					13	А	14					0.36		20/1	RCPT-NORTH 2	14
15	TIME CLOCK 1	20/1						0.01	15	В	16					0.36		20/1	RCPT-NORTH 3	16
17	TIME CLOCK 2	20/1						0.01	17	С	18					0.36		20/1	RCPT-NORTH 4	18
19	RCPT-WEST 1	20/1		0.36					19	А	20					0.36		20/1	RCPT-EAST 1	20
21	RCPT-WEST 2	20/1		0.36					21	В	22					0.36		20/1	RCPT-EAST 2	22
23	RCPT-SOUTH 1	20/1		0.36					23	С	24							20/1	SPACE	24
25	RCPT-SOUTH 2	20/1		0.36					25	А	26							20/1		26
27	RCPT-SOUTH 3	20/1		0.36					27	В	28							20/1		28
29	RCPT-SOUTH 4	20/1		0.36					29	С	30							20/1		30
31		20/1							31	А	32							20/1		32
33		20/1							33	В	34							20/1		34
35		20/1							35	С	36							20/1		36
37	SPD	20/3							37	A	38							20/1		38
39	-	-							39	В	40							20/1		40
11	-	-							41	С	42							20/1		42
	TOTAL AMPS:	33.3	0.40	5.10	0.00	0.00	0.00	1.02				2.00	0.00	0.00	0.00	2.88	0.40			

**REMARKS:** 1. PROVIDE FACTORY MOUNTED 'SPD'.

	LO	AD (KV	A)	CONN.		DESN
LOAD	А	В	С	KVA	MULT	KVA
LIGHTING	0.80	0.00	0.00	0.80	1.25	1.00
RECEPTACLE	2.16	2.52	3.30	7.98	NEC	7.98
MOTOR	0.00	0.00	0.00	0.00	NEC	0.00
LARGEST MOTOR	HP:	1	FLC	4.60		8.00
VOLT/I	PHASE:	208/3	KVA	1.66		9.00
HEAT	0.00	0.00	0.00	0.00	1.00	0.00
KITCHEN	0.00	0.00	0.00	0.00	0.65	0.00
MISCELLANEOUS	1.00	1.01	1.01	3.02	1.00	3.02
TOTAL	3.96	3.53	4.31	11.80		12.00
SPARE	0	AT	0.5	EA	=	0.0
TOTAL + SPARE						12.0

33.3	TOTAL DESN AMPS:
60	Next Standard Bus Rating:
35	Next Standard Trip Rating:
100	SELECTED TRIP RATING:
	CALC. FAULT AT PNL:
0	Next Standard AIC Rating:
10	SELECTED AIC RATING:
XXX	PROJECT NAME:
XXXX	PROJECT NUMBER:

\_\_\_\_\_



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## 07 WALL MOUNTED CONDUIT SUPPORT DETAIL SCALE: NONE



## WATERTIGHT CONDUIT 08 PENETRATION - EXISTING STRUCTURE SCALE: NONE



# 04 GFCI RECEPTACLE WIRING DIAGRAM



# 05 PANELBOARD CLEARANCE DETAIL



- REFER TO NEC ARTICLE 110.26(E)(1)(a) THROUGH 110.23(E)(1)(d) FOR DEDICATED Q EQUIPMENT SPACE FOR ELECTRICAL EQUIPMENT 600V OR LESS.
- REFER TO NEC ARTICLE 110.26(A)(3) FOR HEIGHT OF WORKING SPACE FOR 3 ELECTRICAL EQUIPMENT 600V OR LESS.
- (2) REFER TO NEC ARTICLE 110.26(A)(2) FOR WIDTH OF WORKING SPACE FOR ELECTRICAL EQUIPMENT 600V OR LESS.
- NOTES BY SYMBOL: REFER TO NEC ARTICLE 110.26(A)(1)(a) THROUGH 110.26(A)(1)(c) FOR DEPTH OF WORKING SPACE FOR ELECTRICAL EQUIPMENT 600V OR LESS.









# 02 TRANSFORMER FLOOR MOUNTED DETAIL



# 01 TRANSFORMER FLOOR MOUNTED DETAIL



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	ABBREVIATIONS:			TELECOMMUNICATIONS
ACS			×	TYPICAL FOUR-PAIR UTP DROP LOCATION (X IDENTIFIES QUANTITY OF
AP AV	ACCESS POINT AUDIOVISUAL		POS x	POS FOUR-PAIR UTP DROP LOCATION (x IDENTIFIES QUANTITY OF
AWG AXT BACNET	AMERICAN WIRE GAUGE ALIEN CROSSTALK BUILDING AUTOMATION AND CONTROL NETWORH	к	W×	WALL-MOUNTED FOUR-PAIR UTP DROP LOCATION (X IDENTIFIES
BAS BCT	BUILDING AUTOMATION SYSTEMS BONDING CONDUCTOR FOR TELECOMMUNICATIO		•	TYPICAL 48"AFF.
CAT	CATEGORY CABLE TV	ERNATIONAL	×	FLUSH FLOOR-MOUNTED FOUR-PAIR UTP DROP LOCATION (X IDENTIFIES QUANTITY OF JACKS AND ASSOCIATED CABLING DROPS) TYPICAL 48"AFF
CCTV CM	CLOSED-CIRCUIT TV COMMON MODE		PRJ_x	CEILING MOUNTED PROJECTOR FOUR-PAIR UTP DROP LOCATION
CMP CMR COW	COMMUNICATIONS FLENOM CABLE COMMUNICATIONS RISER CABLE COMPUTER ON WHEELS		CAM <sub>⊥</sub> x	DROPS). TYPICAL 48"AFF.
CPU DAS	CENTRAL PROCESSING UNIT DISTRIBUTED ANTENNA SYSTEM			POWER OVER ETHERNET (IP-BASED CAMERA)
DBA DBU DM	DECIBEL UNIT DIFFERENTIAL MODE		BC x	BIO-CLOCK. TYPICAL 48"AFF.
DP DSP DSY	DEMARCATION POINT DIGITAL SIGNAL PROCESSOR DIGITAL SIGNAL CROSS CONNECT			CABLE TRAY
DVR EBC	DIGITAL SIGNAL CROSS-CONNECT DIGITAL VIDEO RECORDER EQUIPMENT BONDING CONDUCTOR			
EF EIA EMI	ENTRANCE FACILITY ELECTRONIC INDUSTRIES ALLIANCE ELECTROMAGNETIC INTEREERENCE			
EMS	ENERGY MANAGEMENT SYSTEM END-OF-LINE RESISTOR			
EPO ESD ESS	EMERGENCY POWER OFF ELECTROSTATIC DISCHARGE ELECTRONIC SECURITY AND SAFETY			SECURITY
FACP FDC	FIRE ALARM CONTROL PANEL FIBER DISTRIBUTION CENTER (RACK OR WALL M	OUNTED)		
FO FOC FTP	FIBER OPTIC FIBER OPTIC CABLE FOIL TWISTED PAIR			INTERIOR FIXED 110 DEGREE CAMERA
GC GEC	GENERAL CONTRACTOR GROUNDING ELECTRODE CONDUCTOR			
GUI HC HDMI	GRAPHICAL USER INTERFACE HORIZONTAL CROSS-CONNECT HIGH-DEFINITION MULTIMEDIA INTERFACE		ES	ELECTRIC DOOR STRIKE
HDTV HH	HIGH DEFINITION TV HANDHOLE		REX	REQUEST TO EXIT DEVICE
IBC IC ICT	INTERNATIONAL BUILDING CODE INTERMEDIATE CROSS-CONNECT INFORMATION AND COMMUNICATIONS TECHNOL	OGY	DS	DOOR SWITCH
ID IDF	INTERACTIVE DISPLAY INTERMEDIATE DISTRIBUTION FRAME		CR	CARD READER
IDS IP ISP	INTRUSION DETECTION SYSTEMS INTERNET PROTOCOL INSIDE PLANT		ACC	ACCESS CONTROLLER LOCATION
IT КVМ	INFORMATION TECHNOLOGY KEYBOARD/VIDEO/MOUSE		⊕ <sub>Al</sub>	AIPHONE INTERCOM (1-CAT6 DROP)
LAN LCD LED	LOCAL AREA NETWORK LIQUID CRYSTAL DISPLAY LIGHT-EMITTING DIODE		AI []	AIPHONE CONSOLE
LVD MC	LOW VOLTAGE DISCONNECT MAIN CROSS-CONNECT			INTRUSION DETECTION SYSTEM PANEL
MGB MM	MAIN DISTRIBUTION FRAME MAIN ELECTRICAL GROUNDING BUSBAR MULTIMODE		DPS	DOOR POSITION SWITCH (IDS)
MPP MPR	MULTIPURPOSE PLENUM CABLE MULTIPURPOSE RISER CABLE		S	SENSOR
NIST	NATIONAL INSTITUTE OF STANDARDS AND TECH NETWORK VIDEO RECORDER	NOLOGY	<sup>2</sup> PA	PUBLIC ADDRESS SYSTEM CONSOLE
OFNP OFNR	OPTICAL FIBER NON-CONDUCTIVE PLENUM OPTICAL FIBER NON-CONDUCTIVE RISER		PA ((>	DURESS PUSHBUTTON
OSP PA	OUTSIDE PLANT PUBLIC ADDRESS			
PDU POE POS	POWER DISTRIBUTION UNIT POWER OVER ETHERNET POINT OF SALE			
POTS PSTN	PLAIN OLD TELEPHONE SERVICE PUBLIC SWITCHED TELEPHONE NETWORK			
PTP PTZ RDP	POINT-TO-POINT PAN, TILT, AND ZOOM RATE DEMARCATION POINT			
REX RMU	REQUEST TO EXIT RACK MOUNTED UNIT			
RU SCS SM	RACK UNIT STRUCTURED CABLING SYSTEM SINGLEMODE			
SNR STP	SIGNAL-TO-NOISE RATIO SHIELDED TWISTED-PAIR			
TIA TBB TBC	TELECOMMUNICATIONS INDUSTRY ASSOCIATION TELECOMMUNICATIONS BONDING BACKBONE TELECOMMUNICATIONS BONDING CONDUCTOR	N		
TGB TMGB	TELECOM GROUNDING BUSBAR TELECOM MAIN GROUNDING BUSBAR			
TR UL UPS	TELECOMMUNICATION ROOM UNDERWRITERS LABORATORY UNINTERRUPTIBLE POWER SUPPLY			
USB UTP	UNIVERSAL SERIAL BUS UNSHIELDED TWISTED-PAIR			
VOIP WAP WLAN	VOICE OVER INTERNET PROTOCOL WIRELESS ACCESS POINT WIRELESS LAN			
		WIRFI FSS ACC		L NTS
((4))				
((@)		PROVIDE SLEEVE TH     OTHER DEVICES SU	ROUGH EXTERIOF	R WALL AT A HEIGHT NOT GREATER THAN 14 FEET AND IN LINE WITH CAMERAS.
		ROUTE SLEEVE WITH TRAY.	IN 1ST FLOOR CE	ILING INTO ADJACENT LOWER CEILING TOWARDS CABLE PATHWAY/CABLE
1		KEQUIKE SLEEVE TO     FIRE STOP ON BOTH		FAGE OF MASONKY (MAXIMUM 1/4" PROTRUSION). • AT 1·10 TO THE OUTSIDE TO PREVENT MOISTURE INFILTRATION

• WAP INSTALLATION DOES NOT REQUIRE PREDRILLED OR PRECAST ANCHOR SUPPORT.

### GENERAL CONDITIONS:

- THE DRAWINGS ARE GENERALLY DIAGRAMMATIC. THE CONTRACTOR SHALL PROVIDE TELECOMMUNICATION AND SECURITY RACEWAYS TO INCLUDE SERVICE ENTRANCE RACEWAYS, HORIZONTAL LADDER TRAY, WIRE MESH CABLE TRAY, IN-WALL CONDUIT AND BACKBOXES, J-HOOKS, HANGERS, FACEPLATES, AND PULLSTRINGS IN COMPLIANCE WITH THE DIVISION 27 AND 28 SPECIFICATIONS.
- SYMBOLS FOR VARIOUS ELEMENTS AND SYSTEMS ARE SHOWN ON THE DRAWINGS. SHOULD THERE BE ANY DOUBT REGARDING THE MEANING OR INTENT OF THE SYMBOLS USED, AN INTERPRETATION SHALL BE OBTAINED FROM THE RCDD
- 3. THE SCALE OF EACH DRAWING IS RELATIVELY ACCURATE; ANY DIMENSIONS SHOWN ARE APPROXIMATE TO CENTERLINE FROM ASSUMED BUILDING PERIMETER. THE CONTRACTOR SHALL OBTAIN THE NECESSARY DIMENSIONS FOR ANY EXACT TAKEOFFS FROM THE ARCHITECT.
- 4. ONLY EXPERIENCED CRAFTSMEN KNOWLEDGEABLE IN THEIR RESPECTIVE TRADE SHALL PERFORM THE WORK DESCRIBED IN THE CONSTRUCTION DOCUMENTS.
- 5. ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE 2020 EDITION OF THE NFPA STANDARD 70 (NATIONAL ELECTRICAL CODE). CONTRACTOR SHALL ALSO CONFORM TO ALL APPLICABLE LOCAL CODES AND AMENDMENTS.
- 6. ALL TELECOMMUNICATIONS RACEWAYS SHALL BE NEW AND SHALL MEET NEMA AND ANSI STANDARDS AND SHALL BEAR THE UL LABEL. TELECOMMUNICATION CABLING CANNOT SHARE THE SAME CONDUIT OR PATHWAY AS POWER, THEREFORE ALL CONDUITS ARE TO BE SEPARATE AND ANY OTHER PATHWAYS SHALL HAVE A BARRIER BETWEEN THE CABLES.
- CONDUIT RUNS ARE DIAGRAMMATIC IN NATURE. CONTRACTOR IS RESPONSIBLE FOR SIZING AND LOCATING PULL BOXES AT EVERY TWO 90 DEGREE BENDS. A THIRD BEND IS ACCEPTABLE WHERE ENTIRE RUNS ARE LESS THAT 33 FEET, CONDUITS SIZE IS INCREASED, OR THE THIRD BEND IS LOCATED WITHIN 12" OF THE FEED END.
- 8. CONTRACTOR SHALL PROVIDE AND INSTALL ADEQUATE SUPPORTS NECESSARY FOR THE RACEWAY SYSTEM. THIS INCLUDES BUT IS NOT LIMITED TO BLOCKING FOR WALL MOUNTED TELEVISIONS. CONTRACTOR SHALL REFER TO MANUFACTURER'S RECOMMENDATIONS FOR SIZES AND QUANTITIES OF ALL SUPPORTING MEANS.
- 9. PENETRATIONS OF WALLS, FLOORS, ROOFS, AND STRUCTURAL BEAMS FOR THE PASSAGE OF ELECTRICAL RACEWAYS SHALL BE APPROVED BY THE STRUCTURAL ENGINEER OF RECORD PRIOR TO THE COMMENCEMENT OF WORK. ALL SUCH PENETRATIONS SHALL BE PROPERLY SEALED OFF AFTER INSTALLATION OF RACEWAY SO AS TO MAINTAIN THE STRUCTURAL, WATER PROOF, AND FIRE PROOF INTEGRITY OF THE SYSTEM PENETRATED.
- 10. PROVIDE AND INSTALL PATHWAYS IN A MANNER THAT WILL NOT DAMAGE THE CABLING FROM PHYSICAL DAMAGE. INSTALL CONDUITS WITH LONG RADIUS BENDS WITH NYLON BUSHINGS AND PROPER BONDING.

### GENERAL NOTES:

- PRIOR TO INSTALLATION OF SUBSURFACE RACEWAYS IDENTIFY AND MARK ANY EXISTING UTILITIES TO AVOID DAMAGE. UNDERGROUND TELECOMMUNICATIONS RACEWAYS SHOULD MAINTAIN A MINIMUM OF 6" FROM OTHER UTILIZES SUCH AS ELECTRIC.
- 2. PROVIDE AND INSTALL WALL MOUNTED 3/4" TYPE AC FIRE RATED PLYWOOD IN EACH MDF/IDF INDICATED IN TELECOMMUNICATIONS ENLARGED PLANS. FIRE RATED STAMP SHALL BE VISIBLE FOR INSPECTION. FIRE PAINTED PLYWOOD IS NOT ALLOWED PER 2018 IBC.
- 3. ALL HORIZONTAL PATHWAYS THAT PENETRATE FIRE-RATED BARRIERS SHALL BE FIRESTOPPED IN ACCORDANCE WITH APPLICABLE CODES. 4. PROVIDE AND INSTALL CABLE TRAY WITH A MINIMUM OF 12" CLEARANCE ABOVE

AND ON ONE SIDE OF THE TRAY FOR ACCESS.

- 5. PROVIDE AND INSTALL CONDUIT FOR CABLING DISTRIBUTION SPANNING ALL HARD CEILING GREATER THAN 5' IN LENGTH AND SOFFITS TO ACCESSIBLE CEILING (WHERE NECESSARY). ALL TELECOMMUNICATIONS CONDUITS SHALL BE INSTALLED WITH NYLON PULLSTRING.
- 6. AT ALL IN-WALL DATA/AV DROPS LOCATIONS PROVIDE AND INSTALL BACKBOX AND ROUTE 1-1/4" CONDUIT FROM EACH WALL DATA OUTLET TO ABOVE ACCESSIBLE CEILING UNLESS OTHERWISE NOTED. STUB OUT CONDUIT A MINIMUM OF 6" AND PROVIDE AND INSTALL NYLON BUSHINGS AT ALL CONDUIT STUBOUTS ABOVE THE CEILING.
- PROVIDE AND INSTALL J-HOOKS FROM EACH ABOVE CEILING STUBOUT TO CABLE TRAY. J-HOOKS SHALL BE SPACED AT A MAXIMUM OF 4'. INSTALL J-HOOKS AT A MINIMUM OF 15" ABOVE CEILING CHANNEL T-BARS. HOOKS SHALL BE INDEPENDENTLY SUPPORTED.
- 8. ALL PATHWAYS INSTALLED FOR COMMUNICATIONS SHALL BE BONDED TO THE NEAREST TELECOMMUNICATIONS BUSBAR. BUSBARS SHALL BE PREDRILLED WITH STANDARDS NEMA BOLT HOLE SIZING AND SPACING FOR THE BONDING CONDUCTOR CONNECTIONS.
- 9. PROVIDE PROPER TELECOMMUNICATIONS BONDING AND GROUNDING TO ALL TELECOMMUNICATION ELEMENTS PER TIA-607-C.
- 10. CATEGORY 6 & 6A UTP HORIZONTAL CABLING MUST NOT EXCEED 295' IN LENGTH. ALL CABLING SHALL BE RATED FOR THE ENVIRONMENT IN WHICH IT IS INSTALLED. 11. FIBER OPTIC BACKBONE CABLING SHALL BE INSTALLED IN J-HOOK OR WITHIN
- THE CABLE TRAY RUN.
- 12. CABLE MUST NOT BE FASTENED TO ELECTRICAL CONDUITS, MECHANICAL, DUCTWORK/PIPING, SPRINKLER PIPES, OR ROUTED TO OBSTRUCT ACCESS TO HATCHES, DOORS, UTILITY ACCESS PANELS, OR SERVICE WORK AREAS. CABLES SHALL NOT BE ROUTED THROUGH FIRE RATED DOORS, VENTILATION SHAFTS, GRATES, OR PARALLEL WITH LINE VOLTAGE ELECTRICAL CONDUCTORS. CABLES SHALL NOT BE RUN LOOSE ON CEILING GRID OR ON CEILING TILES.
- 13. CABLES ARE TO BE RUN IN BUNDLES OF 24 MAXIMUM IN CABLE TRAY OR HOOKS ABOVE CEILINGS. CABLING SHALL BE LOOSELY BUNDLED WITH CABLE VELCRO HOOK TIES SPACED AT 24" CENTERS. CABLE TIES SHALL NOT BE USED AND SHALL NOTE BE USED TO SUPPORT CABLES.
- 14. EACH CABLE RUN SHALL INCLUDE A FIVE-FOOT SERVICE LOOP WITH BELCRO HOOK TIES LOCATED ABOVE MDF/IDF RACK(S) AND A THREE-FOOT SERVICE LOOP AT THE INFORMATION OUTLET.
- 15. NO CABLES SPLICES ARE ALLOWED.



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TRUE NORTH

- DATA KEYED NOTES:
- PROVIDE (3) DATA DROPS AT POLE MOUNTED AT 3FT, 10FT, AND 15FT ABOVE GRADE. TYPICAL ALL POLES WITH (3)
- PROVIDE 12"X12" BOX IN GROUND FOR ROUTING CABLES FOR WAPS, OWNER INSTALLED EQUIPMENT, AND
- SENSORS.TYPICAL. PROVIDE 1"C DIRECT BURY BETWEEN BOX AND POLE FOR CAT6A. TYPICAL.

DROPS .

- PROVIDE NEMA 3R BOX.
- PROVIDE 24"X24" BOX FOR IT CABINET MOUNTED ON CONCRETE PAD. PROVIDE 24 PORT POE INDUSTRIAL SWITCH IN CABINET ON GRADE.
- PROVIDE (1) 4"C BETWEEN BOXES FOR CAT6A VIA DIRECT BURY. ADD ALT #2: PROVIDE (1) 6"C IN LIEU OF (1) 4"C.
- PROVIDE 4"C BETWEEN BOX AND DISCOVERY PARK FOR CORNING FIBER IN UNDERGROUND VIA DIRECT BURY. COORDINATE ROUTING WITH EXISTING UTILITY LINES. TOP OF CONDUIT TO BE MINIMUM OF 24" BELOW GRADE. PROVIDE NYLON OR POLYPROPYLENE PULL STRING MANUFACTURERED BY GREENLEE OR EQUAL WITH MIN 240LB TENSILE STRENGTH, ROT AND MILDEW RESISTANT. ADD ALT #2: PROVIDE (1) 6"C IN LIEU OF (1) 4"C.
- PROVIDE 2"C BETWEEN BOXES. TYPICAL.
- PROVIDE (2) DATA DROPS AT POLE MOUNTED AT 3FT AND 10FT ABOVE GRADE. TYPICAL.
- 0. PROVIDE CONDUIT BETWEEN EXTERIOR TRANSITION IN ROOM H146 AND EXISTING CABLE TRAY.
- ROUTE IN FIBER JACKET IN CABLE TRAY TO IDF ROOM H101.
- <sup>12.</sup> ROUTE CONDUIT TO PLENUM HEIGHT ON EXTERIOR WALL.
- 13. ADD ALT #1: PROVIDE (2) DATA DROPS AT POLE MOUNTED AT 10FT, 15FT ABOVE GRADE. TYPICAL ALL POLES WITH (2) DROPS.



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01 WIRELESS ACCESS PLAN SCALE: 1" = 30' - 0" 

 $\bigvee$ 

TRUE NORTH





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### DOCUMENT 006000

**PROJECT FORMS** 

### PAYMENT BOND

Surety Bond No.

STATE OF TEXAS § COUNTY OF §

KNOW ALL MEN BY THESE PRESENT: That we, \_\_\_\_\_, as Principal, and \_\_\_\_\_, as Surety, are hereby held and firmly bound unto the University of North Texas System, as Obligee, in the sum of Dollars (\$\_\_\_\_\_) for payment whereof the said Principal and Surety bind themselves, their heirs, executors, administrators, and successors, jointly and severally, by the terms and conditions herein.

The conditions of this obligation are such that whereas the Principal entered into a certain contract with the Obligee, as an entity of the State of Texas, dated the \_\_\_\_day of \_\_\_, 200\_ ("Contract"), which is hereto attached and made a part hereof for all purposes, for the purpose of

NOW THEREFORE, the condition of this obligation is such that this Payment Bond shall remain in full force and effect unless and until 120 days after Principal has faithfully performed the Contract in accordance with the Contract documents and Principal has executed a copy of the attached Payment Affidavit and provided it to Obligee.

In the event that the Principal fails to promptly pay when due any amount owed to persons who have supplied labor, materials, or supplies used in Principal's performance of the said Contract, the Surety will, upon receipt of notice from the Obligee or a claim in the form required by law, satisfy all undisputed balances due, and make arrangements satisfactory to the interested parties to resolve all amounts disputed in good faith, but in no event shall the liability of the Surety for the Principal's failure to promptly pay for labor, materials, or supplies exceed the amount of this bond.

The Surety agrees to pay to the Obligee upon demand all loss and expense, including attorney's fees, incurred by the Obligee by reason of or on account of any breach of this obligation by the Principal or the Surety.

Provided further, that this bond is made and entered into for the protection of all parties supplying labor or materials in the prosecution of the work provided for in the said Contract, and all such parties shall have a direct right of action under this bond as provided in Chapter 2253 of the Texas Government Code. If any legal action is filed upon this bond, venue shall lie in Denton County, Texas.

The liabilities, rights, limitations and remedies concerning this Bond shall be determined in accordance with the provisions of Chapter 2253 of the Texas Government Code, pursuant to which this bond is executed.

IN WITNESS WHEREOF, the above parties have executed this instrument under their several seals this \_\_\_\_\_\_ day of \_\_\_\_\_\_ in the year 20\_\_\_\_, the name and seal of each party being hereto affixed, and duly signed by its undersigned representative pursuant to authority of its governing body.

#### **CONSTRUCTION MANAGER-AT-RISK**

(Firm Name)	(Address)	
(Signature)	(City, State, Zip)	
(Typed Name and Title)	(Telephone)	
(Texas Vendor ID No.)		

### PERFORMANCE BOND

Surety Bond No.

STATE OF TEXAS § COUNTY OF

§

LET IT BE KNOWN BY THIS INSTRUMENT: That we, \_\_\_\_\_ Principal, and \_\_\_\_\_\_\_ a corporation duly authorized to do business in the State of Texas, as Surety, are hereby held and firmly bound unto the University of North Texas System, as Obligee, in the sum of \_\_\_\_\_\_ Dollars (\$\_\_\_\_\_) for payment whereof the said Principal and Surety bind themselves, their heirs, executors, administrators, and successors, jointly and severally, by the terms and conditions herein.

The conditions of this obligation are such that whereas the Principal entered into a certain contract with the Obligee, as an entity of the State of Texas, dated the \_\_\_\_\_day of \_\_\_\_\_, 20 ("Contract"), which is hereto attached and made a part hereof for all purposes, for the purpose of

NOW THEREFORE, the condition of this obligation is such that this Performance Bond shall remain in full force and effect unless and until the Principal has faithfully performed the Contract in accordance with the Plans, Specifications and Contract documents. Further, under the terms of this Performance Bond, Principal shall fully indemnify and save harmless the Obligee from all cost and damage which the Obligee may suffer by reason of Principal's default or failure to perform and shall fully reimburse and repay the Obligee all outlay and expense which the Obligee may incur in making good any such default.

In the event that the Principal's failure as defined by the Contract Documents, to faithfully perform the Contract, Surety will within fifteen (15) days of determination of default, assume full responsibility for completion of said Contract and become entitled to payment of the balance of the Contract amount. Conditioned upon the Surety's faithful performance of its obligations, the liability of the Surety for the Principal's default shall not exceed the penalty of this Bond.

The Surety agrees to pay to the Obligee upon demand all loss and expense, including attorney's fees, incurred by the Obligee by reason of or on account of any breach of this obligation by the Principal or the Surety.

Provided further, that the Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the said Contract, or to the work to be performed thereunder, or the Specifications accompanying the same, shall in anyway affect its obligation on this Bond, and it does hereby waive notice of any such change, extension of time, alteration or addition, to the terms of the said Contract or to the work or to the Specifications.

Provided further, that if any legal action be filed upon this Bond, venue shall lie in Denton County, Texas.

The liabilities, rights, limitations and remedies concerning this Bond shall be determined in accordance with the provisions of Chapter 2253 of the Texas Government Code, pursuant to which this Bond is executed.

IN WITNESS WHEREOF, the above parties have executed this instrument under their several seals this \_\_\_\_\_ day of \_\_\_\_\_\_ in the year 20\_\_\_\_, the name and corporate seal of each corporate party being hereto affixed, and these present duly signed by its undersigned representative pursuant to authority of its governing body.

ATTEST:	
	(Principal)
(Signature)	(Signature)
(Typed Name and Title)	(Typed Name and Title)
(SEAL)	
ATTEST:	(Surety)
(Signature)	(Signature)
(Typed Name and Title)	(Typed Name and Title)
(SEAL)	
Surety's Texas Local Recording Agent or Resident Agent:	Surety's Home Office Agent or Servicing Agent:
(Signature)	(Name)
(Typed Name)	(Title)
(License No.)	(Address)
(File No)	(City, State, Zip)
(Address)	(Telephone)
(City, State, Zip)	-
	-

(Telephone)

## HUB Subcontracting Plan (HSP) QUICK CHECKLIST

While this HSP Quick Checklist is being provided to merely assist you in readily identifying the sections of the HSP form that you will need to complete, it is very important that you adhere to the instructions in the HSP form and instructions provided by the contracting agency.

If you will be awarding all of the subcontracting work you have to offer under the contract to only Texas certified HUB vendors, complete:

Section 1 - Respondent and Requisition Information

Section 2 a. - Yes, I will be subcontracting portions of the contract.

Section 2 b. - List all the portions of work you will subcontract, and indicate the percentage of the contract you expect to award to Texas certified HUB vendors. Section 2 c. - Yes

Section 4 - Affirmation

2

GFE Method A (Attachment A) - Complete an Attachment A for each of the subcontracting opportunities you listed in Section 2 b.

If you will be subcontracting any portion of the contract to Texas certified HUB vendors and Non-HUB vendors, and the aggregate percentage of all the subcontracting work you will be awarding to the Texas certified HUB vendors with which you do not have a <u>continuous contract</u>\* in place for more than five (5) years <u>meets or exceeds</u> the HUB Goal the contracting agency identified in the "Agency Special Instructions/Additional Requirements", complete:

Section 1 - Respondent and Requisition Information

Section 2 a. - Yes, I will be subcontracting portions of the contract.

Section 2 b. - List all the portions of work you will subcontract, and indicate the percentage of the contract you expect to award to Texas certified HUB vendors and Non-HUB vendors.

Section 2 c. - No

Section 2 d. - Yes

Section 4 - Affirmation

GFE Method A (Attachment A) - Complete an Attachment A for each of the subcontracting opportunities you listed in Section 2 b.

If you will be subcontracting any portion of the contract to Texas certified HUB vendors and Non-HUB vendors or only to Non-HUB vendors, and the aggregate percentage of all the subcontracting work you will be awarding to the Texas certified HUB vendors with which you <u>do not</u> have a <u>continuous contract</u> in place for more than five (5) years <u>does not meet or exceed</u> the HUB Goal the contracting agency identified in the "Agency Special Instructions/Additional Requirements", complete:

Section 1 - Respondent and Requisition Information

Section 2 a. - Yes, I will be subcontracting portions of the contract.

Section 2 b. - List all the portions of work you will subcontract, and indicate the percentage of the contract you expect to award to Texas certified HUB vendors and Non-HUB vendors.

Section 2 c. - No

Section 2 d. - No

Section 4 - Affirmation

GFE Method B (Attachment B) - Complete an Attachment B for each of the subcontracting opportunities you listed in Section 2 b.

If you will not be subcontracting any portion of the contract and will be fulfilling the entire contract with your own resources (i.e., employees, supplies, materials and/or equipment), complete:

Section 1 - Respondent and Requisition Information

Section 2 a. - No, I will not be subcontracting any portion of the contract, and I will be fulfilling the entire contract with my own resources.

Section 3 - Self Performing Justification

Section 4 - Affirmation

\*<u>Continuous Contract</u>: Any existing written agreement (including any renewals that are exercised) between a prime contractor and a HUB vendor, where the HUB vendor provides the prime contractor with goods or service, to include under the same contract for a specified period of time. The frequency the HUB vendor is utilized or paid during the term of the contract is not relevant to whether the contract is considered continuous. Two or more contracts that run concurrently or overlap one another for different periods of time are considered by CPA to be individual contracts rather than renewals or extensions to the original contract. In such situations the prime contractor and HUB vendor are entering (have entered) into "new" contracts.



# HUB Subcontracting Plan (HSP)

In accordance with Texas Gov't Code §2161.252, the contracting agency has determined that subcontracting opportunities are probable under this contract. Therefore, all respondents, including State of Texas certified Historically Underutilized Businesses (HUBs) must complete and submit this State of Texas HUB Subcontracting Plan (HSP) with their response to the bid requisition (solicitation).

NOTE: Responses that do not include a completed HSP shall be rejected pursuant to Texas Gov't Code §2161.252(b).

The HUB Program promotes equal business opportunities for economically disadvantaged persons to contract with the State of Texas in accordance with the goals specified in the 2009 State of Texas Disparity Study. The statewide HUB goals defined in 34 Texas Administrative Code (TAC) §20.284 are:

- 11.2 percent for heavy construction other than building contracts,
- 21.1 percent for all building construction, including general contractors and operative builders' contracts,
- 32.9 percent for all special trade construction contracts,
- 23.7 percent for professional services contracts,
- 26.0 percent for all other services contracts, and
- 21.1 percent for commodities contracts.

### - - Agency Special Instructions/Additional Requirements - -

In accordance with 34 TAC §20.285(d)(1)(D)(iii), a respondent (prime contractor) may demonstrate good faith effort to utilize Texas certified HUBs for its subcontracting opportunities if the total value of the respondent's subcontracts with Texas certified HUBs meets or exceeds the statewide HUB goal or the agency specific HUB goal, whichever is higher. When a respondent uses this method to demonstrate good faith effort, the respondent must identify the HUBs with which it will subcontract. If using existing contracts with Texas certified HUBs to satisfy this requirement, only the aggregate percentage of the contracts expected to be subcontracted to HUBs with which the respondent <u>does not</u> have a <u>continuous contract</u>\* in place for <u>more than five (5) years</u> shall qualify for meeting the HUB goal. This limitation is designed to encourage vendor rotation as recommended by the 2009 Texas Disparity Study.

### SECTION 1: RESPONDENT AND REQUISITION INFORMATION

a.	Respondent (Company) Name:	State of Texas VID #:
	Point of Contact:	Phone #:
	E-mail Address:	Fax #:
b.	ls your company a State of Texas certified HUB? 🔲 - Yes 🛛 🗌 - No	
c.	Requisition #:	Bid Open Date:

### Requisition #:

#### SECTION 2: RESPONDENT'S SUBCONTRACTING INTENTIONS

After dividing the contract work into reasonable lots or portions to the extent consistent with prudent industry practices, and taking into consideration the scope of work to be performed under the proposed contract, including all potential subcontracting opportunities, the respondent must determine what portions of work, including contracted staffing, goods and services will be subcontracted. Note: In accordance with 34 TAC §20.282, a "Subcontractor" means a person who contracts with a prime contractor to work, to supply commodities, or to contribute toward completing work for a governmental entity.

a. Check the appropriate box (Yes or No) that identifies your subcontracting intentions:

- Yes, I will be subcontracting portions of the contract. (If Yes, complete Item b of this SECTION and continue to Item c of this SECTION.)
- I vill not be subcontracting any portion of the contract, and I will be fulfilling the entire contract with my own resources, including employees, goods and services. (If No, continue to SECTION 3 and SECTION 4.)
- b. List all the portions of work (subcontracting opportunities) you will subcontract. Also, based on the total value of the contract, identify the percentages of the contract you expect to award to Texas certified HUBs, and the percentage of the contract you expect to award to vendors that are not a Texas certified HUB (i.e., Non-HUB).

		HU	Non-HUBs	
Item #	Subcontracting Opportunity Description	Percentage of the contract expected to be subcontracted to HUBs with which you <u>do not</u> have a <u>continuous contract</u> <sup>*</sup> in place for <u>more than five (5) years</u> .	Percentage of the contract expected to be subcontracted to HUBs with which you have a <u>continuous contract</u> * in place for <u>more than five (5) years</u> .	Percentage of the contract expected to be subcontracted to non-HUBs.
1		%	%	%
2		%	%	%
3		%	%	%
4		%	%	%
5		%	%	%
6		%	%	%
7		%	%	%
8		%	%	%
9		%	%	%
10		%	%	%
11		%	%	%
12		%	%	%
13		%	%	%
14		%	%	%
15		%	%	%
	Aggregate percentages of the contract expected to be subcontracted:	%	%	%

(Note: If you have more than fifteen subcontracting opportunities, a continuation sheet is available online at <a href="https://www.comptroller.texas.gov/purchasing/vendor/hub/forms.php">https://www.comptroller.texas.gov/purchasing/vendor/hub/forms.php</a>).

- c- Check the appropriate box (Yes or No) that indicates whether you will be using <u>only</u> Texas certified HUBs to perform <u>all</u> of the subcontracting opportunities you listed in SECTION 2, Item b.
  - Yes (If Yes, continue to SECTION 4 and complete an "HSP Good Faith Effort Method A (Attachment A)" for each of the subcontracting opportunities you listed.)
  - No (If No, continue to Item d, of this SECTION.)
- d. Check the appropriate box (Yes or No) that indicates whether the aggregate expected percentage of the contract you will subcontract with Texas certified HUBs with which you <u>do not</u> have a <u>continuous contract</u>\* in place with for <u>more than five (5) years</u>, <u>meets or exceeds</u> the HUB goal the contracting agency identified on page 1 in the "Agency Special Instructions/Additional Requirements."
  - Yes (If Yes, continue to SECTION 4 and complete an "HSP Good Faith Effort Method A (Attachment A)" for each of the subcontracting opportunities you listed.)
  - No (If No, continue to SECTION 4 and complete an "HSP Good Faith Effort Method B (Attachment B)" for each of the subcontracting opportunities you listed.)

\*<u>Continuous Contract</u>: Any existing written agreement (including any renewals that are exercised) between a prime contractor and a HUB vendor, where the HUB vendor provides the prime contractor with goods or service under the same contract for a specified period of time. The frequency the HUB vendor is utilized or paid during the term of the contract is not relevant to whether the contract is considered continuous. Two or more contracts that run concurrently or overlap one another for different periods of time are considered by CPA to be individual contracts rather than renewals or extensions to the original contract. In such situations the prime contractor and HUB vendor are entering (have entered) into "new" contracts.

Requisition #:

### SECTION 2: RESPONDENT'S SUBCONTRACTING INTENTIONS (CONTINUATION SHEET)

This page can be used as a continuation sheet to the HSP Form's page 2, Section 2, Item b. Continue listing the portions of work (subcontracting opportunities) you will subcontract. Also, based on the total value of the contract, identify the percentages of the contract you expect to award to Texas certified HUBs, and the percentage of the contract you expect to award to vendors that are not a Texas certified HUB (i.e., Non-HUB).

		HUBs		Non-HUBs
Item #	Subcontracting Opportunity Description	Percentage of the contract expected to be subcontracted to HUBs with which you <u>do not</u> have a <u>continuous contract</u> <sup>*</sup> in place for <u>more than five (5) years</u> .	Percentage of the contract expected to be subcontracted to HUBs with which you have a <u>continuous contract</u> * in place for <u>more than five (5) years</u> .	Percentage of the contract expected to be subcontracted to non-HUBs.
16		%	%	%
17		%	%	%
18		%	%	%
19		%	%	%
20		%	%	%
21		%	%	%
22		%	%	%
23		%	%	%
24		%	%	%
25		%	%	%
26		%	%	%
27		%	%	%
28		%	%	%
29		%	%	%
30		%	%	%
31		%	%	%
32		%	%	%
33		%	%	%
34		%	%	%
35		%	%	%
36		%	%	%
37		%	%	%
38		%	%	%
39		%	%	%
40		%	%	%
41		%	%	%
42		%	%	%
43		%	%	%
	Aggregate percentages of the contract expected to be subcontracted:	%	%	%

\*<u>Continuous Contract</u>: Any existing written agreement (including any renewals that are exercised) between a prime contractor and a HUB vendor, where the HUB vendor provides the prime contractor with goods or service under the same contract for a specified period of time. The frequency the HUB vendor is utilized or paid during the term of the contract is not relevant to whether the contract is considered continuous. Two or more contracts that run concurrently or overlap one another for different periods of time are considered by CPA to be individual contracts rather than renewals or extensions to the original contract. In such situations the prime contractor and HUB vendor are entering (have entered) into "new" contracts.

### Requisition #:

SECTION 3: SELF PERFORMING JUSTIFICATION (If you responded "No" to SECTION 2, Item a, you must complete this SECTION and continue to SECTION 4.) If you responded "No" to SECTION 2, Item a, in the space provided below explain how your company will perform the entire contract with its own employees, supplies, materials and/or equipment.

### SECTION 4: AFFIRMATION

As evidenced by my signature below, I affirm that I am an authorized representative of the respondent listed in SECTION 1, and that the information and supporting documentation submitted with the HSP is true and correct. Respondent understands and agrees that, if awarded any portion of the requisition:

- The respondent will provide notice as soon as practical to all the subcontractors (HUBs and Non-HUBs) of their selection as a subcontractor for the awarded contract. The notice must specify at a minimum the contracting agency's name and its point of contact for the contract, the contract award number, the subcontracting opportunity they (the subcontractor) will perform, the approximate dollar value of the subcontracting opportunity and the expected percentage of the total contract that the subcontracting opportunity represents. A copy of the notice required by this section must also be provided to the contracting agency's point of contact for the contract for the contracting agency's point of contact for the contract <u>no later than ten (10) working days after the contract is awarded</u>.
- The respondent must submit monthly compliance reports (Prime Contractor Progress Assessment Report PAR) to the contracting agency, verifying its compliance with the HSP, including the use of and expenditures made to its subcontractors (HUBs and Non-HUBs). (The PAR is available at <a href="https://www.comptroller.texas.gov/purchasing/docs/hub-forms/ProgressAssessmentReportForm.xls">https://www.comptroller.texas.gov/purchasing/docs/hub-forms/ProgressAssessmentReportForm.xls</a>).
- The respondent must seek approval from the contracting agency prior to making any modifications to its HSP, including the hiring of additional or different subcontractors and the termination of a subcontractor the respondent identified in its HSP. If the HSP is modified without the contracting agency's prior approval, respondent may be subject to any and all enforcement remedies available under the contract or otherwise available by law, up to and including debarment from all state contracting.
- The respondent must, upon request, allow the contracting agency to perform on-site reviews of the company's headquarters and/or work-site where services
  are being performed and must provide documentation regarding staffing and other resources.

Signature	Printed Name	Title	Date
Reminder:			(mm/dd/yyyy)

- If you responded "Yes" to SECTION 2, Items c or d, you must complete an "HSP Good Faith Effort Method A (Attachment A)" for each of the subcontracting opportunities you listed in SECTION 2, Item b.
- If you responded "No" SECTION 2, Items c and d, you must complete an "HSP Good Faith Effort Method B (Attachment B)" for each of the subcontracting opportunities you listed in SECTION 2, Item b.

Requisition #:

*IMPORTANT*: If you responded "*Yes*" to **SECTION 2**, **Items c** or **d** of the completed HSP form, you must submit a completed "HSP Good Faith Effort - Method A (Attachment A)" for <u>each</u> of the subcontracting opportunities you listed in **SECTION 2**, **Item b** of the completed HSP form. You may photo-copy this page or download the form at <u>https://www.comptroller.texas.gov/purchasing/docs/hub-forms/hub-sbcont-plan-gfe-achm-a.pdf</u>

### SECTION A-1: SUBCONTRACTING OPPORTUNITY

Enter the item number and description of the subcontracting opportunity you listed in SECTION 2, Item b, of the completed HSP form for which you are completing the attachment.

Item Number: Description:

### SECTION A-2: SUBCONTRACTOR SELECTION

List the subcontractor(s) you selected to perform the subcontracting opportunity you listed above in SECTION A-1. Also identify whether they are a Texas certified HUB and their Texas Vendor Identification (VID) Number or federal Employer Identification Number (EIN), the approximate dollar value of the work to be subcontracted, and the expected percentage of work to be subcontracted. When searching for Texas certified HUBs and verifying their HUB status, ensure that you use the State of Texas' Centralized Master Bidders List (CMBL) - Historically Underutilized Business (HUB) Directory Search located at <a href="http://mycpa.cpa.state.tx.us/tpasscmblsearch/index.isp">http://mycpa.cpa.state.tx.us/tpasscmblsearch/index.isp</a>. HUB status code "**A**" signifies that the company is a Texas certified HUB.

Company Name	Texas certified HUB	Texas VID or federal EIN Do not enter Social Security Numbers. If you do not know their VID / EIN, leave their VID / EIN field blank.	Approximate Dollar Amount	Expected Percentage of Contract
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%

**REMINDER:** As specified in SECTION 4 of the completed HSP form, if you (respondent) are awarded any portion of the requisition, you are required to provide notice as soon as practical to <u>all</u> the subcontractors (HUBs and Non-HUBs) of their selection as a subcontractor. The notice must specify at a minimum the contracting agency's name and its point of contact for the contract, the contract award number, the subcontracting opportunity they (the subcontractor) will perform, the approximate dollar value of the subcontracting opportunity and the expected percentage of the total contract that the subcontracting opportunity represents. A copy of the notice required by this section must also be provided to the contracting agency's point of contact for the contract is awarded.

Requisition #:

**IMPORTANT:** If you responded "**No**" to **SECTION 2**, **Items c** and **d** of the completed HSP form, you must submit a completed "HSP Good Faith Effort -Method B (Attachment B)" for <u>each</u> of the subcontracting opportunities you listed in **SECTION 2**, **Item b** of the completed HSP form. You may photo-copy this page or download the form at <u>https://www.comptroller.texas.gov/purchasing/docs/hub-forms/hub-sbcont-plan-gfe-achm-b.pdf</u>.

### SECTION B-1: SUBCONTRACTING OPPORTUNITY

Enter the item number and description of the subcontracting opportunity you listed in SECTION 2, Item b, of the completed HSP form for which you are completing the attachment.

Item Number: Description:

### SECTION B-2: MENTOR PROTÉGÉ PROGRAM

If respondent is participating as a Mentor in a State of Texas Mentor Protégé Program, submitting its Protégé (Protégé must be a State of Texas certified HUB) as a subcontractor to perform the subcontracting opportunity listed in **SECTION B-1**, constitutes a good faith effort to subcontract with a Texas certified HUB towards that <u>specific</u> portion of work.

Check the appropriate box (Yes or No) that indicates whether you will be subcontracting the portion of work you listed in SECTION B-1 to your Protégé.

- Yes (If *Yes*, continue to SECTION B-4.)
- No / Not Applicable (If No or Not Applicable, continue to SECTION B-3 and SECTION B-4.)

### SECTION B-3: NOTIFICATION OF SUBCONTRACTING OPPORTUNITY

When completing this section you <u>MUST</u> comply with items <u>a</u>, <u>b</u>, <u>c</u> and <u>d</u>, thereby demonstrating your Good Faith Effort of having notified Texas certified HUBs <u>and</u> trade organizations or development centers about the subcontracting opportunity you listed in SECTION B-1. Your notice should include the scope of work, information regarding the location to review plans and specifications, bonding and insurance requirements, required qualifications, and identify a contact person. When sending notice of your subcontracting opportunity, you are encouraged to use the attached HUB Subcontracting Opportunity Notice form, which is also available online at <u>https://www.comptroller.texas.gov/purchasing/docs/hub-forms/HUBSubcontractingOpportunityNotificationForm.pdf.</u>

Retain supporting documentation (i.e., certified letter, fax, e-mail) demonstrating evidence of your good faith effort to notify the Texas certified HUBs and trade organizations or development centers. Also, be mindful that a working day is considered a normal business day of a state agency, not including weekends, federal or state holidays, or days the agency is declared closed by its executive officer. The initial day the subcontracting opportunity notice is sent/provided to the HUBs and to the trade organizations or development centers is considered to be "day zero" and does not count as one of the seven (7) working days.

- a. Provide written notification of the subcontracting opportunity you listed in SECTION B-1, to three (3) or more Texas certified HUBs. Unless the contracting agency specified a different time period, you must allow the HUBs <u>at least seven (7) working days</u> to respond to the notice prior to you submitting your bid response to the contracting agency. When searching for Texas certified HUBs and verifying their HUB status, ensure that you use the State of Texas' Centralized Master Bidders List (CMBL) Historically Underutilized Business (HUB) Directory Search located at <a href="http://mycpa.cpa.state.tx.us/tpasscmblsearch/index.jsp">http://mycpa.cpa.state.tx.us/tpasscmblsearch/index.jsp</a>. HUB status code "A" signifies that the company is a Texas certified HUB.
- b. List the <u>three (3)</u> Texas certified HUBs you notified regarding the subcontracting opportunity you listed in SECTION B-1. Include the company's Texas Vendor Identification (VID) Number, the date you sent notice to that company, and indicate whether it was responsive or non-responsive to your subcontracting opportunity notice.

Company Name	Texas VID (Do not enter Social Security Numbers.)	Date Notice Sent (mm/dd/yyyy)	Did the HUB Respond?
			- Yes - No
			- Yes - No
			- Yes - No

- c. Provide written notification of the subcontracting opportunity you listed in SECTION B-1 to two (2) or more trade organizations or development centers in Texas to assist in identifying potential HUBs by disseminating the subcontracting opportunity to their members/participants. Unless the contracting agency specified a different time period, you must provide your subcontracting opportunity notice to trade organizations or development centers at least seven (7) working days prior to submitting your bid response to the contracting agency. A list of trade organizations and development centers that have expressed an interest in receiving notices of subcontracting opportunities is available on the Statewide HUB Program's webpage at <a href="https://www.comptroller.texas.gov/purchasing/vendor/hub/resources.php">https://www.comptroller.texas.gov/purchasing/vendor/hub/resources.php</a>.
- d. List two (2) trade organizations or development centers you notified regarding the subcontracting opportunity you listed in SECTION B-1. Include the date when you sent notice to it and indicate if it accepted or rejected your notice.

Trade Organizations or Development Centers	Date Notice Sent (mm/dd/yyyy)	Was the Notice Accepted?
		- Yes - No
		- Yes - No

Requisition #:

### SECTION B-4: SUBCONTRACTOR SELECTION

Enter the item number and description of the subcontracting opportunity you listed in **SECTION 2**, **Item b**, of the completed HSP form for which you are completing the attachment.

a. Enter the item number and description of the subcontracting opportunity for which you are completing this Attachment B continuation page.

Item Number: Description:

b. List the subcontractor(s) you selected to perform the subcontracting opportunity you listed in SECTION B-1. Also identify whether they are a Texas certified HUB and their Texas Vendor Identification (VID) Number or federal Employer Identification Number (EIN), the approximate dollar value of the work to be subcontracted, and the expected percentage of work to be subcontracted. When searching for Texas certified HUBs and verifying their HUB status, ensure that you use the State of Texas' Centralized Master Bidders List (CMBL) - Historically Underutilized Business (HUB) Directory Search located at <a href="http://mycpa.cpa.state.tx.us/tpasscmblsearch/index.jsp">http://mycpa.cpa.state.tx.us/tpasscmblsearch/index.jsp</a>. HUB status code "A" signifies that the company is a Texas certified HUB.

Company Name	Texas certified HUB	Texas VID or federal EIN Do not enter Social Security Numbers. If you do not know their VID / EIN, leave their VID / EIN field blank.	Approximate Dollar Amount	Expected Percentage of Contract
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%
	- Yes - No		\$	%

c. If any of the subcontractors you have selected to perform the subcontracting opportunity you listed in SECTION B-1 is <u>not</u> a Texas certified HUB, provide <u>written</u> justification for your selection process (attach additional page if necessary):

**REMINDER:** As specified in SECTION 4 of the completed HSP form, <u>if you (respondent) are awarded any portion of the requisition</u>, you are required to provide notice as soon as practical to <u>all</u> the subcontractors (HUBs and Non-HUBs) of their selection as a subcontractor. The notice must specify at a minimum the contracting agency's name and its point of contact for the contract, the contract award number, the subcontracting opportunity it (the subcontractor) will perform, the approximate dollar value of the subcontracting opportunity and the expected percentage of the total contract that the subcontracting opportunity represents. A copy of the notice required by this section must also be provided to the contracting agency's point of contact for the contract is awarded.



In accordance with Texas Gov't Code, Chapter 2161, each state agency that considers entering into a contract with an expected value of \$100,000 or more shall, before the agency solicits bids, proposals, offers, or other applicable expressions of interest, determine whether subcontracting opportunities are probable under the contract. The state agency I have identified below in Section B has determined that subcontracting opportunities are probable under the requisition to which my company will be responding.

34 Texas Administrative Code, §20.285 requires all respondents (prime contractors) bidding on the contract to provide notice of each of their subcontracting opportunities to at least three (3) Texas certified HUBs (who work within the respective industry applicable to the subcontracting opportunity), and allow the HUBs at least seven (7) working days to respond to the notice prior to the respondent submitting its bid response to the contracting agency. In addition, at least seven (7) working days prior to submitting its bid response to the contracting opportunities to two (2) or more trade organizations or development centers (in Texas) that serves members of groups (i.e., Asian Pacific American, Black American, Hispanic American, Native American, Woman, Service Disabled Veteran) identified in Texas Administrative Code §20.282(19)(C).

We respectfully request that vendors interested in bidding on the subcontracting opportunity scope of work identified in Section C, Item 2, reply no later than the date and time identified in Section C, Item 1. Submit your response to the point-of-contact referenced in Section A.

SECTION A: PRIME CONTRACTOR'S INFORMATION	
Company Name:	State of Texas VID #:
Point-of-Contact:	Phone #:
E-mail Address:	Fax #:
SECTION B: CONTRACTING STATE AGENCY AND REQUISITION	INFORMATION
Agency Name:	
Point-of-Contact:	Phone #:
Requisition #:	Bid Open Date:
	(mm/dd/yyyy)
SECTION C: SUBCONTRACTING OPPORTUNITY RESPONSE DUE	E DATE, DESCRIPTION, REQUIREMENTS AND RELATED INFORMATION
1. Potential Subcontractor's Bid Response Due Date:	
If you would like for our company to consider your compan	ny's bid for the subcontracting opportunity identified below in Item 2,
we must receive your bid response no later than	on
	Central Time Date (mm/dd/yyyy)
to us submitting our bid response to the contracting agency, we must prorganizations or development centers (in Texas) that serves members of American, Woman, Service Disabled Veteran) identified in Texas Administra (A working day is considered a normal business day of a state agency, not by its executive officer. The initial day the subcontracting opportunity notice is considered to be "day zero" and does not count as one of the seven (7) w	rovide notice of each of our subcontracting opportunities to two (2) or more trade of groups (i.e., Asian Pacific American, Black American, Hispanic American, Native rative Code, §20.282(19)(C). including weekends, federal or state holidays, or days the agency is declared closed e is sent/provided to the HUBs and to the trade organizations or development centers working days.)
2. Subcontracting Opportunity Scope of Work:	
3. Required Qualifications:	- Not Applicable
4. Bonding/Insurance Requirements:	- Not Applicable
5. Location to review plans/specifications:	- Not Applicable

### <u>UNIFORM GENERAL CONDITIONS</u> <u>FOR CONSTRUCTION AND DESIGN CONTRACTS</u> <u>2022</u>



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### UNIFORM GENERAL CONDITIONS FOR CONSTRUCTION AND DESIGN CONTRACTS 2022

### ARTICLE 1. DEFINITIONS

Unless the context clearly requires another meaning, the following terms have the meaning assigned herein.

- 1.1 "Addendum/Addenda" means formally issued written or graphic modification and/or interpretations of the Construction Documents that may add to, delete from, clarify or correct the description and/or scope of the Work. Addenda are issued during the bidding phase of the project.
- 1.2 "Application for Final Payment" means Contractor's final invoice for payment that includes any portion of the Work that has been completed for which an invoice has not been submitted, amounts owing to adjustments to the final Contract Sum resulting from approved change orders, and release of remaining Contractor's retainage.
- 1.3 "Application for Payment" means Contractor's monthly partial invoice for payment that includes any portion of the Work that has been completed and performed in accordance with the requirements of the Contract Documents for which an invoice has not been submitted. The Application for Payment must accurately reflect the progress of the Work, be itemized based on the Schedule of Values, bear the notarized signature of Contractor, and not include subcontracted items for which Contractor does not intend to pay.
- 1.4 "Authority Having Jurisdiction" means a federal, state, local or other regional department, or an individual such as a fire marshal, building official, electrical inspector, utility provider or other individual having statutory authority.
- 1.5 "Baseline Schedule" means the initial time schedule prepared by Contractor for Owner's information and acceptance that conveys Contractor's and Subcontractors' activities (including coordination and review activities required in the Contract Documents to be performed by Design Professional and Owner), durations, and sequence of work related to the entire Project to the extent required by the Contract Documents. The schedule clearly demonstrates the Longest Path of activities, durations, and necessary predecessor conditions that drive the end date of the schedule. The Baseline Schedule shall not exceed the time limit current under the Contract Documents.
- 1.6 "Certificate of Final Completion" means the certificate issued by Design Professional that documents, to the best of Design Professional's knowledge and understanding, Contractor's completion of all Contractor's Punch list items and pre-final Punch list items, final cleanup, and Contractor's provision of Record Documents, operations and maintenance manuals, and all other closeout documents required by the Contract Documents.

- 1.7 "Certificate of Substantial Completion" means the certificate executed by the Design Professional, Owner, and Contractor that documents to the best of the Design Professional's and Owner's knowledge and understanding, Contractor's sufficient completion of the Work in accordance with the Contract, so as to be operational and fit for the use intended.
- 1.8 "Change Order" means a written modification of the Contract between Owner and Contractor, agreed to and signed by Owner, Contractor, and Design Professional.
- 1.9 "Change Order Request (COR)" means a Contractor generated document which describes a change in the scope of Work, including a detailed description, Drawings and Specifications, and a request for changes to costs or time, as necessary, to inform Owner of the nature of the requested change to the Contract.
- 1.10 "Close-Out Documents" mean the product brochures, submittals, product/equipment maintenance and operations instructions, manuals, and other documents/warranties, record documents, affidavits of payment, releases of liens and claims, and other documents as may be further defined, identified, and required by the Contract Documents.
- 1.11 "Construction Cost Limitation (CCL)" means the maximum funding authorized by and available to Owner to pay for the construction of the Project, exclusive of: (I) furniture, fixtures and other equipment (FFE) not in the Contract; (ii) Owner's Contingency; and (iii) any design and/or commissioning fees.
- 1.12 "Contract" means the agreement, including all attachments thereto, and all of the Contract Documents between Owner and Contractor.
- 1.13 "Contract Date" is the date when the agreement between Owner and Contractor becomes effective.
- 1.14 "Contract Documents" mean those documents identified as a component of the Contract between Owner and Contractor. These may include, but are not limited to: Drawings; Specifications; Uniform General Conditions; Owner's Special Conditions; Owner's Design Criteria Package for Design-Build Projects; Guaranteed Maximum Price Proposal executed by Owner and Contractor; all Change Orders; all pre-bid and/or pre-proposal addenda; Owner's Request for Proposal and/or Request for Qualifications; and Contractor's response to Owner's Request for Proposal and/or Request for Qualifications.
- 1.15 "Contract Duration" means the period between the Effective Date of the Contract and the end of the Warranty Period.
- 1.16 "Contract Sum" means the total compensation payable to Contractor for completion of the Work in accordance with the terms of the Contract.
- 1.17 "Contract Time" means the period between the start date identified in the Notice to Proceed with construction and the date to achieve Substantial Completion identified in the Notice to Proceed or as subsequently amended by a Change Order.

- 1.18 "Contractor" means the individual, corporation, limited liability company, partnership, joint venture, firm, or other entity contracted to perform the Work, regardless of the type of construction contract used, so that the term as used herein includes a Construction Manager-at-Risk or a Design-Build firm as well as a general or prime Contractor. The Contract Documents refer to Contractor as if singular in number but shall be interpreted to include the plural. The term "Contractor" shall also be inclusive of and apply to Design Professional in these Uniform General Conditions when the context does not indicate otherwise.
- 1.19 "Construction Change Directive" means an approved change in the Work issued by the Owner without the complete agreement of Contractor as to cost and/or time.
- 1.20 "Construction Documents" mean the Drawings, Specifications, and other documents issued to build the Project. Construction Documents become part of the Contract Documents when listed in the Contract or any Change Order.
- 1.21 "Construction Manager-at-Risk", in accordance with Tex. Education Code §51.782, means a sole proprietorship, partnership, corporation, or other legal entity that assumes the risk for construction, rehabilitation, alteration, or repair of a facility at the contracted price as a general contractor and provides consultation to Owner regarding construction during and after the design of the facility.
- 1.22 "Coordination Documents" means an ongoing process performed by the Contractor that documents, in a format approved by the Owner, the review of plans and specifications developed by the Design Professional demonstrating the Contractor understands the scope of the project and reviews complex interrelationships among project components.
- 1.23 "Date of Commencement" means the date designated in the Notice to Proceed for Contractor to commence the Work.
- 1.24 "Day" means a calendar day unless otherwise specifically stipulated.
- 1.25 "Design-Build" means a project delivery method in which the detailed design and subsequent construction is provided through a single contract with a Design-Build Firm. The Design-Build Project delivery shall be implemented in accordance with Tex. Education Code § 51.780.
- 1.26 "Design-Build Firm", in accordance with Texas Education Code § 51.780, means a partnership, corporation, or other legal entity or team that includes an engineer or architect and builder qualified to engage in building construction in Texas.
- 1.27 "Design Professional" means a person registered as an architect pursuant to Tex. Occ. Code Ann., Chapter 1051, as a landscape architect pursuant to Tex. Occ. Code Ann., Chapter 1052, a person licensed as a professional engineer pursuant Tex. Occ. Code Ann., Chapter 1001, and/or a firm employed by Owner or Design-Build Firm to provide professional architectural or engineering services and to exercise overall responsibility for the design of a Project or a significant portion thereof, and to perform the contract administration responsibilities set forth in the Contract.
- 1.28 "Drawings" mean that product and set of documents of Design Professional which graphically depicts the Work.
- 1.29 "Final Completion" means the date determined and certified by Design Professional and Owner on which the Work is fully and satisfactorily complete in accordance with the Contract.
- 1.30 "Final Payment" means the last and final monetary compensation made to Contractor for any portion of the Work that has been completed and accepted for which payment has not been made including adjustments to the final Contract Sum resulting from approved change orders and release of Contractor's retainage.
- 1.31 "Float" means the period of time a task can be delayed without delaying Substantial Completion Date.
- 1.32 "Historically Underutilized Business (HUB)" pursuant to Tex. Gov't Code, Chapter 2161, means a business that is at least 51% owned by an Asian Pacific American, a Black American, a Hispanic American, a Native American and/or an American Woman; is an entity with its principal place of business in Texas; and has an owner residing in Texas with proportionate interest that actively participates in the control, operations, and management of the entity's affairs.
- 1.33 "Longest Path" means the sequence of directly related activities that comprise the longest continuous chain of activities from the start of the first activity to the finish of the last activity. The activities represent critical path plus Float plus historical Weather Days. Each activity in the Longest Path is critical and directly related in that it prevents its successor from being scheduled earlier than it is.
- 1.34 "Notice to Proceed" means written document furnished by the Owner informing Contractor of the date to commence the Work and the date anticipated for Substantial Completion.
- 1.35 "Open Item List" means a list of work activities, Punch list items, changes, or other issues not expected by Owner, Design Professional, and Contractor to be complete prior to Substantial Completion.
- 1.36 "Owner" means the University of North Texas System and/or its component institutions, as a higher education university system and agency of the State of Texas.
- 1.37 "Owner's Construction Manager (OCM)" means the individual assigned by the Owner to act on its behalf and to undertake certain activities as specifically outlined in the Contract. The OCM does not have the authority to bind the Owner or direct changes to the scope, cost, or time of the Contract.
- 1.38 "Owner's Designated Representative (ODR)" means the individual assigned by Owner to act on its behalf and to undertake certain activities as specifically outlined in the Contract. The ODR is the only party authorized to direct changes to the scope, cost, or time of the Contract.
- 1.39 "Progress Assessment Report (PAR)" means the monthly compliance report to Owner verifying compliance with the HUB subcontracting plan (HSP).

- 1.40 "Project" means all activities necessary for realization and completion of Owner's desired building or other structure including all ancillary and related work. This includes design, contract award(s), execution of the Work itself, fulfillment of all Contract and warranty obligations, and work by Owner's forces or other contractors.
- 1.41 "Project Costs" means all costs necessary for the realization and completion of Owner's desired building or other structure including all ancillary and related work. This includes design, contract award(s), execution of the Work itself, fulfillment of all Contract and warranty obligations, and work by Owner's forces or other contractors.
- 1.42 "Proposal Request (PR)" means a document that informs Contractor, Owner, and Design Professional of a proposed change in the Work and appropriately describes or otherwise documents such change including Contractor's pricing for the proposed change.
- 1.43 "Punch List" means a list of items of Work to be completed or corrected by Contractor before Final Completion, and indicates items to be finished, remaining Work to be performed, or Work that does not meet quality or quantity requirements as required in the Contract Documents.
- 1.44 "Reasonably Inferable" means a fair, proper, and moderate conclusion reached by considering all of the facts and deducing a logical conclusion from them.
- 1.45 "Record Documents" mean the Drawings, Specifications, and other materials maintained by Contractor during construction and as corrected by Design Professional, that documents all addenda, Architect's Supplemental Instructions, Change Orders, and postings and markings that record the as-built conditions of the Work and all changes made during construction.
- 1.46 "Request for Information (RFI)" means a written request by Contractor directed to Design Professional and Owner for a clarification of the information provided in the Contract Documents or for direction concerning information necessary to perform the Work.
- 1.47 "Samples" mean representative physical examples of materials, equipment, or workmanship used to confirm compliance with requirements and/or to establish standards for use in execution of the Work.
- 1.48 "Schedule of Values" means the detailed breakdown of the cost of the materials, labor, and equipment necessary to accomplish the Work, submitted by Contractor for approval by Owner and Design Professional.
- 1.49 "Shop Drawings" mean the drawings, diagrams, illustrations, schedules, performance charts, brochures, and other data prepared by Contractor or its agents which detail a portion of the Work.
- 1.50 "Site" means the geographical area of the location of the Work.
- 1.51 "Special Conditions" mean the documents containing terms and conditions which may be unique to the Work or Project.

- 1.52 "Specifications" mean the written product of Design Professional that establishes the quality and/or performance of products utilized in the Work and processes to be used, including testing and verification for producing the Work.
- 1.53 "Subcontractor" means an individual or entity that enters into an agreement with Contractor to perform part of the Work or to provide services, materials, or equipment for use in the Work.
- 1.54 "Submittal Register" means a list provided by Contractor of all items to be furnished for review and approval by Design Professional and Owner and as identified in the Contract Documents including anticipated sequence and submittal dates.
- 1.55 "Substantial Completion" means the date determined and certified by Contractor, Design Professional, and Owner when the Work, or a designated portion thereof, is sufficiently complete, in accordance with the Contract, so as to be operational and fit for the use intended.
- 1.56 "Substantial Completion Date" means the required date for substantial completion of the project. The Substantial Completion Date can only be changed by a written change order.
- 1.57 "Total Float" means the total number of days an activity on the longest path can be delayed without delaying the Substantial Completion Date.
- 1.58 "Unit Price Work" means the Work or a portion of the Work, paid for based on incremental units of measurement.
- 1.59 "Work" means the administration, procurement, materials, equipment, construction, and all services necessary for Contractor, and/or its agents, to fulfill Contractor's obligations under the Contract.
- 1.60 "Work Progress Schedule" means the continually updated time schedule prepared and monitored by Contractor that coordinates and integrates activities of the Project, including Contractor's services, Design Professional's services, the work of other consultants, suppliers, and Owner's activities with the anticipated construction schedules for other contractors. The Work Progress Schedule accurately indicates all necessary and appropriate revisions, including a Longest Path impact analysis, as required by the conditions of the Work and the Project while maintaining a concise comparison to the Baseline Schedule.

# ARTICLE 2. WAGE RATES AND OTHER LAWS GOVERNING CONSTRUCTION

2.1 <u>Environmental Regulations.</u> Contractor shall conduct activities in compliance with applicable laws and regulations and other requirements of the Contract relating to the environment and its protection at all times. Unless otherwise specifically determined, Contractor is responsible for obtaining and maintaining permits related to storm water run-off. Contractor shall conduct operations consistent with storm water run-off permit conditions. Contractor is responsible for all items it brings to the Site, including hazardous materials, and all such items brought to the Site by

its Subcontractors and suppliers, or by other entities subject to direction of Contractor. Contractor shall not incorporate hazardous materials into the Work without prior approval of Owner, and shall provide an affidavit attesting to such in association with request for Substantial Completion inspection.

- 2.2 <u>Wage Rates.</u> Contractor shall, and shall cause subcontractors to, comply with the Texas Prevailing Wage law. Contractor shall pay not less than the wage scale of the various classes of labor as shown on the prevailing wage schedule as established by the United States Department of Labor in accordance with the Davis-Bacon Act, as amended. The specified wage rates are minimum rates only. Owner is not bound to pay any claims for additional compensation made by Contractor because Contractor pays wages in excess of the applicable minimum rate contained in the Contract. The prevailing wage schedule is not a representation that qualified labor adequate to perform the Work is available locally at the prevailing wage rates. When requested, Contractor shall furnish competent evidence of compliance with the Texas Prevailing Wage Law and the addresses of all workers.
  - 2.2.1 <u>Notification to Workers.</u> Contractor shall post the prevailing wage schedule in a place conspicuous to all workers on the Project Site and shall notify each worker, in writing, of the following as they commence Work on the Contract: the worker's job classification, the established minimum wage rate requirement for that classification, as well as the worker's actual wage. The notice must be delivered to and signed in acknowledgement of receipt by the worker and must list both the wages and fringe benefits to be paid or furnished for each classification in which the worker is assigned duties.
    - 2.2.1.1 Contractor shall submit a copy of each worker's wage-rate notification to *Owner* with the application for progress payment for the period during which the worker was engaged in activities on behalf of the Project.
    - 2.2.1.2 Pursuant to Tex. Gov't Code § 2258.024, Contractor shall keep, on site, true and accurate records showing the name and occupation of each worker employed by the Contractor or subcontractors and the actual per diem wages paid to each worker. The record shall be open to inspection by the ODR and their agents at all reasonable hours for the duration of the contract.
    - 2.2.1.3 With each application for progress payment, Contractor shall make available upon request certified payroll records, including from subcontractors of any tier level, on Form WH-347 as promulgated by the U.S. Department of Labor, as may be revised from time to time and in unlocked and unprotected Excel format, along with copies of any and all Contract Documents between Contractor and any Subcontractor. Pursuant to Tex. Penal Code § 37.02 and 37.10, Employees of Contractor and subcontractors, including all tier levels, shall be subject to prosecution for submitting certified payroll records that contain materially false information.

- 2.2.1.4 The prevailing wage schedule is determined by Owner in compliance with Tex. Gov't Code, Chapter 2258. Should Contractor at any time become aware that a particular skill or trade not reflected on Owner's prevailing wage schedule will be or is being employed in the Work, whether by Contractor or by Subcontractor, Contractor shall promptly inform *Owner* of the proposed wage to be paid for the skill along with a justification for same and *Owner* shall promptly concur with or reject the proposed wage and classification.
- 2.2.1.5 Contractor is responsible for determining the most appropriate wage for a particular skill in relation to similar skills or trades identified on the prevailing wage schedule. In no case, shall any worker be paid less than the wage indicated for laborers.
- 2.2.1.6 Pursuant to Tex. Labor Code § 214.008, Misclassification of Workers; Penalty, Owner requires Contractor and all subcontractors properly classify individuals as employees or independent contractors.
- 2.2.2 <u>Penalty for Violation</u>. Contractor, and any Subcontractor, will pay to the State a penalty of sixty dollars (\$60) for each worker employed for each day, or portion thereof, that the worker is paid less than the wage rates stipulated in the prevailing wage schedule.
- 2.2.3 <u>Complaints of Violations.</u>
  - 2.2.3.1 <u>Owner's Determination of Good Cause.</u> Upon receipt of information concerning a violation, Owner will conduct an investigation in accordance with Tex. Gov't Code, Chapter 2258, and make an initial determination as to whether good cause exists that a violation occurred. Upon making a good cause finding, Owner will retain the full amounts claimed by the claimant or claimants as the difference between wages paid and wages due under the prevailing wage schedule and any supplements thereto, together with the applicable penalties, such amounts being subtracted from successive progress payments pending a final decision on the violation.
  - 2.2.3.2 <u>No Extension of Time.</u> If Owner's determination proves valid that good cause existed to believe a violation had occurred, Contractor is not entitled to an extension of time for any delay arising directly or indirectly from the arbitration procedures.
  - 2.2.3.3 <u>Cooperation with Owner's Investigation.</u> Contractor shall cooperate with Owner during any investigation hereunder. Such cooperation shall include, but not necessarily be limited to, timely providing the information and/or documentation requested by Owner, which may include certified payroll records on Form WH-347 as promulgated by the U.S Department of Labor, as may be revised from time to time and in unlocked and unprotected Excel

format; and copies of any and all Contract Documents between Contractor and any Subcontractors.

- 2.2.3.4 <u>Notification to Owner</u>. In the event Contractor or Subcontractor elect to appeal an initial determination made pursuant to Paragraph 2.2.3.1, the Contractor and/or Subcontractor, as applicable, shall deliver notice thereof to Owner.
- 2.3 <u>Licensing of Trades.</u> Contractor shall comply with all applicable provisions of State law related to license requirements for skilled tradesmen, contractors, suppliers, and laborers, as necessary to accomplish the Work. In the event Contractor, or one of its Subcontractors, loses its license during the term of performance of the Contract, Contractor shall promptly hire or contract with a licensed provider of the service at no additional cost to Owner.
- 2.4 <u>Royalties, Patents, and Copyrights.</u> Contractor shall pay all royalties and license fees, defend suits or claims for infringement of copyrights and patent rights, and shall hold Owner harmless from loss on account thereof. Provided, however, if Contractor is a Construction Manager-at-Risk, Contractor shall not be responsible for such defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by Owner or Design Professional; unless Contractor has reason to believe that the required design, process, or product is an infringement of a copyright or a patent then Contractor shall be responsible for such loss unless notice of such information is promptly furnished to Design Professional.
- 2.5 <u>State Sales and Use Taxes.</u> Owner qualifies for exemption from certain State and local sales and use taxes pursuant to the provisions of Tex. Tax Code, Chapter 151. Upon request from Contractor, Owner shall furnish evidence of tax-exempt status. Contractor may claim exemption from payment of certain applicable State taxes by complying with such procedures as prescribed by the State Comptroller of Public Accounts. Owner acknowledges not all items qualify for exemption. Owner is not obligated to reimburse Contractor for taxes paid on items that qualify for tax exemption.
- 2.6 <u>Antiquities.</u> Contractor shall take precaution to avoid disturbing primitive records and antiquities of archaeological, paleontological, or historical significance. No objects of this nature shall be disturbed without written permission of Owner and the Texas Historical Commission. When such objects are uncovered unexpectedly, the Contractor shall stop all Work in close proximity and notify the OCM and the Texas Historical Commission of their presence and shall not disturb them until written permission and permit to do so is granted. All primitive rights and antiquities, as defined in Chapter 191, Texas Natural Resource Code, discovered on the Owner's property shall remain property of State of Texas. If it is determined by Owner, in consultation with the Texas Historical Commission that exploration or excavation of primitive records or antiquities on the Project Site is necessary to avoid loss, Contractor shall cooperate in salvage work attendant to preservation. If the Work stoppage or salvage work causes an increase in the Contractor's cost of, or time required for, performance of the Work, Contractor may notify the Owner in accordance with Article 14.

2.7 <u>Franchise Tax Status.</u> Upon request, the Contractor agrees to execute and provide to the Owner a Certification of Franchise Tax Payment, on a form approved by the Owner.

# ARTICLE 3. GENERAL RESPONSIBILITIES OF OWNER

- 3.1 <u>Preconstruction Conference.</u> Prior to, or concurrent with, the issuance of Notice to Proceed, a conference will be convened for attendance by Owner, Contractor, Design Professional and appropriate Subcontractors. The purpose of the conference is to establish a working understanding among the parties as to the Work, the operational conditions at the Project Site, and general administration of the Project. Topics include communications, schedules, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, maintaining required records and all other matters of importance to the administration of the Project and effective communications between the Project team members.
- 3.2 <u>Owner's Construction Manager (OCM).</u> Prior to the start of construction, Owner will identify its OCM, who has the express authority to act on behalf of the Owner to the extent and for the purposes described in the Contract, including responsibilities for general administration of the Contract.
  - 3.2.1 <u>Point of Contact.</u> Unless otherwise specifically defined elsewhere in the Contract Documents, OCM is the single point of contact between Owner and Contractor. Notice to OCM, unless otherwise noted, constitutes notice to Owner under the Contract.
  - 3.2.2 <u>Directives.</u> All directives on behalf of Owner will be conveyed to Contractor and Design Professional by OCM in writing.

### 3.3 <u>Owner Supplied Materials and Information.</u>

- 3.3.1 <u>Surveys.</u> Owner will furnish to Contractor those surveys Owner possesses describing the physical characteristics, legal description, limitations of the Site, Site utility locations, and other information used in the preparation of the Contract Documents.
- 3.3.2 <u>Drawings and Specifications.</u> Owner will furnish or cause to be furnished, free of charge, the number of complete sets, paper or electronic, of the Drawings, Specifications, and addenda as provided in the Contract.
- 3.3.3 <u>Other Information.</u> Owner will provide information, equipment, or services under Owner's control to Contractor with reasonable promptness.
- 3.4 <u>Availability of Lands.</u> Owner will furnish, as indicated in the Contract, all required rights to use the lands upon which the Work occurs. This includes rights-of-way and easements for access and such other lands that are designated for use by Contractor. Contractor shall comply with all Owner identified encumbrances or restrictions specifically related to use of lands so furnished. Owner

will obtain and pay for easements for permanent structures or permanent changes in existing facilities, unless otherwise required in the Contract Documents.

- 3.5 <u>Limitation on Owner's Duties.</u>
  - 3.5.1 <u>No Control.</u> Owner will not supervise, direct, control or have authority over, or be responsible for Contractor's means, methods, technologies, sequences, or procedures of construction or the safety precautions and programs incident thereto. Owner is not responsible for any failure of Contractor to comply with laws and regulations applicable to the Work. Owner is not responsible for the failure of Contractor to perform or furnish the Work in accordance with the Contract Documents. Except as provided herein, Owner is not responsible for the acts or omissions of Contractor, or any of its Subcontractors, suppliers, or of any other person or organization performing or furnishing any of the Work on behalf of Contractor.
  - 3.5.2 <u>No Contravention of Design Professional.</u> Owner will not take any action in contravention of a design decision made by Design Professional in preparation of the Contract Documents, when such actions are in conflict with statutes under which Design Professional is licensed for the protection of the public health and safety.

## ARTICLE 4. GENERAL RESPONSIBILITIES OF DESIGN PROFESSIONAL

- 4.1 <u>Role of Design Professional.</u> Unless specified otherwise in the Contract between Owner and Contractor, in addition to design services Design Professional shall provide general administration services for Owner during the construction phase of the project. Written correspondence, RFIs, and Shop Drawings/submittals shall be directed to Design Professional for determination and action. Design Professional has the authority to act on behalf of Owner to the extent provided in the Contract Documents, unless otherwise modified by written instrument, which will be furnished to Contractor by OCM, upon request.
- 4.2 <u>Site Visits.</u> Design Professional will make visits to the Site at intervals as provided in the Design Professional's Contract with Owner, to observe the progress and the quality of the various aspects of Contractor's executed Work and report findings to OCM.
- 4.3 <u>Inspections.</u> Design Professional has the authority to interpret Contract Documents and inspect the Work for compliance and conformance with the Contract. Except as referenced in Paragraph 3.1.5.2, Owner retains the sole authority to accept or reject Work and issue direction for correction, removal, or replacement of Work.
- 4.4 <u>Clarifications and Interpretations.</u> It may be determined that clarifications or interpretations of the Contract Documents are necessary. Such clarifications or interpretations will be provided by Design Professional consistent with the intent of the Contract Documents. Design Professional will issue these clarifications with reasonable promptness to Contractor as Design Professional's supplemental instruction ("ASI") or similar instrument. If Contractor believes that such

clarification or interpretation justifies an adjustment in the Contract Sum or the Contract Time, Contractor shall so notify Owner in accordance with the provisions of Article 14.

- 4.5 <u>Limitations on Design Professional Authority.</u> Design Professional is not responsible for:
  - Contractor's means, methods, techniques, sequences, procedures, safety, or programs incident to the Work, nor will Design Professional supervise, direct, control, or have authority over the same;
  - The failure of Contractor to comply with laws and regulations applicable to the furnishing or performing the Work;
  - Contractor's failure to perform or furnish the Work in accordance with the Contract Documents; or
  - Acts or omissions of Contractor, or of any other person or organization performing or furnishing any of the Work.

# ARTICLE 5. GENERAL RESPONSIBILITIES OF CONTRACTOR

- 5.1 <u>Contractor's General Responsibilities.</u> Contractor is solely responsible for implementing the Work in full compliance with all applicable laws and the Contract Documents and shall supervise and direct the Work using the best skill and attention to assure that each element of the Work conforms to the Contract requirements. Contractor is solely responsible for all construction means, methods, techniques, safety, sequences, coordination, procedures and protection of the installed work as part of the contract until Substantial Completion of the project. Contractor remains responsible for the care and protection of materials and Work in the areas where Punch list items are completed until Final Completion.
  - 5.1.1 <u>Site Visit.</u> Contractor shall visit the Site before commencing the Work and become familiar with local conditions such as the location, accessibility and general character of the Site and/or building. Contractor shall evaluate and plan for all construction related activities that will potentially impact the safety of students, staff, and visitors. A site-specific safety plan must be provided to the OCM prior to the commencement of any construction activities. The site-specific safety plan must include, at the minimum, project site controls and safety, building locations, delivery logistics, project offices, materials staging and parking.
- 5.2 <u>Project Administration.</u> Contractor shall provide Project administration for all Subcontractors, vendors, suppliers, and others involved in implementing the Work and shall coordinate administration efforts with those of Design Professional and OCM in accordance with these Uniform General Conditions and other provisions of the Contract, and as outlined in the pre-construction conference. Contractor's Project Administration includes periodic daily reporting on weather, work progress, labor, materials, equipment, obstruction to prosecution of the work, accidents and injuries in accordance with the Contract and transmitted no less frequently than on a weekly basis.

- 5.2.1 <u>Contractor's Management Personnel.</u> Contractor shall employ a competent person or persons who will be present at the Project Site during the progress of the Work to supervise or oversee the Work. Contractor's management personnel are subject to the approval of OCM, and shall be removed and replaced at the request of OCM. Contractor shall not change approved staff during the course of the Project without the written approval of OCM unless the staff member leaves the employment of Contractor in which case Contractor shall notify OCM and appoint an approved replacement as soon as reasonably possible. Contractor shall provide additional quality control, safety, and other staff as may be stated in the Contract Documents or as may be necessary or advisable for completion of the Work.
- 5.2.2 <u>Labor.</u> Contractor shall provide competent, suitably qualified personnel to survey, lay-out, and construct the Work as required by the Contract Documents and maintain good discipline and order at the Site at all times.
- 5.2.3 <u>Services, Materials, and Equipment.</u> Unless otherwise specified, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities, incidentals, and services necessary for the construction, performance, testing, start-up, inspection, and completion of the Work. The Contractor shall provide, without extra charge, all incidental items required as a part of the Work, even if not particularly specified or indicated in the Contract Documents.
- 5.2.4 <u>No Substitutions without Approval.</u> Contractor may make substitutions only with the consent of the Owner, after evaluation and recommendation by the Design Professional and in accordance with a Change Order.
- 5.3 <u>Owner Equipment or Material.</u> For Owner furnished equipment or material that will be in the care, custody, and control of Contractor, Contractor will be responsible for any damage or loss.
- 5.4 <u>Non-Compliant Work.</u> Should Design Professional and/or OCM identify Work as noncompliant with the Contract Documents, Design Professional and/or OCM shall communicate the finding to Contractor, and Contractor shall correct such Work at no additional cost to the Owner. The approval of Work by either Design Professional or OCM does not relieve Contractor from the obligation to comply with all requirements of the Contract Documents.
- 5.5 <u>Subcontractors.</u> Contractor shall not employ any Subcontractor, supplier, or other person or organization, whether initially or as a substitute, against whom Owner shall have reasonable objection. Owner will communicate such objections in writing within ten (10) days of receipt of Contractor's intent to use such Subcontractor, supplier, or other person or organization. Contractor is not required to employ any Subcontractor, supplier, or other person or organization to furnish any of the work to whom Contractor has reasonable objection. Contractor shall not substitute Subcontractors without the acceptance of Owner.

- 5.5.1 <u>Contract Documents.</u> All Subcontracts and supply contracts shall be consistent with and bind the Subcontractors and suppliers to the terms and conditions of the Contract Documents including provisions of the Contract between Contractor and Owner.
- 5.5.2 <u>Scheduling.</u> Contractor shall be solely responsible for scheduling and coordinating the Work of Subcontractors, suppliers, and other persons and organizations performing or furnishing any of the Work under a direct or indirect contract or subcontract with Contractor. Contractor shall require all Subcontractors, suppliers, and such other persons and organizations performing or furnishing any of the Work to communicate with Owner only through Contractor. Contractor shall furnish to Owner a copy, at Owner's request, of each first-tier subcontract promptly after its execution. Contractor agrees that Owner has no obligation to review or approve the content of such contracts and that providing Owner such copies in no way relieves Contractor of any of the terms and conditions of the Subcontractor to be bound to Contractor in the same manner in which Contractor is bound to Owner.
- 5.6 <u>Continuing the Work.</u> Contractor shall carry on the Work and adhere to the progress schedule during all disputes, disagreements, or alternative resolution processes with Owner. Contractor shall not delay or postpone any Work because of pending unresolved disputes, disagreements, or alternative resolution processes, except as Owner and Contractor may agree in writing.
- 5.7 <u>Cleaning.</u> Contractor shall at all times, keep the Site and the Work clean and free from accumulation of waste materials or rubbish caused by the construction activities under the Contract. Contractor shall ensure that the entire Project is thoroughly cleaned prior to requesting Substantial Completion inspection and, again, upon completion of the Project prior to the final inspection.
- 5.8 <u>Acts and Omissions of Contractor, its Subcontractors, and Employees.</u> Contractor shall be responsible for acts and omissions of its employees and its Subcontractors and their agents and employees. Owner may, in writing, require Contractor to remove from the Project any of Contractor's or its Subcontractor's employees or agents whom OCM finds to be careless, incompetent, unsafe, uncooperative, disruptive, or otherwise objectionable.
- 5.9 <u>Ancillary Areas.</u> Contractor shall operate and maintain operations and associated storage areas at the site of the Work in accordance with the following:
  - All Contractor operations, including storage of materials and employee parking upon the Site of Work, shall be confined to areas designated by OCM.
  - Contractor may erect, at its own expense, temporary buildings that will remain its property. Contractor will remove such buildings and associated utility service lines upon completion of the Work, unless Contractor requests and Owner provides written consent that it may abandon such buildings and utilities in place.
  - Contractor will use only established roadways or construct and use such temporary roadways as may be authorized by OCM. Contractor will not allow load limits of

vehicles to exceed the limits prescribed by appropriate regulations or law. Contractor will provide protection to road surfaces, curbs, sidewalks, trees, shrubbery, sprinkler systems, drainage structures, and other like existing improvements to prevent damage and will repair any damage thereto at the expense of Contractor.

- Owner may restrict Contractor's entry to the Site to specifically assigned entrances and routes.
- 5.10 <u>Off-Site Storage.</u> With prior approval by Owner and in the event, Contractor elects to store materials at an off-site location, Contractor must abide by the following conditions, unless otherwise agreed to in writing by Owner:
  - Store materials in a commercial warehouse meeting the criteria stated below.
  - Provide insurance coverage adequate not only to cover materials while in storage, but also in transit from the off-site storage areas to the Project Site. Copies of duly authenticated certificates of insurance must be filed with Owner's representative.
  - Inspection by Owner's representative is allowed at any time. OCM must be satisfied with the security, control, maintenance, and preservation measures.
  - Materials for this Project must be physically separated and marked for the Project in a sectioned-off area. Only materials which have been approved through the submittal process are to be considered for payment.
  - Owner reserves the right to reject materials at any time prior to final acceptance of the complete Contract if they do not meet Contract requirements regardless of any previous progress payment made.
  - With each monthly payment estimate, Contractor must submit a report to OCM and Design Professional listing the quantities of materials already paid for and still stored in the off-site location.
  - Contractor must make warehouse records, receipts, and invoices available to Owner's representatives, upon request, to verify the quantities and their disposition.
  - In the event of Contract termination or default by Contractor, the items in storage off-site, upon which payment has been made, will be promptly turned over to Owner or Owner's agents in place or at a location near the jobsite as directed by OCM. The full provisions of performance and payment bonds on this Project cover the materials off-site in every respect as though they were stored on the Project Site.
- 5.11 <u>Separate Contracts.</u> Owner reserves the right to award other contracts in connection with the Project or other portions of the Project under the same or substantially similar contract conditions, including those portions related to insurance and waiver of subrogation. Owner reserves the right to perform operations related to the Project with Owner's own forces.
  - 5.11.1 <u>Continuation of Contract.</u> Under a system of separate contracts, the conditions described herein continue to apply except as may be amended by Amendment or Change Order.

- 5.11.2 <u>Cooperation.</u> Contractor shall cooperate with other contractors or forces employed on the Project by Owner, including providing access to Site, integration of activities within Contractor's Work Progress Schedule and Project information as requested.
- 5.11.3 <u>Reimbursement.</u> Owner shall be reimbursed by Contractor for costs incurred by Owner which are payable to a separate contractor because of delays, improperly timed activities, or defective construction by Contractor. Owner will equitably adjust the Contract by Change Order for costs incurred by Contractor because of delays, improperly timed activities, damage to the Work, or defective construction by a separate contractor.

### ARTICLE 6. <u>HISTORICALLY UNDERUTILIZED BUSINESS (HUB) SUBCONTRACTING PLAN</u>

- 6.1 <u>General Description.</u> The purpose of the Historically Underutilized Business (HUB) program is to promote equal business opportunities for economically disadvantaged persons (as defined by Tex. Gov't Code, Chapter 2161) to contract with the State of Texas in accordance with the goals specified in the State of Texas Disparity Study. The HUB program annual procurement utilization goals are defined in 34 T.A.C. § 20.284.
  - 6.1.1 <u>Good Faith Effort.</u>
    - 6.1.1.1 State agencies are required by statute to make a good faith effort to assist HUBs in participating in contract awards issued by the State. 34 T.A.C., Chapter 20, Subchapter D, Division 1 outlines the State's policy to encourage the utilization of HUBs in State contracting opportunities through race, ethnic, and gender-neutral means.
    - 6.1.1.2 A Contractor who contracts with the State in an amount of \$100,000 or greater is required to make a good faith effort to award subcontracts to HUBs in accordance with 34 T.A.C. § 20.285 by submitting a HUB subcontracting plan within twenty-four (24) hours after the bid or response is due and complying with the HUB subcontracting plan after it is accepted by Owner and during the term of the Contract.
- 6.2 <u>Compliance with Approved HUB Subcontracting Plan.</u> Contractor, having been awarded this Contract in part by complying with the HUB program statute and rules, hereby covenants to continue to comply with the HUB program as follows:
  - Prior to adding or substituting a Subcontractor, promptly notify Owner in the event a change is required for any reason to the accepted HUB subcontracting plan.
  - Conduct the good-faith effort activities required, and provide Owner with necessary documentation to justify approval of a change to the approved HUB subcontracting plan.
  - Cooperate in the execution of a Change Order or such other approval of the change in the HUB subcontracting plans as Contractor and Owner may agree to.

- Maintain and make available to Owner upon request business records documenting compliance with the accepted HUB subcontracting plan.
- Upon receipt of payment for performance of Work, submit to Owner a compliance report, in the format required by Owner that demonstrates Contractor's performance of the HUB subcontracting plan.
- Submit monthly Progress Assessment Reports (PAR) to Owner, verifying compliance with the HUB subcontracting plan, including the use/expenditures made made/to Subcontractors. (The PAR is available at the following link: http://www.window.state.tx.us/procurement/prog/hub/hub-forms/.)
- Promptly and accurately explain and provide supplemental information to Owner to assist in Owner's investigation of Contractor's good-faith effort to fulfill the HUB subcontracting plan and the requirements under 34 T.A.C. § 20.285.
- 6.3 <u>Failure to Demonstrate Good-Faith Effort.</u> Upon a determination by Owner that Contractor has failed to demonstrate a good-faith effort to fulfill the HUB subcontracting plan or any Contract covenant detailed above, Owner may, in addition to all other remedies available to it, report the failure to perform to the Comptroller of Public Accounts, Texas Procurement and Support Services Division, Historically Underutilized Business Program and may bar Contractor from future contracting opportunities with Owner.

# ARTICLE 7. BONDS

- 7.1 <u>Construction Bonds.</u> Contractor is required to tender to Owner, prior to commencing the Work, performance and payment bonds, as required by Tex. Gov't Code, Chapter 2253.
- 7.2 <u>Bond Requirements.</u> Each bond shall be executed by a corporate surety or sureties authorized to do business in the State of Texas, acceptable to Owner, and in compliance with the relevant provisions of the Texas Insurance Code. If any bond is for more than ten percent (10%) of the surety's capital and surplus, Owner may require certification that the company has reinsured the excess portion with one or more reinsurers authorized to do business in the State. A reinsurer may not reinsure for more than ten percent (10%) of its capital and surplus. If a surety upon a bond loses its authority to do business in the State, Contractor shall, within thirty (30) days after such loss, furnish a replacement bond at no added cost to Owner.
  - 7.2.1 <u>Performance Bonds.</u> A Performance bond is required if the Contract Sum is in excess of \$100,000. The performance bond is solely for the protection of Owner. The performance bond is to be for the Contract Sum to guarantee the faithful performance of the Work in accordance with the Contract Documents. For Design-Build Projects the performance bond is to be for the full amount of both the construction and design services in accordance with the Contract Documents. The form of the bond shall be approved by Owner. The performance bond shall be effective through Contractor's warranty period.

- 7.2.2 <u>Payment Bonds.</u> A Payment bond is required if the Contract Sum is in excess of \$25,000. The payment bond is to be for the Contract Sum and is payable to Owner solely for the protection and use of payment bond beneficiaries. For Design-Build Projects the payment bond is to be for the full amount of both the construction and design services in accordance with the Contract Documents. The form of the bond shall be approved by Owner.
- 7.2.3 <u>When Bonds Are Due.</u> Payment and performance bonds are due before Contractor commences any Work.
- 7.2.4 <u>Power of Attorney</u>. Each bond shall be accompanied by a valid power of attorney (issued by the surety company and attached, signed and sealed with the corporate embossed seal, to the bond) authorizing the attorney-in-fact who signs the bond to commit the company to the terms of the bond, and stating any limit in the amount for which the attorney can issue a single bond.
- 7.3 <u>Bond Indemnification.</u> The process of requiring and accepting bonds and making claims thereunder shall be conducted in compliance with Tex. Gov't Code, Chapter 2253. IF FOR ANY REASON A STATUTORY PAYMENT OR PERFORMANCE BOND IS NOT HONORED BY THE SURETY, CONTRACTOR SHALL FULLY INDEMNIFY AND HOLD HARMLESS OWNER, AND ITS COMPONENT INSTITUTIONS, REGENTS, ELECTED AND APPOINTED OFFICIALS, DIRECTORS, OFFICERS, EMPLOYEES, AGENTS, REPRESENTATIVES, AND VOLUNTEERS, FROM AND AGAINST ANY COSTS, LOSSES, OBLIGATIONS, OR LIABILITIES IT INCURS AS A RESULT.
  - 7.3.1 <u>Furnishing Bond Information</u>. Owner shall furnish certified copies of the payment bond and the related Contract to any qualified person seeking copies who complies with Tex. Gov't Code § 2253.026.
  - 7.3.2 <u>Claims on Payment Bonds.</u> Claims on payment bonds must be sent directly to Contractor and his surety in accordance with Tex. Gov't Code § 2253.041. All payment bond claimants are cautioned that no lien exists on the funds unpaid to Contractor on such Contract, and that reliance on notices sent to Owner may result in loss of their rights against Contractor and/or his surety. Owner is not responsible in any manner to a claimant for collection of unpaid bills, and accepts no such responsibility because of any representation by any agent or employee.
- 7.4 <u>Payment of Claims when Payment Bond is Not Required.</u> The rights of Subcontractors regarding payment are governed by Tex. Prop. Code § 53.231 53.239 when the value of the Contract between Owner and Contractor is less than \$25,000.00. These provisions set out the requirements for filing a valid lien on funds unpaid to Contractor as of the time of filing the claim, and actions necessary to release the lien and satisfaction of such claim.
- 7.5 <u>Sureties.</u> A surety shall be listed on the US Department of the Treasury's Listing of Approved Sureties maintained by the Bureau of Financial Management Service (FMS), <u>https://fiscal.treasury.gov/surety-bonds/list-certified-companies.html</u>, stating companies holding

Certificates of Authority as acceptable sureties on federal bonds and acceptable reinsuring companies (FMS Circular 570). The Owner will consider acceptable any corporate surety which is qualified under this paragraph and which has a rating of at least B in Best's Insurance Reports – Property – Casualty.

7.6 <u>Bond Costs.</u> The costs of bonds are a pass-through amount to the Owner. No markup amounts are to be included and documentation of bond costs are required in requests for payment. Any costs associated with subcontractor bonds or SubGuard-related items are not paid by the Owner in General Conditions or Cost of Work.

## ARTICLE 8. INDEMNITY AND INSURANCE

- 8.1 Indemnification of Owner. Contractor covenants and agrees to FULLY INDEMNIFY and HOLD HARMLESS Owner, and its component institutions, Regents, elected and appointed officials, directors, officers, employees, agents, representatives, and volunteers, individually or collectively, from and against any and all costs, claims, liens, damages, losses, expenses, fees, fines, penalties, proceedings, actions, demands, causes of action, liability, and suits of any kind and nature, including but not limited to, personal or bodily injury, death, or property damage, made upon Owner directly or indirectly arising out of, resulting from, or related to Contractor's activities under the Contract, including any acts or omissions of Contractor, or any director, officer, employee, agent, representative, consultant, or Subcontractor of Contractor, and their respective directors, officers, employees, agents, and representatives while in the exercise of performance of the rights or duties under the Contract. The indemnity provided for in this paragraph does not apply to any liability resulting from the negligence of Owner or separate contractors in instances where such negligence causes personal injury, death, or property damage. IN THE EVENT CONTRACTOR AND OWNER ARE FOUND JOINTLY LIABLE BY A COURT OF COMPETENT JURISDICTION, LIABILITY WILL BE APPORTIONED COMPARATIVELY IN ACCORDANCE WITH THE LAWS OF THE STATE OF TEXAS, WITHOUT WAIVING ANY GOVERNMENTAL IMMUNITY AVAILABLE TO THE STATE UNDER TEXAS LAW AND WITHOUT WAIVING ANY DEFENSES OF THE PARTIES UNDER TEXAS LAW.
  - 8.1.1 <u>No Third-Party Beneficiaries.</u> The provisions of this indemnification are solely for the benefit of the parties hereto and not intended to create or grant any rights, contractual or otherwise, to any other person or entity.
  - 8.1.2 <u>Notice.</u> Contractor shall promptly advise Owner in writing of any claim or demand against Owner or against Contractor known to Contractor related to or arising out of Contractor's activities under this Contract.
  - 8.1.3 The indemnity provisions shall survive the termination of the Contract regardless of the reason for termination.

- 8.2 <u>Insurance Requirements.</u> Design Professional shall carry insurance in the types and amounts indicated in the Contract for the duration of the Contract. Unless otherwise provide for in the Contract, Contractor shall carry insurance in the types and amounts indicated in these Uniform General Conditions for the duration of the Contract. The insurance shall be evidenced by delivery to Owner of certificates of insurance executed by the insurer or its authorized agent stating coverage, limits, expiration dates, and compliance with all applicable required provisions. Upon request, Owner and its agents shall be entitled to receive, without expense, copies of the policies and all endorsements. Contractor shall update all expired policies prior to submission for monthly payment. Failure to update policies shall be reason for withholding of payment until renewal is provided to Owner.
  - 8.2.1 <u>Period of Coverage.</u> Contractor, consistent with its status as an independent contractor, shall provide and maintain all insurance coverages with the minimum amounts described below until the end of the warranty period unless expressly agreed otherwise. Failure to maintain insurance coverage, as required, is grounds for suspension of Work for cause pursuant to Article 17.
  - 8.2.2 <u>Certificates.</u> Contractor shall deliver to Owner true and complete copies of certificates and corresponding policy endorsements prior to the issuance of any Notice to Proceed.
  - 8.2.3 <u>Failure to Provide Certificates.</u> Failure of Owner to demand such certificates or other evidence of Contractor's full compliance with these insurance requirements or failure of Owner to identify a deficiency in compliance from the evidence provided shall not be construed as a waiver of Contractor's obligation to maintain such insurance.
  - 8.2.4 <u>Contractor's Liability.</u> The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner in the Contract Documents.
  - 8.2.5 <u>Insurance Limits.</u> The insurance coverage and limits established herein shall not be interpreted as any representation or warranty that the insurance coverage and limits necessarily will be adequate to protect Contractor.
  - 8.2.6 <u>Insurers.</u> Coverage shall be written on an occurrence basis by companies authorized and admitted to do business in the State of Texas and rated A-, VII or better by A.M. Best Company or similar rating company or otherwise acceptable to Owner.

### 8.3 Insurance Coverage Required.

- 8.3.1 <u>Workers' Compensation Insurance.</u> Coverage with limits as required by the Texas Workers' Compensation Act, with the policy endorsed to provide a waiver of subrogation as to Owner, and Employer's Liability Insurance with limits of not less than:
  - \$1,000,000 each accident;
  - \$1,000,000 disease each employee; and
  - \$1,000,000 disease policy limit.

- Workers' compensation insurance coverage must meet the statutory requirements of Tex. Lab. Code § 401.011(44), and requirements specific to construction projects for public entities as required by Tex. Lab. Code § 406.096.
- Policies must include (a) Other States Endorsement to include TEXAS if business is domiciled outside the State of Texas, and (b) a waiver of all rights of subrogation in favor of Owner.
- 8.3.2 <u>Commercial General Liability Insurance.</u> Coverage including premises, operations, independent contractor's liability, products, and completed operations and contractual liability, covering, but not limited to, the liability assumed under the indemnification provisions of this Contract, fully insuring Contractor's (or Subcontractor's) liability for bodily injury (including death) and property damage with a minimum limit of:
  - \$1,000,000 per occurrence;
  - \$2,000,000 general aggregate;
  - \$5,000 Medical Expense each person;
  - \$1,000,000 Personal Injury and Advertising Liability;
  - \$2,000,000 products and completed operations aggregate;
  - \$50,000 Damage to Premises Rented by You; and
  - Coverage shall be on an "occurrence" basis.
  - The policy shall include coverage extended to apply to completed operations and explosion, collapse, and underground hazards. The policy shall include endorsement CG2503 Amendment of Aggregate Limits of Insurance (per Project) or its equivalent.
  - If the Work involves any activities within fifty (50) feet of any railroad, railroad protective insurance as may be required by the affected railroad, written for not less than the limits required by such railroad.
- 8.3.3 <u>Asbestos Abatement Liability Insurance.</u> Coverage including coverage for liability arising from the encapsulation, removal, handling, storage, transportation, and disposal of asbestos containing materials. This requirement applies if the Work or the Project includes asbestos containing materials.
  - The combined single limit for bodily injury and property damage will be a minimum of \$1,000,000 per occurrence.
  - Specific requirement for claims-made form: Required period of coverage will be determined by the following formula: continuous coverage for life of the Contract, plus one (1) year (to provide coverage for the warranty period), and an extended discovery period for a minimum of five (5) years which shall begin at the end of the warranty period.
  - Employer's liability limits for asbestos abatement will be:
  - \$1,000,000 each accident;
  - \$1,000,000 disease each employee; and
  - \$1,000,000 disease policy limit.

- 8.3.4 <u>Comprehensive Automobile Liability Insurance.</u> Coverage covering owned, hired, and non-owned vehicles, with a minimum combined single limit for bodily injury (including death) and property damage of \$1,000,000 per occurrence. No aggregate shall be permitted for this type of coverage.
  - Such insurance is to include coverage for loading and unloading hazards.
  - Contractor, or any subcontractor of Contractor, responsible for transporting asbestos or other hazardous materials defined as asbestos shall provide pollution coverage for any vehicle hauling asbestos containing cargo. The policy must include an MCS 90 endorsement with a \$5,000,000 limit and the CA 9948 Pollution Endorsement, or its equivalent.
- 8.3.5 <u>All-Risk Builder's Risk Insurance.</u> Coverage shall be all-risk (or all-risk installation floater for instances in which the project involves solely the installation of material and/or equipment), including, but not limited to, fire, extended coverage, vandalism and malicious mischief, theft and, if applicable, flood, earth movement and named storm. Builder's risk and installation floater limits shall be equal to 100 percent of the Contract Sum plus, if any, existing property and Owner-furnished equipment specified by Owner. The policy shall be written jointly in the names of Owner and Contractor. Subcontractors shall be named as additional insureds. The policy shall have endorsements as follows:
  - This insurance shall be specific as to coverage and not contributing insurance with any permanent insurance maintained on the property.
  - This insurance shall not contain an occupancy clause suspending or reducing coverage should Owner partially occupy the Site and before the parties have determined Substantial Completion.
  - Loss, if any, shall be adjusted with and made payable to Owner as trustee for the insureds as their interests may appear. Owner shall be named as loss payee.
  - For renovation projects or projects that involve portions of Work contained within an existing structure, refer to Supplementary or Special Conditions for possible additional builder's risk insurance requirements.
  - For Owner furnished equipment or materials that will be in care, custody or control of Contractor, Contractor will be responsible for damage and loss.
  - For those properties located within a Tier 1 or 2 windstorm area, named storm coverage must be provided with limits specified by Owner.
  - For those properties located in flood prone areas, flood insurance coverage must be provided with limits specified by Owner.
  - Builder's risk insurance policy shall remain in effect until Substantial Completion.
  - If this Contract is for asbestos abatement only, the foregoing All-Risk Builder's Risk or All-Risk Installation Floater is not required.
- 8.3.6 <u>"Umbrella" Liability Insurance.</u> Coverage during the Contract term, insuring Contractor (or Subcontractor) that provides coverage at least as broad as and applies in excess and follows form of the primary liability coverage required above. The policy shall provide

"drop down" coverage where underlying primary insurance coverage limits are insufficient or exhausted.

• "Umbrella" Liability Insurance coverage shall be for the following Contract amounts in the corresponding coverage amounts:

Contract Amount	<u>Occurrence</u>	Annual Aggregate
< \$1,000,000	No Umbrella	
\$1,000,000 up to < \$3,000,000	\$1,000,000	\$2,000,000
\$3,000,000 up to < \$5,000,000	\$5,000,000	\$5,000,000
\$5,000,000 or greater	\$10,000,000	\$10,000,000

- 8.4 <u>Policy Requirements.</u> Policies must include the following clauses, as applicable:
  - This insurance shall not be suspended, voided, canceled, materially changed, or nonrenewed except after thirty (30) days, or ten (10) days for non-payment of premium, written notice has been given to Owner.
  - It is agreed that Contractor's insurance shall be deemed primary with respect to any insurance or self-insurance carried by Owner for liability arising out of operations under the Contract with Owner.
  - Owner, its officials, directors, employees, representatives, and volunteers are added as additional insureds with respect to operations and activities of, or on behalf of the named insured performed under the Contract with Owner. The additional insured status must cover completed operations as well. This is not applicable to workers' compensation policies.
  - A waiver of subrogation in favor of Owner shall be provided in all policies.
  - If Owner is damaged by the failure of Contractor (or Subcontractor) to maintain insurance as required herein and/or as further described in Owner's Special Conditions, then Contractor shall bear all reasonable costs properly attributable to that failure.
- 8.5 WITHOUT LIMITING ANY OF THE OTHER Subcontractor Insurance Coverage. OBLIGATIONS OR LIABILITIES OF CONTRACTOR, CONTRACTOR SHALL **REQUIRE EACH SUBCONTRACTOR PERFORMING WORK UNDER THE** CONTRACT TO MAINTAIN DURING THE TERM OF THE CONTRACT, THE SAME STIPULATED MINIMUM INSURANCE INCLUDING THE REQUIRED PROVISIONS AND ADDITIONAL POLICY CONDITIONS AS SHOWN ABOVE, AS AN ALTERNATIVE. CONTRACTOR MAY INCLUDE ITS SUBCONTRACTORS AS ADDITIONAL INSUREDS ON ITS OWN COVERAGE AS PRESCRIBED UNDER THESE REQUIREMENTS. CONTRACTOR'S CERTIFICATE OF INSURANCE SHALL NOTE IN SUCH EVENT THAT SUBCONTRACTORS ARE INCLUDED AS ADDITIONAL INSUREDS AND THAT CONTRACTOR AGREES TO PROVIDE WORKERS' COMPENSATION FOR SUBCONTRACTORS AND THEIR EMPLOYEES. CONTRACTOR SHALL OBTAIN AND MONITOR THE CERTIFICATES OF

INSURANNCE FROM EACH SUBCONTRACTOR IN ORDER TO ASSURE COMPLIANCE WITH THE INSURANCE REQUIREMENTS. CONTRACTOR MUST RETAIN THE CERTIFICATES OF INSURANCE FOR THE DURATION OF THE CONTRACT PLUS SEVEN (7) YEARS AND SHALL HAVE THE RESPONSIBILITY OF ENFORCING THESE INSURANCE REQUIREMENTS ITS SUBCONTRACTORS. OWNER SHALL BE ENTITLED, UPON REQUEST AND WITHOUT EXPENSE, TO RECEIVE COPIES OF THESE CERTIFICATES. CONTRUCTION DOCUMENTS, COORDINATION DOCUMENTS, AND RECORD DOCUMENTS.

#### ARTICLE 9.

# CONSTRUCTION DOCUMENTS, COORDINATION DOCUMENTS, AND RECORD DOCUMENTS

#### 9.1 Drawings and Specifications.

- 9.1.1 <u>Copies Furnished.</u> Design Professional will furnish, free of charge, the number of complete sets of Drawings, Specifications, and addenda as provided in the Contract. Contractor will be furnished, free of charge, the number of complete sets of Drawings, Specifications, and addenda as provided in the Contract. Additional complete sets of Drawings and Specifications, if requested, will be furnished at reproduction cost to the one requesting such additional sets. Electronic copies of such documents will be provided to Contractor without charge.
- 9.1.2 <u>Ownership of Drawings and Specifications.</u> All Drawings, Specifications and copies thereof furnished by Design Professional shall be property of the Owner. These documents are not to be used by the Design Professional on any other project. Owner may use the Contract record set and electronic versions as needed for warranty operations or future renovations or additions without written approval of the Design Professional. All additional or confirmatory land survey field notes, sketches and related data, and additional or confirmatory soils engineering or investigations, samples, calculations, test results, and reports, for which Owner has paid for such direct services, shall be the sole property of Owner.
- 9.2 <u>Interrelation of Documents.</u> The Contract Documents as referenced in the Contract between Owner and Contractor are complimentary, and what is required by one shall be as binding as if required by all.
- 9.3 <u>Resolution of Conflicts in Documents.</u> Where conflicts may exist within the Contract Documents, the documents shall govern in the following order: (a) Change Orders or other written, signed amendments or addenda; (b) the Contract; (c) Uniform General Conditions; (d) Drawings; (e) Specifications (but Specifications shall control over Drawings as to quality of materials); and (f) other Contract Documents. Among other categories of documents having the same order of precedence, the term or provision that includes the latest date shall control. Contractor shall notify Design Professional and Owner for resolution of the issue prior to executing the Work in question.

- 9.4 <u>Contractor's Duty to Review Contract Documents.</u> In order to facilitate Contractor's responsibilities for completion of the Work in accordance with and as reasonably inferable from the Contract Documents, Contractor shall, prior to commencing the Work, examine and compare the Contract Documents, information furnished by Owner, relevant field measurements made by Contractor, and any visible or reasonably anticipated conditions at the Site affecting the Work. This duty extends throughout the design phase and construction phase prior to commencing each particular work activity and/or system installation. Updated Coordination Documents shall be provided to the Owner and Design Professional monthly.
- 9.5 <u>Discrepancies and Omissions in Drawings and Specifications.</u> Contractor shall immediately report to OCM and to Design Professional the discovery of any discrepancy, error, omission, or inconsistency in the Contract Documents prior to execution of the Work. When performing as a Construction Manager-at-Risk, Contractor has a shared responsibility with Design Professional for discovery and resolution of discrepancies, errors, omissions, and inconsistencies in the Contract Documents. In such case, Contractor's responsibility pertains to review, coordination, and recommendation of resolution strategies within budget constraints.
  - 9.5.1 <u>Design-Build Firm.</u> It is recognized that Contractor is not acting in the capacity of a licensed design professional, unless it is performing as a Design-Build firm. When performing as a Design-Build firm, Contractor has sole responsibility for discrepancies, errors, and omissions in the Drawings and Specifications.
  - 9.5.2 <u>Construction Manager-at-Risk Examination and Reporting.</u> When performing as a Construction Manager-at-Risk, Contractor has no liability for discrepancies, errors, omissions, or inconsistencies unless Contractor fails to immediately report in writing a discovered or apparent discrepancy, error, omission, or inconsistency to OCM and Design Professional. Should Contractor fail to perform the examination and reporting obligations of these provisions, Contractor is responsible for avoidable costs and direct and/or consequential damages.
  - 9.5.3 <u>Other Limitations.</u> Unless Contractor is performing as a Design-Build Firm or a Construction Manager-at-Risk, Contractor's examination of Contract Documents is to facilitate construction and does not create an affirmative responsibility to detect discrepancies, errors, omissions, or inconsistencies or to ascertain compliance with applicable laws, building codes, or regulations.
- 9.6 <u>No Warranty or Representation by Owner.</u> Owner makes no representations, express or implied, about the adequacy or accuracy of the Drawings, Specifications, or other Construction Documents provided or their suitability for their intended use. Owner expressly disclaims any implied warranty that the Construction Documents are adequate, accurate, or suitable for their intended use.
- 9.7 <u>Requirements for Record Documents.</u>
  - 9.7.1 Contractor shall:

- 9.7.1.1 Maintain at the Site one copy of all Drawings, Specifications, addenda, approved submittals, Contract modifications, Change Orders, and all Project correspondence and one record copy of approved Shop Drawings, Samples, and similar required submittals.
- 9.7.1.2 Keep current and maintain Drawings and Specifications in good order with postings and markings to record actual conditions of Work, and show and reference all changes made during construction. Provide Owner and Design Professional access to these documents.
- 9.7.1.3 Keep current and maintain the record set of Drawings and Specifications which reflect the actual field conditions and representations of the Work performed, whether it be directed by addendum, Change Order, or otherwise. Make available all records prescribed herein for reference and examination by Owner and Design Professional, and their representatives and agents.
- 9.7.1.4 Be responsible for marking the Record Documents for all Contractor initiated documents and changes to the Contract Documents due to coordination and actual field conditions, including RFIs. During construction, update the Record Documents, including all related RFI's, ASI's CCD's, and CO's, at least monthly prior to submission of periodic partial pay estimates. Failure to maintain current Record Documents constitutes cause for denial of a progress payment otherwise due.
- 9.7.1.5 Within thirty (30) days of Substantial Completion, Contractor shall furnish the Design Professional a copy of its marked-up Record Documents and a preliminary copy of each instructional manual, maintenance and operating manual, parts catalog, wiring diagrams, spare parts, specified written warranties and like publications, or parts for all installed equipment, systems, and like items, and as described in the Contract Documents. A complete set must be provided to the Design Professional within seven (7) days of Final Completion.

### 9.7.2 <u>Design Professional shall:</u>

- 9.7.2.1 In coordination with Contractor, shall update Record Documents to accurately depict progress of the Work and "as-built" condition of the Project.
- 9.7.2.2 Be responsible for updating the Record Documents for any addenda, Change Orders, Design Professional supplemental instructions, and any other alterations to the Contract Documents generated by Design Professional or Owner. Design Professional shall provide Owner with an electronic copy of the Auto-CADD files, BIM files, and Record Documents in both native format and a reproducible format within thirty (30) days following Final Completion.

9.7.2.3 Upon final completion and as a condition of final payment, once Record Documents are determined acceptable by OCM and with input from the Contractor, provide one (1) reproducible copy and one (1) electronic media copy of all Record Documents incorporating all of the above requirements, unless required otherwise.

### ARTICLE 10. CONSTRUCTION SAFETY

- 10.1 <u>General.</u> It is the duty and responsibility of Contractor and all of its Subcontractors to be familiar with, enforce, and comply with all requirements of Public Law No. 91-596, 29 U.S.C. § 651 et. seq., the Occupational Safety and Health Act of 1970, (OSHA) and all amendments thereto. Contractor shall prepare a site-specific safety plan specific to the Project and submit it to OCM and Design Professional prior to commencing Work. In addition, Contractor and all of its Subcontractors shall comply with all applicable laws and regulations of any public body having jurisdiction for safety of persons or property to protect them from damage, injury, or loss and erect and maintain all necessary safeguards for such safety and protection.
  - 10.1.1 <u>Site Visits.</u> The OCM/ODR may perform random visits to Project Sites to address adherence to the site-specific safety plans and any Contractor safety requirements. Any violations that are discovered will be reported to Contractor for prompt remediation and correction. Poor performance in regards to safety, as determined by the OCM/ODR, is grounds for contract termination and/or immediate removal. The OCM/ODR may also require meetings with contractors regarding safety on the Project. The OCM/ODR may request to review safety policies of Contractor, Contractor's safety inspection forms, and the most current site-specific safety plan, as required.
- 10.2 <u>Notices.</u> Contractor shall provide notices as follows:
  - 10.2.1 <u>Utilities and Adjacent Properties.</u> Notify owners of adjacent property, including those that own or operate utilities, utility services, and/or underground facilities, when prosecution of the Work may affect them or their facilities, and cooperate with them in the protection, removal, relocation and replacement, and access to their facilities and/or utilities.
  - 10.2.2 <u>Safety Data Sheets.</u> Coordinate the exchange of safety data sheets (SDSs) or other hazard communication information required to be made available to or exchanged between or among employers at the site in connection with laws and regulations. Maintain a complete file of SDSs for all materials in use on site throughout the construction phase and make such file available to Owner and its agents as requested.
- 10.3 <u>Emergencies.</u> In any emergency affecting the safety of persons or property, Contractor shall act to minimize, mitigate, and prevent threatened damage, injury, or loss. Contractor shall:
  - 10.3.1 <u>On Call Response.</u> Have authorized agents of Contractor respond immediately upon call at any time of day or night when circumstances warrant the presence of Contractor to

protect the Work or adjacent property from damage or to take such action pertaining to the Work as may be necessary to provide for the safety of the public.

- 10.3.2 Notice.
  - 10.3.2.1 <u>To OCM and Design Professional:</u> Give OCM and Design Professional prompt notice of all such events.
  - 10.3.2.2 <u>Changes or Variations to Work:</u> If Contractor believes that any changes in the Work or variations from Contract Documents have been caused by its emergency response, promptly notify Owner within twenty-four (24) hours of the emergency response event.
- 10.3.3 <u>Owner Remedy.</u> Should Contractor fail to respond, Owner is authorized to direct other forces to take action as necessary and Owner may deduct any cost of remedial action from funds otherwise due Contractor.
- 10.4 <u>Injuries.</u> In the event of an incident or accident involving outside medical care for an individual on or near the Work, Contractor shall notify OCM and other parties as may be directed promptly, but no later than twenty-four (24) hours after Contractor learns that an event required medical care. Contractor shall:
  - 10.4.1 <u>Documentation</u>. Record the location of the event and the circumstances surrounding it, by using photography or other means, and gather witness statements and other documentation which describes the event.
  - 10.4.2 <u>Incident Report.</u> Supply OCM and Design Professional with an incident report no later than thirty-six (36) hours after the occurrence of the event. In the event of a catastrophic incident (one (1) fatality or three (3) workers hospitalized), barricade and leave intact the scene of the incident until all investigations are complete. A full set of incident investigation documents, including facts, finding of cause, and remedial plans shall be provided within one (1) week after occurrence, unless otherwise directed by legal counsel. Contractor shall provide OCM with written notification within one (1) week of such catastrophic event if legal counsel delays submission of full report.
- 10.5 <u>Environmental Safety.</u> Upon encountering any previously unknown potentially hazardous material, or other materials potentially contaminated by hazardous material, Contractor shall immediately stop work activities impacted by the discovery, secure the affected area, and notify OCM immediately.
  - 10.5.1 <u>Subcontractors.</u> Contractor shall bind all Subcontractors to the same duty.
  - 10.5.2 <u>Owner.</u> Upon receiving such notice, OCM will promptly engage qualified experts to make such investigations and conduct such tests as may be reasonably necessary to determine the existence or extent of any environmental hazard. Upon completion of this investigation, OCM will issue a written report to Contractor identifying the material(s)

found and indicate any necessary steps to be taken to treat, handle, transport or dispose of the material.

- 10.5.2.1 Owner may hire third-party Contractors to perform any or all such steps.
- 10.5.2.2 Should compliance with OCM's instructions result in an increase in Contractor's cost of performance or delay the Work, upon Contractor's submission of substantiated costs or an updated Work Progress Schedule and substantiated critical path analysis, Owner will make an equitable adjustment to the Contract Sum and/or the time of completion, and issue a Change Order accordingly.
- 10.6 <u>Trenching Plan.</u> When the project requires excavation which either exceeds a depth of four (4) feet, or results in any worker's upper body being positioned below grade level, Contractor is required to submit a trenching plan to OCM prior to commencing trenching operations unless an engineered plan is part of the Contract Documents. The plan is required to be prepared and sealed by a professional engineer registered in the State of Texas and hired or employed by Contractor or Subcontractor to perform the work. Said engineer cannot be anyone who is otherwise either directly or indirectly engaged on this project.
  - 10.6.1 <u>OSHA Regulations</u>: All trench excavations shall be performed in full compliance with OSHA Regulations. The regulation identified as 29 CFR Subpart P Excavations, consisting of sections 1926.650 through 1926.652 with Appendices A through F, of the OSHA Health and Safety Regulations, as amended or modified, shall apply to Contractor's trench excavations. Contractor shall meet and comply with this regulation and all other applicable safety standards that have been adopted by government agencies that have jurisdiction over this Project. It is the Contractor's responsibility to comply with any additional requirements resulting from any pre-construction conference relating to coordination of geotechnical investigation subjects.
  - 10.6.2 <u>Texas State Law:</u> Texas State Law (Underground Facility Damage Prevention and Safety Act: Tex. Util. Code, Chapter 251) requires Contractors submit all required notifications to the authorities having jurisdiction two working days prior to commencement of all excavation site work. It is the Contractor's responsibility to inform Texas Excavation Safety System (1-800-DIG-TESS or 811) about all planned excavations and provide adequate notice. Contractor is required to coordinate identification of underground facilities with the Design Professional and ODR, and site mark approximate locations prior to planned excavation.
  - 10.6.3 <u>Contractor Responsibility:</u> It is the sole duty and responsibility of the Contractor to determine the specific applicability of the designed trench safety systems to each field condition and to make inspections of the trench safety systems. Contractor shall maintain a permanent record of inspections, readily available to the ODR at any time.

- 10.7 Crane Safety. Any and all construction associated activities with crane operations must be coordinated and reviewed with OCM/ODR prior to commencement of such activities. Prior to the operation of any crane on Site, a suitable location needs to be determined and consulted with the OCM/ODR. Such location must be included on the site-specific safety plan. Consideration should be made to the capacity and type of crane in safe relationship to the physical site location limitations, as well as any existing or future underground/overhead conditions and utilities. Contractor is required to coordinate identification of underground/overhead facilities with Design Professional and ODR and site mark approximate locations prior to initial planned setup and activities. Any critical lift plans must be reviewed by OCM/ODR prior to activity occurring. If possible, avoiding critical lifts is preferred. All crane operators must be certified by the National Commission for Certification of Crane Operators (NCCCO). All signal persons & riggers at a minimum need to be qualified in accordance with OSHA standard. Contractor should have certified riggers & signal persons working on campus and Owner reserves the right to request such certification depending on the scope of work being performed. Contractor shall develop a lift plan for any crane activities being performed. The lift plan must be submitted to OCM/ODR prior to any lifting or hoisting activities occurring, with any additional documentation, including but not limited to, equipment manuals, inspections, certifications and licenses to be provided to the owner upon request.
- 10.8 <u>Unmanned Aircraft System (UAS) Usage.</u> Any UAS operation on Owner's property must follow Federal Aviation Administration (FAA) regulations, state law, and Owner's policies and procedures. Any images or video obtained from a pre-authorized and compliant UAS flight on Owner's property must be approved for use by the Owner prior to usage of any such images or video obtained. Any violations will result in an ODR directed no-fly restriction for UAS operations on Owner's property.
- 10.9 <u>Fire Protection Procedures.</u> Contractor shall maintain compliance with all Life/Safety Code requirements throughout the duration of the Contract and take precautions to prevent potential fire hazards at the jobsite. Contractor shall adhere to the preventative fire protection procedures of the University of North Texas System Fire Marshal and instruct all associated subcontractors, skilled tradesmen, contractors, material men, suppliers and/or laborers of the procedures for preventative fire measures. Construction sites and structures are required to have proper site access and egress, active and certified extinguishing devices or systems at all times, and all fire and egress systems clearly marked and identified. Fire department access (fire lanes) shall be kept clear of vehicles, equipment and materials at all times. Occupied buildings which require any fire protection systems to be non-active, require two weeks advance notice and life safety protection method of procedures must be reviewed by University of North Texas System Fire Marshal, prior to system deactivation.
- 10.10 <u>Smoke and Tobacco Free Campus.</u> All campuses within the University of North Texas System are designated 'Smoke and Tobacco Free' environments. Due to State health, sanitation and safety regulations, tobacco products are not permitted to be consumed by construction personnel in any Owner's property, occupied or unoccupied, including mechanical and other service spaces. Contractor shall be responsible for enforcing this policy on the construction site, at all times.

### ARTICLE 11. QUALITY CONTROL

11.1 <u>Materials & Workmanship.</u> Contractor shall execute Work in a good and workmanlike matter in accordance with the Contract Documents. Contractor shall develop and provide a quality control plan specific to this Project and acceptable to Owner. Where Contract Documents do not specify quality standards, complete and construct all Work in compliance with generally accepted construction industry standards. Unless otherwise specified, incorporate all new materials and equipment into the Work under the Contract.

#### 11.2 <u>Testing.</u>

- 11.2.1 <u>Owner</u>. Owner is responsible for coordinating and paying for routine and special tests required to confirm compliance with quality and performance requirements, except as stated below or otherwise required by the Contract Documents.
- 11.2.2 <u>Contractor</u>. Contractor shall provide the following testing:
  - 11.2.2.1 Any test of basic material or fabricated equipment included as part of a submittal for a required item in order to establish compliance with the Contract Documents.
  - 11.2.2.2 Any test of basic material or fabricated equipment offered as a substitute for a specified item on which a test may be required in order to establish compliance with the Contract Documents.
  - 11.2.2.3 Preliminary, start-up, pre-functional, and operational testing of building equipment and systems as necessary to confirm operational compliance with requirements of the Contract Documents.
  - 11.2.2.4 All subsequent tests on original or replaced materials conducted as a result of prior testing failure.
- 11.2.3 <u>Standards.</u> All testing shall be performed in accordance with standard test procedures by an accredited laboratory, or special consultant as appropriate, acceptable to Owner. Results of all tests shall be provided promptly to OCM, Design Professional, and Contractor.
- 11.2.4 <u>Non-Compliance (Test Results).</u> Should any of the tests indicate that a material and/or system does not comply with the Contract requirements, the burden of proof remains with Contractor, subject to:
  - 11.2.4.1 Contractor selection and submission of the laboratory for Owner acceptance.
  - 11.2.4.2 Acceptance by Owner of the quality and nature of tests.

- 11.2.4.3 All tests taken in the presence of Design Professional and/or OCM, or their representatives.
- 11.2.4.4 If tests confirm that the material/systems comply with Contract Documents, Owner will pay the cost of the test.
- 11.2.4.5 If tests reveal noncompliance, Contractor will pay those laboratory fees and costs of that particular test and all future tests, of that failing Work, necessary to eventually confirm compliance with Contract Documents.
- 11.2.4.6 Proof of noncompliance with the Contract Documents will make Contractor liable for any corrective action which OCM determines appropriate, including complete removal and replacement of noncompliant work or material.
- 11.2.5 <u>Notice of Testing</u>. Contractor shall give OCM and Design Professional timely notice of its readiness and the date arranged so OCM and Design Professional may observe such inspection, testing, or approval.
- 11.2.6 <u>Test Samples.</u> Contractor is responsible for providing Samples of sufficient size for test purposes and for coordinating such tests with the Work Progress Schedule to avoid delay.
- 11.2.7 <u>Covering Up Work.</u> If Contractor covers up any Work without providing Owner an opportunity to inspect, Contractor shall, if requested by OCM, uncover and recover the work at Contractor's expense.
- 11.3 <u>Submittals.</u>
  - 11.3.1 <u>Contractor's Submittals.</u> Contractor shall submit with reasonable promptness consistent with the Project schedule and in orderly sequence all Shop Drawings, Samples, or other information required by the Contract Documents, or subsequently required by Change Order. Prior to submitting, Contractor shall review each submittal for general compliance with Contract Documents and approve submittals for review by Design Professional and Owner by an approval stamp affixed to each copy. Submittal data presented without Contractor's stamp will be returned without review or comment, and any delay resulting from failure is Contractor's responsibility.
    - 11.3.1.1 Contractor shall within twenty-one (21) days of the effective date of the Notice to Proceed with construction, submit to OCM and Design Professional, a submittal schedule/register, organized by specification section, listing all items to be furnished for review and approval by Design Professional and Owner. The list shall include Shop Drawings, manufacturer literature, certificates of compliance, materials Samples, materials colors, guarantees, and all other items identified throughout the Specifications.
    - 11.3.1.2 Contractor shall indicate the type of item, Contract requirements reference, and Contractor's scheduled dates for submitting the item along with the

requested dates for approval answers from Design Professional and Owner. The Submittal Register shall indicate the projected dates for procurement of all included items and shall be updated at least monthly with actual approval and procurement dates. Contractor's Submittal Register must be reasonable in terms of the review time for complex submittals. Contractor's submittal schedule must be consistent with the Work Progress Schedule and identify critical submittals. Show and allow a minimum of fifteen (15) days duration after receipt by Design Professional and OCM for review and approval. If resubmittal required, allow a minimum of an additional *seven (7)* days for review. Submit the updated Submittal Register with each request for progress payment. Owner may establish routine review procedures and schedules for submittals at the preconstruction conference and/or elsewhere in the Contract Documents. If Contractor fails to update and provide the Submittal Register as required, Owner may, after seven (7) days notice to Contractor.

- 11.3.1.3 Contractor shall coordinate the Submittal Register with the Work Progress Schedule. Do not schedule Work requiring a submittal to begin prior to scheduling review and approval of the related submittal. Revise and/or update both schedules monthly to ensure consistency and current project data. Provide to OCM the updated Submittal Register and schedule with each application for progress payment. Refer to requirements for the Work Progress Schedule for inclusion of procurement activities therein. Regardless, the Submittal Register shall identify dates submitted and returned and shall be used to confirm status and disposition of particular items submitted, including approval or other action taken and other information not conveniently tracked through the Work Progress Schedule.
- 11.3.1.4 By submitting Shop Drawings, Samples or other required information, Contractor represents that it has determined and verified all applicable field measurements, field construction criteria, materials, catalog numbers and similar data; and has checked and coordinated each Shop Drawing and Sample with the requirements of the Work and the Contract Documents.
- 11.3.2 <u>Review of Submittals.</u> Design Professional and OCM review is only for conformance with the design concept and the information provided in the Contract Documents. Responses to submittals will be in writing. The approval of a separate item does not indicate approval of an assembly in which the item functions. The approval of a submittal does not relieve Contractor of responsibility for any deviation from the requirements of the Contract unless Contractor informs Design Professional and OCM of such deviation in a clear, conspicuous, and written manner on the submittal transmittal and at the time of submission, and obtains Owner's written specific approval of the particular deviation.
- 11.3.3 <u>Correction and Resubmission</u>. Contractor shall make any corrections required to a submittal and resubmit the required number of corrected copies promptly so as to avoid

delay, until submittal approval. Direct attention in writing to Design Professional and OCM, when applicable, to any new revisions other than the corrections requested on previous submissions.

- 11.3.4 <u>Limits on Shop Drawing Review.</u> Contractor shall not commence any Work requiring a submittal until review of the submittal under Subsection 11.3.2. Contractor shall construct all such work in accordance with reviewed submittals. Comments incorporated as part of the review in Subsection 11.3.2 of Shop Drawings and Samples is not authorization to Contractor to perform extra work or changed work unless authorized through a Change Order. Design Professional's and OCM's review does not relieve Contractor from responsibility for defects in the Work resulting from errors or omissions of any kind on the submittal, regardless of any approval action.
- 11.3.5 <u>No Substitutions without Approval.</u> OCM and Design Professional may receive and consider Contractor's request for substitution when Contractor agrees to reimburse Owner for review costs and satisfies the requirements of this section. If Contractor does not satisfy these conditions, OCM and Design Professional will return the request without action except to record noncompliance with these requirements. Owner will not consider the request if Contractor cannot provide the product or method because of failure to pursue the Work promptly or coordinate activities properly. Contractor's request for a substitution may be considered by OCM and Design Professional when:
  - 11.3.5.1 The Contract Documents do not require extensive revisions; and
  - 11.3.5.2 Proposed changes are in keeping with the general intent of the Contract Documents and the design intent of Design Professional and do not result in an increase in cost to Owner; and
  - 11.3.5.3 The request is timely, fully documented, properly submitted and one or more of the following apply:
    - Contractor cannot provide the specified product, assembly or method of construction within the Contract Time;
    - The request directly relates to an "or-equal" clause or similar language in the Contract Documents;
    - The request directly relates to a "product design standard" or "performance standard" clause in the Contract Documents;
    - The requested substitution offers Owner a substantial advantage in cost, time, energy conservation or other considerations, after deducting additional responsibilities Owner must assume;
    - The specified product or method of construction cannot receive necessary approval by an authority having jurisdiction, and OCM can approve the requested substitution;
    - Contractor cannot provide the specified product, assembly or method of construction in a manner that is compatible with other materials and

where Contractor certifies that the substitution will overcome the incompatibility;

- Contractor cannot coordinate the specified product, assembly or method of construction with other materials and where Contractor certifies they can coordinate the proposed substitution; or
- The specified product, assembly or method of construction cannot provide a warranty required by the Contract Documents and where Contractor certifies that the proposed substitution provides the required warranty.
- The manufacture of the specified product has been removed from production due to cancellation or obsolescence.
- 11.3.6 <u>Unauthorized Substitutions at Contractor's Risk.</u> Contractor is financially responsible for any additional costs or delays resulting from unauthorized substitution of materials, equipment or fixtures other than those specified. Contractor shall reimburse Owner for any increased design or contract administration costs resulting from such unauthorized substitutions.
- 11.4 <u>Field Mock-up.</u> Mock-ups shall be constructed prior to commencement of a specified scope of work to confirm acceptable workmanship.
  - 11.4.1 <u>Minimum.</u> As a minimum, field mock-ups shall be constructed for roofing systems, exterior veneer / finish systems, glazing systems, and any other Work requiring a mock-up as identified throughout the Contract Documents. Mock-ups for systems not part of the Project scope shall not be required.
  - 11.4.2 <u>No Incorporation Unless Approved.</u> Mock-ups may be incorporated into the Work if allowed by the Contract Documents and if acceptable to OCM. If mock-ups are freestanding, they shall remain in place until otherwise directed by Owner.
  - 11.4.3 <u>Schedule</u>. Contractor shall include field mock-ups in their Work Progress Schedule and shall notify OCM and Design Professional of readiness for review sufficiently in advance to coordinate review without delay.
- 11.5 <u>Inspection During Construction.</u> Contractor shall provide sufficient, safe, and proper facilities, including equipment as necessary for safe access, at all reasonable times for observation and/or inspection of the Work by Owner or Design Professional and their agents. Contractor shall not cover up any Work with finishing materials or other building components prior to providing Owner and Design Professional and their agents an opportunity to perform an inspection of the Work.
  - 11.5.1 <u>Corrected Work.</u> Should corrections of the Work be required for approval, Contractor shall not cover up corrected Work until Owner indicates approval.
  - 11.5.2 <u>Owner's Self Help.</u> Should Contractor be unable to perform corrective work without impacting the overall WPS, Owner reserves the right to hire a separate Contractor to

complete the correction. The cost of the correction performed by separate Contractor will be charged back to Contractor.

11.5.3 <u>Notice.</u> Contractor shall provide notification of at least five (5) working days or otherwise as mutually agreed, to OCM of the anticipated need for an inspection so that Contractor may proceed with cover-up of Work. Should OCM fail to make the necessary inspection within the agreed period, Contractor may proceed with cover-up Work, but is not relieved of responsibility for Work to comply with requirements of the Contract Documents.

### ARTICLE 12. CONSTRUCTION SCHEDULES

- 12.1 <u>Contract Time.</u> **TIME IS AN ESSENTIAL ELEMENT OF THE CONTRACT**. The Contract Time is the time between the dates indicated in the Notice to Proceed for commencement of the Work and for achieving Substantial Completion. The Contract Time can be modified only by Change Order. Failure to achieve Substantial Completion within the Contract Time will cause damage to Owner and may subject Contractor to liquidated damages as provided in the Contract Documents. If Contractor fails to achieve Final Completion within thirty (30) days after Substantial Completion, Contractor shall be responsible for Owner's additional inspection, project management, and maintenance cost to the extent caused by Contractor's failure to achieve Final Completion.
- 12.2 <u>Notice to Proceed.</u> Owner will issue a Notice to Proceed which shall state the dates for commencing Work and for achieving Substantial Completion of the Work.
- 12.3 <u>Work Progress Schedule.</u> Refer to Division 1 of the Specifications for additional schedule requirements. Contractor shall submit for review and approval a Construction Baseline Schedule to Owner and Design Professional no later than twenty-one (21) days after the effective date of the Notice to Proceed with construction. The Construction Baseline Schedule shall indicate the dates for starting and completing the various aspects required to complete the work and shall utilize the Longest Path Method with fully editable logic. The schedule shall include mobilization, procurement, installation, testing, inspection, delivery of Close-out Documents, and acceptance of all Work. This Baseline Schedule shall become the comparison to the actual conditions throughout the Contract duration and become a part of the Work Progress Schedule (WPS). Contractor shall coordinate and integrate the Work Progress Schedule with the services and activities of Owner, Contractor, Design Professional, other consultants/suppliers, subcontractors and the requirements of governmental entities.

This section applies to construction phase Work Progress Schedules. Requirements for design phase scheduling for Construction Manager-at-Risk and Design Build contracts are outlined in the specific agreements.

12.3.1 <u>Work Progress Schedule Updates.</u>

- 12.3.1.1 Contractor shall update the Work Progress Schedule and the Submittal Register weekly during the Owner/Architect/Contractor (OAC) meetings, at a minimum, to reflect progress to date and current plans for completing the Work, while maintaining the Baseline Schedule, and shall submit electronic and paper copies of the update to Design Professional and OCM as directed but at a minimum with each request for payment. Owner has no duty to make progress payments unless accompanied by the updated Work Progress Schedule.
- 12.3.1.2 Contractor should revise the Work Progress Schedule as necessary or appropriate for the management of the Work. All updated Work Progress Schedules must show the anticipated date of completion and reflect all extensions of time granted through Change Order as of the date of the update.
- 12.3.1.3 Contractor shall identify all proposed changes to schedule logic to Owner and to Design Professional via an executive summary accompanying the updated Work Progress Schedule for review and approval prior to implementation of any revisions to the Work Progress Schedule. Schedule changes that materially impact Owner's operations shall be communicated within forty-eight (48) hours to OCM.
- 12.3.1.4 The Work Progress Schedule constitutes Contractor's representation to Owner of the accurate depiction of all progress to date and that Contractor will follow the schedule as submitted in performing the Work.
- 12.3.2 <u>Use of Work Progress Schedules.</u> The Work Progress Schedule is for Contractor's use in managing the Work and submittal of the Work Progress Schedule, and successive updates or revisions, is for the information of Owner and to demonstrate that Contractor has complied with requirements for planning and completing the Work.
  - 12.3.2.1 Owner will coordinate its own activities with Contractor's activities as shown on the Work Progress Schedule.
  - 12.3.2.2 Owner's review of the Work Progress Schedule, or update or revision, does not indicate any approval of Contractor's proposed sequences and duration.
  - 12.3.2.3 Owner's review of a Work Progress Schedule update or revision indicating early or late completion does not constitute Owner's consent, alter the terms of the Contract, or waive either Contractor's responsibility for timely completion or Owner's right to damages for Contractor's failure to so do.
  - 12.3.2.4 Contractor's scheduled dates for completion of any activity or the entire Work do not constitute a change in terms of the Contract. Change Orders are the only method of modifying the Substantial Completion Date(s) and Contract Time.

- 12.4 <u>Ownership of Float.</u> Unless indicated otherwise in the Contract Documents, Contractor shall develop its schedule, pricing, and execution plan to provide a minimum of ten percent (10%) total Float at acceptance of the Baseline Schedule. Float time contained in the Work Progress Schedule is not for the exclusive benefit of Contractor or Owner, but belongs to the Project and may be consumed by either party. Before Contractor uses any portion of the Float, Contractor must submit a written request to Owner and receive Owner's written authorization to use the portion of Float. Owner's approval will not unreasonably be withheld.
- 12.5 <u>Completion of Work.</u> Contractor is responsible and accountable for completing the Work within the Contract Time stated in the Contract, or as otherwise amended by Change Order.
  - 12.5.1 <u>Owner's Self Help.</u> Should Contractor be unable to complete portion of Work, Owner may hire separate Contractor to complete these items. The cost to complete this Work will be charged back to Contractor.
  - 12.5.2 <u>Requirement to Regain Schedule.</u> If, in the judgment of Owner, the Work is behind schedule and the rate of placement of Work is inadequate to regain scheduled progress to insure timely completion of the entire Work or a separable portion thereof, Contractor, when so informed by Owner, shall immediately take action to increase the rate of Work placement by:
    - 12.5.2.1 An increase in working forces.
    - 12.5.2.2 An increase in equipment or tools.
    - 12.5.2.3 An increase in hours of work or number of shifts.
    - 12.5.2.4 Expedited delivery of materials.
    - 12.5.2.5 Other action proposed if acceptable to Owner.
  - 12.5.3 <u>Recovery Schedule.</u> Within ten (10) days after such notice, Contractor shall notify OCM in writing of the specific measures taken and/or plan to increase the rate of progress. Contractor shall include an estimate as to the date of scheduled progress recovery and an updated Work Progress Schedule illustrating Contractor's plan for achieving timely completion of the Work. Should Owner deem the plan of action inadequate, Contractor shall take additional steps or make adjustments as necessary to its plan of action until it meets with Owner's approval.
  - 12.5.4 <u>Owner's Notice Not Acceleration</u>. Owner's notice to Contractor shall not be considered acceleration by Owner and Owner shall not be responsible for any increased costs incurred by Contractor.
- 12.6 <u>Modification of the Contract Time.</u> Delays and extensions of Contract Time are valid only if properly noticed and documented by Change Order.

- 12.6.1 <u>Extension Request.</u> When a delay is an Excusable Delay, as defined below, and such delay prevents Contractor from completing the Work within the Contract Time, Contractor may be granted an extension of Contract Time. Owner will extend Contract Time by the number of days lost due to Excusable Delay, as measured by a substantiated critical path analysis of the Work Progress Schedule; provided, however, in no event will an extension of Contract Time be granted for delays that merely extend the duration of non-critical activities, or concurrent delay or which only consume Float. All extensions of Contract Time will be granted in calendar days.
- 12.6.2 <u>Weather Days.</u> "Weather Days" means days contained in the Baseline Schedule that are reasonably foreseeable adverse weather conditions and will not constitute an Excusable Delay. "Seasonably foreseeable adverse weather conditions" means weather conditions in keeping with the historical average listed by the National Oceanic and Atmospheric Administration on its website, www.noaa. When a Weather Day prevents critical path activities at the site from proceeding, Contractor shall: (a) immediately notify OCM for confirmation of the conditions and provide a detailed list of critical path activities impacted; and (b) at the end of each calendar month, submit to OCM and Design Professional a list of Weather Days occurring in that month along with documentation of the impact on critical path activities. Based on substantiated critical path analysis to the Work Progress Schedule, Owner will issue a Weather Day confirmation for any Contract Time extension to be documented by Change Order.
- 12.6.3 <u>Excusable Delay</u>. An "Excusable Delay" is a delay to Contractor's current schedule caused by circumstances listed below that prevents Contractor from completing the Work within the Contract Time. Based on substantiated critical path analysis to the Work Progress Schedule, any Contract Time extension will be issued by Change Order. Excusable Delay may be caused by the following:
  - 12.6.3.1 Discrepancies, errors, omissions, and inconsistencies in design, which Design Professional corrects by means of changes in the Drawings and Specifications; provided, however, that this does not apply if (a) Contractor is a Design-Build Firm, or (b) Contractor is a Construction Manager-at-Risk and failed to promptly report a discovered or apparent discrepancy, error, omission, or inconsistency during the pre-construction phase.
  - 12.6.3.2 Unanticipated physical conditions at the Site, which Design Professional corrects by means of changes to the Drawings and Specifications or for which ODR directs changes in the Work identified in the Contract Documents.
  - 12.6.3.3 Changes in the Work that delay activities identified in Contractor's Work Progress Schedule as "critical" to completion of the entire Work, if such changes are directed by ODR or recommended by Design Professional and directed by ODR.
- 12.6.3.4 Suspension of Work for unexpected natural events, civil unrest, strikes or other events which are not within the reasonable control of Contractor.
- 12.6.3.5 Suspension of Work for convenience of Owner, which prevents Contractor from completing the Work within the Contract Time.
- 12.7 <u>No Damages for Weather Days.</u> An extension of Contract Time shall be the sole remedy of Contractor for delays in performance of the Work due to Weather Days, and Contractor shall not be entitled to any compensation or recovery of any direct or indirect costs or damages.
- 12.8 <u>Costs for Excusable Delay.</u> In the event that Contractor incurs additional direct costs because of an Excusable Delay (other than described in Subsection 12.6.3.4) within the reasonable control of Owner, in addition to an extension of Contract Time the Contract Sum will be equitably adjusted by Owner pursuant to the provisions of Article 14.
- 12.9 No Damages for Other Delay. Except for direct costs for Excusable Delay as provided above, Contractor has no claim for monetary damages for delay or hindrances to the Work from any cause, whether or not such delays are foreseeable, except for delays caused solely by acts of Owner that constitute intentional interference with Contractor's performance of the Work and then only to the extent such acts continue after Contractor notifies Owner in writing of such interference. For delays caused by any act other than the sole intentional interference of Owner that continues after notice, Contractor shall not be entitled to any compensation or recovery of any damages including, without limitation, direct and indirect costs, consequential damages, lost opportunity costs, impact damages, loss of productivity, or other similar damages. Owner's exercise of any of its rights or remedies under the Contract including, without limitation, ordering changes in the Work or directing suspension, rescheduling, or correction of the Work, shall not be construed as intentional interference with Contractor's performance of the work, shall not be construed as intentional interference with Contractor's performance of the work, shall not be construed as intentional interference with Contractor's performance of the work regardless of the extent or frequency of Owner's exercise of such rights or remedies.
- 12.10 <u>Concurrent Delay.</u> Notwithstanding anything herein to the contrary, when the completion of the Work is simultaneously delayed by a Weather Day or an Excusable Delay and a delay arising from a cause not designated as excusable, Contractor will not be entitled to an extension of Contract Time for the period of concurrent delay.
- 12.11 <u>Time Extension Requests for Changes to the Work or Excusable Delay.</u> Extensions to Contract Time requested in association with changes to the Work directed or requested by Owner shall be included with Contractor's proposed costs for such change. If Contractor believes that the completion of the Work is delayed by Excusable Delay, Contractor shall give OCM written notice, stating the nature of the delay and the activities potentially affected, within five (5) days after the onset of the event or circumstance giving rise to the Excusable Delay. Contractor shall provide sufficient written evidence to document the Excusable Delay. In the case of a continuing cause of delay, only one claim is necessary. Claims for extensions of time should be made in numbers of whole or half days.

- 12.11.1 <u>Content of Request.</u> Within ten (10) days after the cessation of the Excusable Delay, Contractor shall formalize in writing its request for extension of Contract Time to include substantiation of the excusable nature of the delay and a complete analysis of impact to critical path activities. Based on substantiated critical path analysis to the Work Progress Schedule, any Contract Time extension granted will be issued by Change Order.
- 12.11.2 <u>No Release</u>. No extension of time releases Contractor or the Surety furnishing a performance or payment bond from any obligations under the Contract or such a bond. Those obligations remain in full force until the discharge of the Contract.
- 12.11.3 Longest Path Analysis. Contractor shall provide with each time extension request a quantitative demonstration of the impact of the delay on completion of the Work and Contract Time, based on the Work Progress Schedule. Contractor shall include with time extension requests a reasonably detailed narrative setting forth:
  - 12.11.3.1 The nature of the delay and its cause due to a change in the Work or an Excusable Delay and the basis of Contractor's claim of entitlement to an extension of Contract Time.
  - 12.11.3.2 Documentation of the actual impacts of the claimed delay on the Longest Path in Contractor's Work Progress Schedule, and any concurrent delays.
  - 12.11.3.3 Description and documentation of steps taken by Contractor to mitigate the effect of the claimed delay, including, when appropriate, the modification of the Work Progress Schedule.
- 12.11.4 <u>Owner Response</u>. Owner will respond to the time extension request by providing to Contractor written notice of the number of days granted, if any, and giving its reason if this number differs from the number of days requested by Contractor.
  - 12.11.4.1 Owner will not grant time extensions for delays that do not affect the Contract Substantial Completion date.
  - 12.11.4.2 Owner will respond to each properly submitted Time Extension Request within a reasonable time following receipt. If Owner does not have enough information to make a determination or cannot reasonably make a determination within forty-five (45) days, Owner will notify Contractor in writing.
- 12.12 <u>Failure to Complete Work in the Contract Time</u>. **TIME IS AN ESSENTIAL ELEMENT OF THE CONTRACT.** Contractor's failure to achieve substantial completion by the Contract Time or to achieve Substantial Completion as required will cause damage to Owner. These damages shall be liquidated by agreement of Contractor and Owner, in the amount per day as set forth in Section 12.13 below or elsewhere in the Contract Documents.

12.13 <u>Liquidated Damages.</u> Unless otherwise stated in the Contract, for each consecutive calendar day beyond the Contract Time that Substantial Completion of the Work is not achieved, Contractor shall pay Owner, within ten (10) days following written demand, an amount determined by the following schedule:

Project Cost		Liquidated Damages
From	<u>To</u>	Per Day
	<u>&lt;</u> \$ 1,000,000	<u>\$ 250</u>
<u>\$ 1,000,000</u>	<\$ 25,000,000	<u>\$ 1,000</u>
\$ 25,000,000	<\$ 50,000,000	<u>\$ 2,500</u>
<u>\$ 50,000,000</u>	<\$ 75,000,000	<u>\$ 5,000</u>
<u>\$ 75,000,000</u>	<\$ 100,000,000	<u>\$ 7,500</u>
> \$ 100,000,000		<u>\$ 10,000</u>

- 12.13.1 <u>Reasonable Estimate.</u> Such amount is not a penalty but liquidated damages representing the parties' estimate at the time of Contract execution of the damages that Owner will sustain for late Substantial Completion of Work. The parties stipulate and agree that the actual damages sustained by Owner for late Substantial Completion of the Work will be uncertain and difficult to ascertain, that calculating Owner's actual damages would be impractical, unduly burdensome, and cause unnecessary delay, and that the amount of daily liquidated damages set forth above is a reasonable estimate.
- 12.13.2 <u>Offset.</u> Owner may also recover the liquidated damages from any money due or that becomes due Contractor. The amount of liquidated damages may be adjusted by the terms of the Contract.
- 12.13.3 <u>No Waiver</u>. Payment or offset of the liquidated damages does not preclude recovery under the Contract, except for claims related to delays in Substantial Completion or Final Completion. Owner's right to receive liquidated damages shall not affect Owner's right to terminate the Contract as provided in these Uniform General Conditions or elsewhere in the Contract Documents, nor shall termination of the Contract release Contractor from the obligation to pay liquidated damages.

# ARTICLE 13. <u>PAYMENTS</u>

13.1 <u>Job Order Contracts</u>. Contractor shall submit to OCM pricing based on the **regional** RS Means or Gordian Group pricing. The Job Order may be a fixed price, lump-sum contract based on unit pricing applied to estimated quantities or unit price order based on the quantities and line items delivered and the coefficient applied to the work items.

- 13.2 <u>Schedule of Values (utilized in Construction-Manager-at-Risk and General Construction</u> <u>Agreement).</u> Contractor shall submit to OCM and Design Professional for acceptance a Schedule of Values accurately itemizing material and labor for the various classifications of the Work based on the organization of the specification sections and of sufficient detail acceptable to OCM. The accepted Schedule of Values will be the basis for the progress payments under the Contract.
  - 13.2.1 Requirements.
    - 13.2.1.1 No progress payments will be made prior to receipt and acceptance of the Schedule of Values, provided in such detail as required by OCM, and submitted not less than twenty-one (21) days after the effective date of the Notice to Proceed. The Schedule of Values shall follow the order of trade divisions of the Specifications and include itemized costs for General Conditions, costs for preparing Close-Out Documents, fees, contingencies, and Owner cash allowances, if applicable, so that the sum of the items will equal the Contract Sum. As appropriate, assign each item labor and/or material values, the subtotal thereof equaling the value of the Work in place when complete.
    - 13.2.1.2 Owner requires that the Work items be inclusive of the cost of the Work items only. Any contract markups for overhead and profit, General Conditions, etc., shall be contained within separate line items for those specific purposes which shall be divided into at least two (2) lines, one (1) for labor and one (1) for materials.
    - 13.2.1.3 Contractor shall retain a copy of all worksheets used in preparation of its bid or proposal, supported by a notarized statement that the worksheets are true and complete copies of the documents used to prepare the bid or proposal, and shall make the worksheets available to Owner at the time of Contract execution. Thereafter, Contractor shall grant Owner during normal business hours access to said copy of worksheets at any time during the period commencing upon execution of the Contract and ending one (1) year after final payment.
- 13.3 <u>Progress Payments.</u> Contractor will receive periodic progress payments for Work performed, materials in place, suitably stored on Site, or as otherwise agreed to by Owner and Contractor. Payment is not due until receipt by Owner or its designee of a correct and complete Pay Application in electronic and/or hard copy format as required by the Contract Documents, and certified by Design Professional. Progress payments are made provisionally and do not constitute acceptance of Work not in accordance with the Contract Documents. Owner will not process progress payment applications for Change Order Work until all parties execute the Change Order.
  - 13.3.1 <u>Preliminary Pay Worksheet</u>. Once each month that a progress payment is to be requested, the Contractor shall submit to Design Professional and OCM a complete, clean copy of a preliminary pay worksheet or preliminary pay application, to include the following:

- 13.3.1.1 Contractor's estimate of the amount of Work performed, labor furnished, and materials incorporated into the Work, using the established Schedule of Values;
- 13.3.1.2 An updated Work Progress Schedule reflecting progress of Work, including the executive summary and all required schedule reports. The progress of Work shall be the same progress as payment request;
- 13.3.1.3 HUB subcontracting plan Progress Assessment Report (PAR); The PAR should document compliance with the HUB Plan.
- 13.3.1.4 Reimbursable Expenses: Reimbursable expenses incurred solely and directly in support of the Project within one of the following categories:
  - Travel expenditures at State of Texas reimbursement rates, provided that reimbursement will not be granted for travel 1) within the Denton-Dallas-Fort Worth area or 2) involving less than 150 miles round-trip; or
  - Reproductions, printing, printing supplies, plotting, photographs, renderings, postage, binding, collating, delivery and handling of reports; Drawings and Specifications or other project-related work product other than that used solely in-house by Contractor at actual expense incurred; or
  - Fees and associated reimbursable expenses paid to consultants hired in accordance with prior written approval from Owner.
  - Expenses excluded from reimbursement include telephone charges, FAX services, alcoholic beverages, laundry service, valet service, entertainment expenses and any non-Project related items.
  - Reimbursement of tips shall not exceed fifteen percent (15%).
- 13.3.1.5 Such additional documentation as Owner may require in the Contract Documents; and
- 13.3.1.6 Construction payment affidavit.
- 13.3.2 <u>Contractor's Application for Payment.</u> As soon as practicable, but in no event later than seven (7) days after receipt of the preliminary pay worksheet, Design Professional and OCM will meet with Contractor to review the preliminary pay worksheet and to observe the condition of the Work. Based on this review, OCM and Design Professional may require modifications to the preliminary pay worksheet prior to the submittal of an Application for Payment, and will promptly notify Contractor of revisions necessary for approval. As soon as practicable, Contractor shall submit its Application for Payment on the appropriate and completed form, reflecting the required modifications to the Schedule of Values required by Design Professional and/or OCM, and must attach all additional

documentation required by OCM and/or Design Professional, as well as an affidavit affirming that all payrolls, bills for labor, materials, equipment, subcontracted work, and other indebtedness connected with Contractor's Application for Payment are paid or will be paid within the time specified in Tex. Gov't Code, Chapter 2251. No Application for Payment is complete unless it fully reflects all required modifications, and attaches all required documentation including Contractor's affidavit.

- 13.3.3 <u>Certification by Design Professional.</u> Within five (5) days or earlier following Design Professional's receipt of Contractor's formal Application for Payment, Design Professional will review the Application for Payment for completeness, and forward it to OCM. Design Professional will certify that the application is complete and payable, or that it is incomplete, stating in particular what is missing. If the Application for Payment is incomplete, Contractor shall make the required corrections and resubmit the Application for Payment for processing.
- 13.4 <u>Owner's Duty to Pay.</u> Owner has no duty to pay the Contractor except on receipt by OCM of: (a) a complete Application for Payment certified by Design Professional; and (b) Contractor's updated Work Progress Schedule.
  - 13.4.1 <u>Stored Materials.</u> Payment for stored materials and/or equipment confirmed by Owner and Design Professional to be on-site or otherwise properly stored is limited to eighty-five percent (85%) of the invoice price or eighty-five percent (85%) of the scheduled value for the materials or equipment, whichever is less.
  - 13.4.2 <u>Retainage.</u> Owner will withhold from each progress payment, as retainage, whichever is more of the following three options: (a) five percent (5%) of the total earned amount; (b) the amount authorized by law; or (c) as otherwise set forth in the Contract Documents. Retainage will be managed in conformance with Tex. Gov't Code, Chapter 2252, Subchapter B.
    - 13.4.2.1 Contractor shall provide written consent of its surety and concurrence of Design Professional for any request for reduction or release of retainage.
    - 13.4.2.2 At least sixty-five percent (65%) of the Contract, or such other discrete Work phase as set forth in Subsection 15.1.6 or Work package delineated in the Contract Documents, must be completed before Owner can consider a retainage reduction or release, and only if permissible by law.
    - 13.4.2.3 Contractor shall not withhold retainage from its Subcontractors and suppliers in amounts that are any percentage greater than that withheld in its Contract with Owner under this subsection, unless otherwise acceptable to Owner.
  - 13.4.3 <u>Price Reduction to Cover Loss.</u> Owner may reduce any Application for Payment, prior to payment to the extent necessary to protect Owner from loss on account of actions of Contractor including, but not limited to, the following:

- 13.4.3.1 Defective or incomplete Work not remedied;
- 13.4.3.2 Damage to Work of a separate Contractor;
- 13.4.3.3 Failure to maintain scheduled progress;
- 13.4.3.4 Reasonable evidence provided with Work Progress Schedule that the Work will not be completed within the Contract Time;
- 13.4.3.5 Persistent failure to carry out the Work in accordance with the Contract Documents;
- 13.4.3.6 Reasonable evidence that the Work cannot be completed for the unpaid portion of the Contract Sum;
- 13.4.3.7 Assessment of fines for violations of prevailing wage rate law; or
- 13.4.3.8 Failure to include the appropriate amount of retainage for that periodic progress payment.
- 13.4.4 <u>Title.</u>
  - 13.4.4.1 Title to all material and Work covered by progress payments transfers to Owner upon payment.
  - 13.4.4.2 Transfer of title to Owner does not: (a) relieve Contractor and its Subcontractors of the sole responsibility for the care and protection of materials and Work upon which payments have been made until final acceptance; (b) diminish the responsibility of Contractor and its Subcontractors to restore any damaged Work; or (c) waive the right of Owner to require the fulfillment of all the terms of the Contract.
- 13.4.5 <u>Contracts with No Payment Bond.</u> For a Contract in any amount less than \$25,000.00, payment will be made in one lump sum at the Final Completion of the Work, including Punch list items and change orders.
- 13.4.6 <u>No Release</u>. Progress payments to Contractor do not release Contractor or its surety from any obligations under the Contract.
- 13.4.7 Documentation.
  - 13.4.7.1 Upon Owner's request, Contractor shall furnish manifest proof of the status of Subcontractor's accounts in a form acceptable to Owner.
  - 13.4.7.2 Pay estimate certificates must be signed by a corporate officer or a representative duly authorized by Contractor.

- 13.4.7.3 Provide copies of bills of lading, invoices, delivery receipts, or other evidence of the location and value of such materials in requesting payment for materials. For purposes of Tex. Gov't Code § 2251.021(a)(2), the date the performance of service is complete is the date when ODR approves the Application for Payment.
- 13.5 <u>Time for Payment by Contractor:</u> Pursuant to Tex. Gov't Code § 2251.023, upon Contractor's receipt of payment from Owner, Contractor shall pay Subcontractor the appropriate share of the payment not later than the tenth (10th) day after the date the Contractor receives the payment. The appropriate share is overdue on the eleventh (11th) day after the date Contactor receives the payment.

## ARTICLE 14. CHANGES

14.1 <u>Change Orders.</u> A Change Order issued after execution of the Contract is a written order to Contractor, signed by ODR, Contractor, and Design Professional, authorizing a change in the Work or an adjustment in the Contract Sum or the Contract Time. The Contract Sum and the Contract Time can only be changed by Change Order. A Change Order signed by Contractor indicates his agreement therewith, including the adjustment in the Contract Sum and/or the Contract Time. ODR may issue a written authorization for Contractor to proceed with Work of a Change Order in advance of final execution by all parties in accordance with the provisions herein or other Contract provisions.

Whenever Change Orders Requests to adjust the contract price become necessary, the Owner will have the right to select the method of pricing to be used by the Contractor among the following options: 1) lump sum Change Order; 2) unit price Change Order, or 3) cost plus fee Change Order.

- 14.1.1 <u>Owner Ordered Changes.</u> Owner, without invalidating the Contract and without approval of Contractor's Surety, may order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, and the Contract Sum and the Contract Time will be adjusted accordingly. All such changes in the Work shall be authorized by Change Order or Construction Change Directive, and shall be performed under the applicable conditions of the Contract Documents. If such changes cause an increase or decrease in Contractor's cost of, or time required for, performance of the Work, an adjustment to Contract Sum or Contract Time shall be made and authorized by a Change Order.
- 14.1.2 <u>Corrections.</u> It is recognized by the parties hereto and agreed by them that the Drawings and Specifications may not be complete or free from discrepancies, errors, omissions, or inconsistencies, or that they may require changes or additions in order for the Work to be completed to the satisfaction of Owner. Accordingly, it is the express intention of the parties, notwithstanding any other provisions in the Contract, that any discrepancies, errors, omissions, or inconsistencies in such Drawings and Specifications, or any changes in or additions to Drawings and Specifications or to the Work ordered by Owner and any

resulting delays in the Work or increases in Contractor's costs and expenses arising out of such discrepancies, errors, omissions, or inconsistencies shall not constitute or give rise to any claim, demand, or cause of action of any nature whatsoever in favor of Contractor, whether for breach of Contract, or otherwise. However, Contractor will be entitled to the time or sum stated to be due Contractor in any Change Order approved and signed by all parties, which shall constitute full compensation to Contractor for all costs, expenses, and damages to Contractor.

- 14.2 <u>Lump Sum Change Order Request.</u> Contractor will submit a properly itemized Lump Sum Change Order Request covering the additional work and/or the work to be deleted. This Request will be itemized for the various components of work and segregated by labor, material and equipment in a detailed format satisfactory to Owner. Owner will require itemized Change Orders on all Change Order Requests from Contractor, subcontractors and sub-subcontractors regardless of tier. Details to be submitted include detailed line item estimates showing detailed materials quantity take-offs, material prices by item, and related labor hour pricing information and extensions (by line item or by drawing as applicable).
  - 14.2.1 <u>Self-Performed Labor</u>. Estimated labor costs to be included for self-performed work shall be based on the actual cost per hour paid by any Contractor (regardless of tier) for those workers or crews of workers who the Contractor reasonably anticipates will perform the Change Order work. Estimated labor hours shall include hours only for the worker and working foreman directly involved in performing the change order work. Supervision above the level of working foreman (such as general foreman, superintendent, project manager, etc.) is considered to be included in the markup percentages as outlined in the Contract. Note: No separate allowances for warranty or safety expenses will be allowed as a direct cost of a Change Order. Costs attributed to warranty expenses and safety expense will be considered to be covered by the markup percentage as outlined in the Contract.
  - 14.2.2 <u>Overhead and Profit.</u> Overhead shall be considered to include insurance beyond the scope of Article 8, field and office supervisors and assistants, including safety and scheduling personnel, use of small tools, incidental job burdens, and general home office expenses. No separate allowance will be made.
  - 14.2.3 <u>Labor Burden</u>. Labor burden allowable in Change Orders shall be defined as Contractor's net actual cost of payroll taxes (FICA, Medicare, SUTA, FUTA), net actual cost for Contractor's cost of union benefits (or other usual and customary fringe benefits if the employees are not union employees), and net actual cost to Contractor for worker's compensation insurance taking into consideration adjustments for experience modifiers, premium discounts, dividends, rebates, expense constants, assigned risk pool costs, net cost reductions due to policies with deductibles for self-insured losses, assigned risks rebates, etc. Contractor shall reduce their standard payroll tax percentages to properly reflect the effective cost reduction due to the estimated impact of the annual maximum wages subject to payroll taxes. (An estimated percentage for labor burden may be used for pricing change orders. However, the percentage used for labor burden to price change orders will be

examined at the conclusion of the project and an adjustment to the approved change orders will be processed if it is determined that the actual labor burden percentage should have been more or less than the estimated percentage used.)

- 14.2.3.1 <u>Non-Reimbursable Labor Burden.</u> Employee Stock Ownership Plan (ESOP) related to fringe benefit costs are specifically considered non-reimbursable labor burden and any ESOP costs are considered covered by the allowable change order markups to cover overhead and profit.
- 14.2.4 <u>Material.</u> Estimated material change order costs shall reflect Contractor's reasonably anticipated net actual cost for the purchase of the material needed for the change order work. Estimated material costs shall reflect cost reductions available to Contractor due to "non-cash" discounts, trade discounts, free material credits, and/or volume rebates. "Cash" discounts (i.e. prompt payment discounts of 1.5% or less) available on material purchased for change order work shall be credited to Owner if Contractor has provided Owner funds in time for Contractor to take advantage of any such "cash" discounts. Price quotations from material suppliers must be itemized with unit prices for each specific item to be purchased. "Lot pricing" quotations will not be considered sufficient substantiating detail.
- 14.2.5 <u>Equipment.</u> Allowable change order estimated costs may include appropriate amounts for rental of major equipment specifically needed to perform the change order work (defined as tools and equipment with an individual purchase order cost of more than \$750). For Contractor owned equipment, the "bare" equipment rental rates allowed to be used for pricing change order proposals shall be 75% of the monthly rate listed in the most current publication of The AED Green Book divided by 173.3 to arrive at a maximum hourly rate to be applied to the hours the equipment is used performing the change order work. Further, for Contractor owned equipment the aggregate equipment rent charges for any signed piece of equipment used in all change order work shall be limited to 50% of the fair market value of the piece of equipment when the first change order is priced involving usage of the piece of equipment. Fuel necessary to operate the equipment will be considered a separate direct cost associated with the change order work.
- 14.2.6 <u>Maximum Markup Percentage Allowable on Self-Performed Work.</u> With respect to pricing change orders, the maximum markup percentage fee to be paid to any Contractor (regardless of tier) on self-performed work shall be a single markup percentage not-to-exceed fifteen percent (15%) of the net direct cost of 1) direct labor and allowable labor burden costs applicable to the change order or extra work 2) the net cost of material and installation equipment incorporated into the change or extra work, and 3) net rental cost of major equipment and related fuel costs necessary to complete the change in the work.
- 14.2.7 <u>Maximum Markup Percentages Allowable on Work Performed by Subcontractors.</u> With respect to pricing the portion of change order proposals involving work performed by Subcontractors, the maximum markup percentage fee allowable to the Contractor supervising the Subcontractor's work shall not exceed five percent (5%) of the net of all

approved change order work performed by all subcontractors combined for any particular Change Order Request.

- 14.2.8 <u>GMP Limitation</u>. For Contracts based on a GMP, the Construction Manager-at-Risk or Design Builder shall NOT be entitled to a percentage mark-up or additional fee on any Change Order Work unless the Change Order increases the GMP or if contingency funds are utilized. If the GMP increases or contingency funds are utilized, the Construction-Manager-at-Risk or Design Builder will be allowed additional fees at the rate specified in the Contract.
- 14.2.9 <u>No Markup on Bonds and Liability Insurance Costs.</u> Change Order cost adjustments due increases or decreases in bond or insurance costs (if applicable) shall not be subject to any markup percentage fee.
- 14.2.10 Direct and Indirect Costs Covered by Markup Percentages. As a further clarification, the agreed upon markup percentage fee is intended to cover the Contractor's profit and all indirect costs associated with the Change Order Work. Items intended to be covered by the markup percentage fee include, but are not limited to: home office expenses, branch office and field office overhead expense of any kind; project management; superintendents, general foremen; non-working foremen; estimating; engineering; coordinating; expediting; purchasing; detailing; legal; accounting; data processing or other administrative expenses; shop drawings; permits; auto insurance and umbrella insurance; pick-up truck costs; ESOP related costs; and warranty expense costs. The cost for the use of small tools is also to be considered covered by the markup percentage fee. Small tools shall be defined as tools and equipment (power or non-power) with an individual purchase cost of less than \$750.
- 14.2.11 <u>Deduct Change Orders and Net Deduct Changes.</u> The application of the markup percentage referenced in the Contract will apply to both additive and deductive change orders. In the case of a deductive change order, the credit will be computed by applying the sliding scale percentages as outlined above so that a deductive change order would be computed in the same manner as an additive change order. In those instances where a change order involves but additive and deductive work, the additions and deductions will be netted and the markup percentage adjustments will be applied to the net amount.
- 14.2.12 <u>Contingency</u>. In no event will any lump sum or percentage amounts for "contingency" be allowed to be added as a separate line item in change order estimates. Unknowns attributed to labor hours will be accounted for when estimating labor hours anticipated to perform the work. Unknowns attributable to material scrap and waste will be estimated as part of the material costs.
- 14.3 <u>Unit Price Change Order Requests</u>. As an alternative to Lump Sum Change Order Request, the Owner or the Contractor acting with the approval of the Owner may choose the option to use Contract unit prices. Agreed upon Contract unit prices shall be the same for added quantities and deductive quantities. Unit prices are not required to be used for pricing change orders where other methods of pricing change order work are more equitable.

- 14.3 Cost Plus Change Order Requests. As an alternative to either Lump Sum Change Order Requests or Unit Price Change Order Requests, the Owner may elect to have any extra work performed on a cost plus markup percentage fee basis. Upon written notification, the Contractor shall perform such authorized extra work at actual cost for direct labor (working foreman, journeymen, apprentices, helpers, etc.), actual cost of labor burden, actual cost of material used to perform the extra work, and actual cost of rental of major equipment (without any charge for administration, clerical expense, general supervision or superintendent of any nature whatsoever, including general foremen, or the cost or rental of small tools, minor equipment, or plant) plus the approved markup percentage fee. The intent of this clause is to define allowable cost plus chargeable costs to be the same as those allowable when pricing Lump Sum Change Requests as outlined above. Owner and Contractor may agree in advance in writing on a maximum price for this work and Owner shall not be liable for any charge in excess of the maximum. Daily time sheets with names of all Contractor's employees working on the project will be required to be submitted to the Owner for both labor and equipment used by the Contractor for the time periods during which extra work is performed on a cost plus fee basis. Daily time sheets will break down the paid hours worked by the Contractor's employees showing both base contract work as well as extra work performed by each employee.
- 14.4 <u>Job Order Unit Prices.</u> Job Order unit prices as stated in the contract document or Change Order Request shall be based upon a regional RS Means Book or Gordian Group pricing.
- 14.5 <u>Claims for Additional Costs.</u>
  - 14.5.1 <u>Claim with no Requested Change.</u> If Contractor wishes to make a claim for an increase in the Contract Sum not related to a requested change, Contractor shall give Owner and Design Professional written notice thereof within twenty-one (21) days after the occurrence of the event giving rise to such claim, but, in any case before proceeding to execute the Work considered to be additional cost or time, except in an emergency endangering life or property in which case Contractor shall act in accordance with Section 10.3. No such claim shall be valid unless so made. If Owner and Contractor cannot agree on the amount of the adjustment in the Contract Sum, it shall be determined as set forth under Article 18. Any change in the Contract Sum resulting from such claim must be authorized by a Change Order.
  - 14.5.2 <u>Miscellaneous Claims.</u> If Contractor claims that additional cost is involved because of, but not limited to: (1) any written interpretation of the Contract Documents; (2) any order by Owner to stop the Work pursuant to Article 17 where Contractor was not at fault; or (3) any written order for a minor change in the Work issued pursuant to Section 14.6, Contractor shall make such claim as provided in Section 14.5.1.
  - 14.5.3 <u>Failure to Notify.</u> Should Contractor fail to call to the attention of Owner and Design Professional to discrepancies, errors, omissions, or inconsistencies in the Contract Documents, but claim additional costs for corrective Work after Contract award or after Owner's acceptance of Contractor's Construction Manager-at-Risk guaranteed maximum price, Owner may assume intent to circumvent competitive bidding for the necessary

corrective Work. In such case, Owner may choose to let a separate Contract for the corrective Work, or issue a CCD to require performance by Contractor. Claims for time extensions or for extra cost resulting from delayed notice of patent Contract Document discrepancies, errors, omissions, or inconsistencies will not be considered by Owner.

- 14.6 <u>Minor Changes.</u> Design Professional, with concurrence of OCM, will have authority to order minor changes in the Work not involving an adjustment in the Contract Sum or an extension of the Contract Time. Such changes shall be affected by written order which Contractor shall carry out promptly and record on as-built Record Documents.
- 14.7 <u>Concealed Site Conditions.</u> Contractor is responsible for visiting the Site and being familiar with local conditions such as the location, accessibility, and general character of the Site and/or building. If, in the performance of the Contract, subsurface, latent, or concealed conditions at the Site are found to be materially different from the information included in the Contract Documents, or if unknown conditions of an unusual nature are disclosed differing materially from the conditions usually inherent in Work of the character shown and specified, OCM and Design Professional shall be notified in writing of such conditions, Design Professional, with the approval of ODR, will promptly make such changes in the Drawings and Specifications as deemed necessary to conform to the different conditions. Any increase or decrease in the cost of the Work, or in the time within which the Work is to be completed, resulting from such changes will be adjusted by Change Order.
- 14.8 <u>Extension of Time</u>. All changes to the Contract Time made as a consequence of requests as required in the UGC's, must be documented by Change Order.
- 14.9 <u>Administration of Change Order Requests.</u> All changes in the Contract shall be administered in accordance with procedures approved by Owner, and when required, make use of such electronic information management system(s) as Owner may employ.
  - 14.9.1 Procedures.
    - 14.9.1.1 Procedures for administration of Change Orders shall be established by Owner and stated in the Contract Documents.
    - 14.9.1.2 No oral order, oral statement, or oral direction of Owner or his duly appointed representative shall be treated as a change under this article or entitle Contractor to an adjustment.
  - 14.9.2 <u>Routine Changes.</u> Routine changes shall be formally initiated by Design Professional or Owner by means of a Proposal Request form detailing requirements of the proposed change for pricing by Contractor, or may be initiated by Contractor by means of a Change Order Request form detailing proposed work, pricing, and time. This action may be preceded by communications between Contractor, Design Professional, and OCM concerning the need and nature of the change, but such communications shall not constitute a basis for beginning the proposed Work by Contractor. Except for emergency conditions described

below, approval of Contractor's cost proposal by Design Professional and ODR will be required for authorization to proceed with the Work being changed. Owner will not be responsible for the cost of Work changed without prior approval and Contractor may be required to remove Work so installed.

- 14.9.3 <u>Documentation</u>. All proposed costs or time for Change Order Work must be supported by itemized accounting of material, equipment, and associated itemized installation costs in sufficient detail following the outline and organization of the established Schedule of Values, and be supported by documented impact to critical path activities, to permit analysis by Design Professional and ODR using current estimating guides and/or practices. Photocopies of Subcontractor and vendor proposals shall be furnished unless specifically waived by ODR. Contractor shall provide written response to a change request within twenty-one (21) days of receipt.
- 14.9.4 <u>Emergencies.</u> Emergency changes to save life or property may be initiated by Contractor alone with the claimed cost and/or time of such work to be fully documented as to necessity and detail of the reported costs and/or time.
- 14.9.5 <u>Coordination with Schedule of Values.</u> The method of incorporating approved Change Orders into the parameters of the accepted Schedule of Values must be coordinated and administered in a manner acceptable to Owner.
- 14.10 <u>Construction Change Directive (CCD).</u> Owner may issue a written CCD directing a change in the Work prior to reaching agreement with Contractor on the adjustment, if any, in the Contract Sum and/or the Contract Time. Owner retains sole discretion whether or not to issue any CCD. Owner's issuance of a CCD does not require Owner to issue subsequent Change Orders. Owner and Contractor shall negotiate for appropriate adjustments, as applicable, to the Contract Sum or the Contract Time arising out of a CCD. Contractor shall not submit its costs for CCD Work with its Application for Payment until a Change Order has been issued. The Parties reserve their rights as to the disputed amount, subject to Article 18.
- 14.11 <u>Audit of Changes.</u> All Change Orders are subject to audit by Owner or its representative at any time and Change Order amounts may be adjusted lower as a result of such audit.

#### ARTICLE 15. PROJECT COMPLETION AND ACCEPTANCE

- 15.1 <u>Closing Inspections.</u>
  - 15.1.1 <u>Purpose of Inspection.</u> Inspection is for determining the completion of the Work, and does not relieve Contractor of its overall responsibility for completing the Work in a good and competent fashion, in compliance with the Contract. Work accepted with incomplete Punch list items, or the failure of Owner or other parties to identify Work that does not comply with the Contract Documents or is defective in operation or workmanship, does

not constitute a waiver of Owner's rights under the Contract or relieve Contractor of its responsibility for performance or warranties.

- 15.1.2 <u>Annotation</u>. Any Certificate issued under this Article may be annotated to indicate that it is not applicable to specified portions of the Work, or that it is subject to any limitation as determined by Owner.
- 15.1.3 <u>Substantial Completion Inspection.</u> When Contractor considers the entire Work or part thereof Substantially Complete, it shall notify OCM in writing that the Work will be ready for Substantial Completion inspection on a specific date. Contractor shall include with this notice Contractor's Punch list to indicate that it has previously inspected all the Work associated with the request for inspection, noting items it has corrected and included all remaining work items with date scheduled for completion or correction prior to final inspection. The failure to include any items on this list does not alter the responsibility of Contractor to complete all Work in accordance with the Contract Documents. If any of the items on this list prevents the Project from being used as intended, Contractor shall not request a Substantial Completion inspection. Owner and its representatives will review the list of items and schedule the requested inspection, or inform Contractor in writing that such an inspection is premature because the Work is not sufficiently advanced or conditions are not as represented on Contractor's list.
  - 15.1.3.1 Prior to the Substantial Completion inspection, Contractor shall furnish a copy of its marked-up Record Documents and a preliminary copy of each instructional manual, maintenance and operating manual, parts catalog, wiring diagrams, spare parts, specified written warranties, and like publications or parts for all installed equipment, systems, and like items as described in the Contract Documents. Delivery of these items is a prerequisite for requesting the Substantial Completion inspection.
  - 15.1.3.2 On the date requested by Contractor, or as mutually agreed upon pending the status of the Open Items List, Design Professional, OCM, Contractor, and other Owner representatives as determined by Owner will jointly attend the Substantial Completion inspection, which shall be conducted by OCM or Owner's representative. If Owner and Design Professional determines that the Work is Substantially Complete, Design Professional will issue a Certificate of Substantial Completion to be signed by Design Professional, Owner, and Contractor establishing the date of Substantial Completion and identifying responsibilities for security and maintenance. Design Professional will provide with this certificate a list of Punch list items (the pre-final Punch list) for completion prior to final inspection. This list may include items in addition to those on Contractor's Punch list, which the inspection team deems necessary to correct or complete prior to final inspection. If Owner occupies the Project upon determination of Substantial Completion, Contractor shall complete all corrective Work at the convenience of Owner, without disruption to Owner's use of the Project for its intended purposes.

- 15.1.4 <u>Final Inspection</u>. Contractor shall correct or complete all items on the final Punch list before requesting a Final Completion inspection and Final Payment. Unless otherwise agreed to in writing by the parties, Contractor shall complete this work within thirty (30) days of receiving the final Punch list. Upon completion of the final Punch list, Contractor shall notify Design Professional and OCM in writing stating the disposition of each final Punch list item. Design Professional, Owner, and Contractor shall promptly inspect the completed items. When the final Punch list is complete, and the Contract is fully satisfied according to the Contract Documents Design Professional will issue a certificate establishing the date of Final Completion. Completion of all Work is a condition precedent to Contractor's right to receive Final Payment.
- 15.1.5 Additional Inspections.
  - 15.1.5.1 If Owner's inspection team determines that the Work is not Substantially Complete at the Substantial Completion inspection, Owner or Design Professional will give Contractor written notice listing cause(s) of the rejection. Contractor will set a time for completion of incomplete or defective work acceptable to Owner. Contractor shall complete or correct all work so designated prior to requesting a second Substantial Completion inspection. Owner's or Design Professional's failure to include items as causes of rejection does not constitute a waiver of Owner's right under the Contract or relieve Contractor of its responsibility for performance.
  - 15.1.5.2 If Owner's inspection team determines that the Work is not complete at the Final Completion inspection, Owner or Design Professional will give Contractor written notice listing the cause(s) of the rejection. Contractor will set a time for completion of incomplete or defective work acceptable to Owner. Contractor shall complete or correct all Work so designated prior to again requesting a final inspection. Owner's or Design Professional's failure to include items as causes of rejection does not constitute a waiver of Owner's right under the Contract or relieve Contractor of its responsibility for performance.
  - 15.1.5.3 The Contract contemplates three (3) comprehensive inspections: the Substantial Completion inspection, the Final Completion inspection, and the inspection of completed final Punch list items. The cost to Owner of additional inspections resulting from the Work not being ready for one or more of these inspections is the responsibility of Contractor. Owner may issue a CO deducting these costs from Final Payment. Upon Contractor's written request, Owner will furnish documentation of any costs so deducted. Work added to the Contract by Change Order after Substantial Completion inspection is not corrective Work for purposes of determining timely completion, or assessing the cost of additional inspections.

- 15.1.6 <u>Phased Completion</u>. The Contract may provide, or Project conditions may warrant, as determined by ODR, that designated elements or parts of the Work be completed in phases. Where phased completion is required or specifically agreed to by the parties, the provisions of the Contract related to closing inspections, occupancy, and acceptance apply independently to each designated element or part of the Work. For all other purposes, unless otherwise agreed by the parties in writing, Substantial Completion of the Work as a whole is the date on which the last element or part of the Work as a whole is the date on which the last element or part of the Work as a whole is the date on which the last element or part of the Work as a whole is the date on which the last element or part of the Work as a whole is the date on which the last element or part of the Work as a whole is the date on which the last element or part of the Work as a Final Completion certificate.
- 15.2 <u>Owner's Right of Occupancy.</u> Owner may occupy or use all or any portion of the Work following Substantial Completion, or at any earlier stage of completion. Should Owner wish to use or occupy the Work, or part thereof, prior to Substantial Completion, Owner will notify Contractor in writing and identify responsibilities for security and maintenance. Work performed on the premises by third parties on Owner's behalf does not constitute occupation or use of the Work by Owner for purposes of this Article. All Work performed by Contractor after occupancy, whether in part or in whole, shall be at the convenience of Owner so as to not disrupt Owner's use of, or access to, occupied areas of the Project.

#### 15.3 Acceptance and Payment.

- 15.3.1 <u>Request for Final Payment.</u> Following the certified completion of all Work, including all final Punch list items, cleanup, and the delivery of Record Documents, Contractor shall submit a certified Application for Final Payment and include all sums held as retainage and forward to Design Professional and OCM for review and approval.
- 15.3.2 <u>Final Payment Documentation</u>. Contractor shall submit, prior to or with the Application for Final Payment, final copies of all Close-Out Documents, maintenance and operating instructions, guarantees and warranties, certificates, Record Documents, and all other items required by the Contract. Contractor shall submit evidence of return of access keys and cards, evidence of delivery to Owner of attic stock, spare parts, and other specified materials. Contractor shall submit consent of surety to Final Payment form and an affidavit that all payrolls, bills for materials and equipment, subcontracted work, and other indebtedness connected with the Work, except as specifically noted, are paid, will be paid after payment from Owner, or otherwise satisfied within the period of time required by Tex. Gov't Code, Chapter 2251. Contractor shall furnish documentation establishing payment or satisfaction of all such obligations, such as receipts, releases, and waivers of claims and liens arising out of the Contract. Contractor is affidavit notes that claim as an exception.
- 15.3.3 <u>Design Professional Approval.</u> Design Professional will review a submitted Application for Final Payment promptly but in no event later than ten (10) days after its receipt. Prior to the expiration of this deadline, Design Professional will either: 1) return the Application

for Final Payment to Contractor with corrections for action and resubmission; or 2) accept it, note approval, and send to Owner.

- 15.3.4 <u>Offsets and Deductions.</u> Owner may deduct from the Final Payment all sums due from Contractor. If the Certificate of Final Completion notes any Work remaining, incomplete, or defects not remedied, Owner may deduct the cost of remedying such deficiencies from the Final Payment. On such deductions, Owner will identify each deduction, the amount, and the explanation of the deduction on or by the twenty-first (21st) day after Owner's receipt of an approved Application for Final Payment. Such offsets and deductions shall be incorporated via a final Change Order, including a CCD as may be applicable.
- 15.3.5 <u>Final Payment Due</u>. Final Payment is due and payable by Owner, subject to all allowable offsets and deductions, on the thirtieth (30th) day following Owner's approval of the Application for Payment. If Contractor disputes any amount deducted by Owner, Contractor shall give notice of the dispute on or before the thirtieth (30th) day following receipt of Final Payment. Failure to do so will bar any subsequent claim for payment of amounts deducted.
- 15.3.6 <u>Effect of Final Payment</u>. Final Payment shall not constitute a waiver of claims by Owner relating to the condition of the Work including those arising from:
  - 15.3.6.1 Faulty or defective Work appearing after Substantial Completion (latent defects);
  - 15.3.6.2 Failure of the Work to comply with the requirements of the Contract Documents;
  - 15.3.6.3 Terms of any warranties required by the Contract, or implied by law; or
  - 15.3.6.4 Claims arising from personal injury or property damage to third parties.
- 15.3.7 <u>Waiver of Claims.</u> Acceptance of final payment constitutes a waiver of all claims and liens by Contractor except those specifically identified in writing and submitted to ODR prior to the application for Final Payment.
- 15.3.8 <u>Effect on Warranty.</u> Regardless of approval and issuance of Final Payment, the Contract is not deemed fully performed by Contractor and closed until the expiration of all warranty periods.

# ARTICLE 16. WARRANTY AND GUARANTEE

16.1 <u>Contractor's General Warranty and Guarantee</u>. Contractor warrants to Owner that all Work is executed in accordance with the Contract, complete in all parts and in accordance with approved practices and customs, and of the required finish and workmanship. Contractor further warrants

that unless otherwise specified, all materials and equipment incorporated in the Work under the Contract are new. Owner may, at its option, agree in writing to waive any failure of the Work to conform to the Contract, and to accept a reduction in the Contract Sum for the cost of repair or diminution in value of the Work by reason of such defect. Absent such a written agreement, Contractor's obligation to perform and complete the Work in accordance with the Contract Documents is absolute and is not waived by any inspection or observation, or lack thereof, by Owner, Design Professional, or others, by making any progress payment or final payment, by the use or occupancy of the Work or any portion thereof by Owner, at any time, or by any repair or correction of such defect made by Owner.

- 16.1.1 <u>Warranty Period</u>. Except as may be otherwise specified or agreed, Contractor shall repair all defects in materials, equipment, or workmanship appearing within one (1) year from the date of Substantial Completion of the Work. If Substantial Completion occurs by phase, the warranty period for that particular Work begins on the date of Substantial Completion of that phase, or as otherwise stipulated on the Certificate of Substantial Completion for that particular Work.
- 16.1.2 <u>Limits on Warranty.</u> Contractor's warranty and guarantee hereunder excludes defects or damage caused by:
  - 16.1.2.1 Modification or improper maintenance or operation by persons other than Contractor, Subcontractors, or any other individual or entity for whom Contractor is not responsible, unless Owner is compelled to undertake maintenance or operation due to the neglect of Contractor.
  - 16.1.2.2 Normal wear and tear under normal usage after acceptance of the Work by Owner.
- 16.1.3 <u>Events Not Affecting Warranty.</u> Contractor's obligation to perform and complete the Work in a good and workmanlike manner in accordance with the Contract Documents is absolute. None of the following will constitute an acceptance of defective Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:
  - 16.1.3.1 Observations, or lack thereof, by Owner and/or Design Professional;
  - 16.1.3.2 Recommendation to pay any progress or final payment by Design Professional;
  - 16.1.3.3 The issuance of a certificate of Substantial Completion or any payment by Owner to Contractor under the Contract Documents;
  - 16.1.3.4 Use or occupancy of the Project or any part thereof by Owner;
  - 16.1.3.5 Any acceptance by Owner or any failure to do so;

- 16.1.3.6 Any review by Owner of a Shop Drawing or sample submittal; or
- 16.1.3.7 Any inspection, test or approval by others.
- 16.2 <u>Separate Warranties.</u> If a particular piece of equipment or component of the Work for which the Contract requires a separate warranty is placed in continuous service before Substantial Completion, the warranty period for that equipment or component will not begin until Substantial Completion, regardless of any warranty agreements in place between suppliers and/or Subcontractors and Contractor. Contractor shall assume any duty to repair not otherwise covered by those warranty agreements. Owner will certify the date of service commencement in the Substantial Completion certificate.
  - 16.2.1 <u>Assumption.</u> In addition to Contractor's warranty and duty to repair, Contractor expressly assumes all warranty obligations required under the Contract for specific building components, systems, and equipment.
  - 16.2.2 <u>Assignment.</u> Contractor may satisfy any such obligation by obtaining and assigning to Owner a complying warranty from a manufacturer, supplier, or Subcontractor. Where an assigned warranty is tendered and accepted by Owner which does not fully comply with the requirements of the Contract, Contractor remains liable to Owner on all elements of the required warranty not provided by the assigned warranty.
- 16.3 <u>Correction of Defects.</u> Upon receipt of written notice from Owner, or any agent of Owner designated as responsible for management of the warranty period, of the discovery of a defect, Contractor shall promptly remedy the defect(s), and provide written notice to Owner and designated agent indicating action taken. In case of emergency where delay would cause serious risk of loss or damage to Owner, or if Contractor fails to remedy within thirty (30) days, or within another period agreed to in writing, Owner may correct the defect and be reimbursed the cost of remedying the defect from Contractor or its surety.
- 16.4 <u>Certification of No Asbestos Containing Materials or Work.</u> Contractor shall provide a notarized certification to Owner that all equipment and materials used in fulfillment of its Contract responsibilities are non-Asbestos Containing Building Materials (ACBM). This certification must be provided no later than Contractor's application for Final Payment. Contractor shall insure that Texas Department of State Health Services licensed individual, consultants or companies are used for any required asbestos work including asbestos inspection, asbestos abatement plans/specifications, asbestos abatement, asbestos project management and third-party asbestos monitoring.
- 16.5 <u>Compliance with Acts.</u> Contractor shall warrant and ensure compliance with the following Acts by Contractor or Contractor's Subcontractors and assigns:
  - Asbestos Hazard Emergency Response Act (AHERA-40 CFR 763-99 (7));
  - National Emission Standards for Hazardous Air Pollutants (NESHAP-EPA 40 CFR 61, Subpart M-National Emission Standard for Asbestos); and

• Texas Asbestos Health Protection Rules (TAHPR-Tex. Admin. Code Title 25, Part 1, Ch. 295C, Asbestos Health Protection)

#### ARTICLE 17. SUSPENSION AND TERMINATION

- 17.1 <u>Suspension of Work for Cause.</u> Owner may, at any time without prior notice, suspend all or any part of the Work, if after reasonable observation and/or investigation, Owner determines it is necessary to do so to prevent or correct any condition of the Work, which constitutes an immediate safety hazard, or which may reasonably be expected to impair the integrity, usefulness, or longevity of the Work when completed.
  - 17.1.1 <u>Cease Work.</u> Owner will give Contractor a written notice of suspension for cause, setting forth the reason for the suspension and identifying the Work suspended. Upon receipt of such notice, Contractor shall immediately stop the Work so identified.
  - 17.1.2 <u>Investigation</u>. As soon as practicable following the issuance of such a notice, Owner will initiate and complete a further investigation of the circumstances giving rise to the suspension, and issue a written determination of the findings. Contractor shall cooperate with Owner's investigation.
  - 17.1.3 <u>Outcome.</u> If it is confirmed that the cause was within the control of Contractor, Contractor will not be entitled to an extension of Contract Time or any compensation for delay resulting from the suspension. If the cause is determined not to have been within the control of Contractor, and the suspension has prevented Contractor from completing the Work within the Contract Time, the suspension shall be considered an Excusable Delay and an extension of Contract Time will be granted through a Change Order.
  - 17.1.4 <u>Time.</u> Suspension of Work under this provision will be no longer than is reasonably necessary to investigate and remedy the conditions giving rise to the suspension.
- 17.2 Suspension of Work for Owner's Convenience. Upon seven (7) days written notice to Contractor, Owner may at any time without breach of the Contract suspend all or any portion of the Work for its own convenience. When such a suspension prevents Contractor from completing the Work within the Contract Time, it shall be considered an Excusable Delay. A notice of suspension for convenience may be modified by Owner at any time on seven (7) days written notice to Contractor. If Owner suspends the Work for its convenience for more than sixty (60) consecutive days, Contractor may elect to terminate the Contract pursuant to the provisions of the Contract.
- 17.3 <u>Termination by Owner for Cause.</u>
  - 17.3.1 <u>Cause.</u> Upon written notice to Contractor and its surety, Owner may, without prejudice to any right or remedy, terminate the Contract and take possession of the Site and of all materials, equipment, tools, construction equipment, and machinery thereon owned by Contractor under any of the following circumstances:

- 17.3.1.1 Persistent or repeated failure or refusal, except during complete or partial suspensions of work authorized under the Contract, to supply enough properly skilled workmen or proper materials;
- 17.3.1.2 Persistent disregard of laws, ordinances, rules, regulations, or orders of any public authority having jurisdiction, including Owner;
- 17.3.1.3 Persistent failure to prosecute the Work in accordance with the Contract, and to ensure its completion within the Contract Time;
- 17.3.1.4 Failure to remedy defective work;
- 17.3.1.5 Failure to pay Subcontractors, laborers, and material suppliers pursuant to Tex. Gov't Code, Chapter 2251;
- 17.3.1.6 Persistent endangerment to the safety of labor or of the Work;
- 17.3.1.7 Failure to supply or maintain statutory bonds or to maintain required insurance pursuant to the Contract;
- 17.3.1.8 Any material breach of the Contract; or
- 17.3.1.9 Contractor's insolvency, bankruptcy, or demonstrated financial inability to perform the Work.
- 17.3.2 <u>No Waiver</u>. Failure by Owner to exercise the right to terminate in any instance is not a waiver of the right to do so in any other instance.
- 17.3.3 <u>Notice.</u> Owner may immediately terminate the Contract under the provisions of this Section 17.3 upon written notice to Contractor and Contractor's sureties. Owner may also give notice to Contractor and Contractor's sureties of Owner's intent to terminate the Contract under the provisions of this Section 17.3 at any later date upon written notice to Contractor and its sureties.
- 17.3.4 <u>Cure.</u> Should Contractor or its surety, after having received notice of Owner's intent to terminate at a later date, demonstrate to the satisfaction of Owner that Contractor or its surety are proceeding to correct such default with diligence and promptness, upon which the notice of intent to terminate was based, the notice of intent to terminate may be rescinded in writing by Owner. If so rescinded, the Work may continue without an extension of Contract Time.
- 17.3.5 <u>Failure to Cure.</u> Should Contractor or its surety fail, after having received notice of Owner's intent to terminate, to commence and continue correction of such default with diligence and promptness to the satisfaction of Owner within the date specified by Owner, Owner may arrange for completion of the Work and deduct the cost of completion from the unpaid Contract Sum.

- 17.3.5.1 This amount includes the cost of additional Owner costs such as Design Professional services, other consultants, and contract administration.
- 17.3.5.2 Owner will make no further payment to Contractor or its surety unless the costs to complete the Work are less than the Contract balance, then the difference shall be paid to Contractor or its surety. If such costs exceed the unpaid balance, Contractor or its surety will pay the difference to Owner.
- 17.3.5.3 This obligation for payment survives the termination of the Contract.
- 17.3.5.4 Owner reserves the right in termination for cause to take assignment of all the Contracts between Contractor and its Subcontractors, vendors, and suppliers. Owner will promptly notify Contractor of the contracts Owner elects to assume. Upon receipt of such notice, Contractor shall promptly take all steps necessary to effect such assignment.
- 17.3.6 <u>Conversion to Termination for Convenience.</u> In the event that any termination of the Contract for cause under this Section 17.3 is later determined to have been improper, the termination shall automatically convert to a termination for convenience of Owner and Contractor's recovery for termination shall be strictly limited to the payments allowable under Subsection 17.4.3.
- 17.4 <u>Termination for Convenience of Owner</u>. Owner reserves the right, without breach, to terminate the Contract prior to, or during the performance of the Work, for any reason. Upon such an occurrence, the following shall apply:
  - 17.4.1 <u>Notice.</u> Owner will immediately notify Contractor and Design Professional in writing, specifying the reason for and the effective date of the Contract termination. Such notice may also contain instructions necessary for the protection, storage, or decommissioning of incomplete Work or systems, and for safety.
  - 17.4.2 <u>Contractor Action</u>. Upon receipt of the notice of termination, Contractor shall immediately proceed with the following obligations, regardless of any delay in determining or adjusting any amounts due at that point in the Contract:
    - 17.4.2.1 Stop all work.
    - 17.4.2.2 Place no further subcontracts or orders for materials or services.
    - 17.4.2.3 Terminate all subcontracts for convenience.
    - 17.4.2.4 Cancel all materials and equipment orders as applicable.
    - 17.4.2.5 Take action that is necessary to protect and preserve all property related to the Contract which is in the possession of Contractor.

- 17.4.3 <u>Contractor Remedy.</u> When the Contract is terminated for Owner's convenience, Contractor may recover from Owner payment for all Work completed including the corresponding pro rata portion of Contractor's overhead and profit. Contractor may not claim lost profits on other work or lost business opportunities.
- 17.5 <u>Termination by Contractor.</u> If the Work is stopped for a period of ninety (90) days under an order of any court or other public authority having jurisdiction, or as a result of an act of government, such as a declaration of a national emergency making materials unavailable, through no act or fault of Contractor or Subcontractor or their agents or employees or any other persons performing any of the Work under a contract with Contractor, then Contractor may, upon thirty (30) additional days written notice to ODR, terminate the Contract and recover from Owner payment for all Work completed including the corresponding pro rata portion of Contractor's overhead and profit, but not lost profits on other work or lost business opportunities. If the cause of the Work stoppage is removed prior to the end of the thirty (30) day notice period, Contractor may not terminate the Contract.
- 17.6 <u>Settlement on Termination.</u> When the Contract is terminated for any reason, at any time prior to one hundred eighty (180) days after the effective date of termination, Contractor shall submit a final termination settlement proposal to Owner based upon recoverable costs as provided under the Contract. If Contractor fails to submit the proposal within the time allowed, Owner may determine the amount due to Contractor because of the termination and pay the determined amount to Contractor as final payment.

## ARTICLE 18. DISPUTE RESOLUTION

- 18.1 <u>Contracts Less Than \$250,000.</u> The dispute resolution process provided for in Texas Government Code, Chapter 2260, shall be used by Contractor or Design Professional to attempt to resolve any claim for breach of Contract made by Contractor or Design Professional that is not resolved under procedures described throughout the Uniform General Conditions or any Supplementary or Special Conditions of the Contract, *where the amount in controversy is less than \$250,000*.
- 18.2 <u>Contracts \$250,000 or Greater.</u> Contractor or Design Professional and Owner shall use the following dispute resolution process prior to initiating any litigation or filing suit in a court of competent jurisdiction.
  - 18.2.1 <u>Mediation.</u> If a dispute arises out of or relates to the Contract or the breach thereof in which the amount in controversy is \$250,000 or greater, and if the dispute cannot be settled through negotiation, the parties agree first to try to settle the dispute by mediation using the procedures specified in this section prior to the commencement of any legal action. The parties commit to participate in the proceedings in good faith with the intention of resolving the dispute if at all possible.
    - 18.2.1.1 The party seeking to initiate mediation of a dispute shall give written notice to the other party describing the nature of the dispute, the initiating party's claim

for relief and identifying one or more individuals with authority to settle the dispute on such party's behalf. The party receiving such notice shall have five (5) business days to designate by written notice one or more individuals with authority to settle the dispute on such party's behalf.

- 18.2.1.2 The parties shall then have ten (10) business days to submit to each other a written list of acceptable qualified mediators not affiliated with any of the parties. The mediator shall possess the qualifications required under Civil Practice and Remedies Code, § 154.052, be subject to the standards and duties prescribed by Civil Practice and Remedies Code, §154.053, and have the qualified immunity prescribed by Civil Practice and Remedies Code, §154.055, if applicable. The parties shall mutually agree on the mediator.
- 18.2.1.3 In consultation with the mediator selected, the parties shall promptly designate a mutually convenient time and place for the mediation, and unless circumstances require otherwise, such time to be not later than forty-five (45) days after selection of the mediator.
- 18.2.1.4 The parties agree to participate in the mediation to its conclusion. The mediation shall be terminated (i) by the execution of a settlement agreement by the parties, (ii) by a declaration of the mediator that the mediation is terminated, or (iii) by a written declaration of a party to the effect that the mediation process is terminated at the conclusion of one (1) full day's mediation session. Even if the mediation is terminated without a resolution of the dispute, the parties agree not to terminate negotiations and not to commence any legal action or seek other remedies prior to the expiration of five (5) days following the mediation. Notwithstanding the foregoing, any party may commence litigation within such five (5) day period if litigation could be barred by an applicable statute of limitations or in order to request an injunction to prevent irreparable harm.
- 18.2.1.5 The parties shall share the cost of the mediation process equally although each party's attorneys and witnesses or specialists are the direct responsibility of each party and their fees and expenses shall be the responsibility of the individual parties.
- 18.2.1.6 The entire mediation process is confidential, and no stenographic, visual or audio record shall be made. All conduct, statements, promises, offers, views and opinions, whether oral or written, made in the course of the mediation by any party, their agents, employees, representatives or other invitees and by the mediator are confidential and shall, in addition and where appropriate, be deemed to be privileged and shall not be discoverable or admissible for any purpose, including impeachment, in any litigation or other proceeding involving the parties.

- 18.3 <u>Owner Retained Rights.</u> Nothing herein shall hinder, prevent, or be construed as a waiver of Owner's right to seek redress on any disputed matter in a court of competent jurisdiction.
- 18.4 <u>No Waiver.</u> Except as may be expressly and specifically provided otherwise by Chapter 114, Texas Civil Practice & Remedies Code, nothing herein shall be construed as a waiver of sovereign immunity; nor constitute or be construed as a waiver of any of the privileges, rights, defenses, remedies, or immunities available to the State of Texas or the University of North Texas System.
- 18.5 <u>No Attorney's Fees.</u> In any litigation between Owner and Contractor or Design Professional arising from the Contract or Project, neither party will be entitled to an award of legal fees or costs in any judgment regardless of which is deemed the prevailing party.
- 18.6 <u>Interest.</u> Owner shall be billed in accordance with Chapter 2251 of Texas Government Code and interest, if any, on past due payments shall accrue and be paid in accordance with 2251 of the Texas Government Code.

### ARTICLE 19. MISCELLANEOUS

- 19.1 Right to Audit. Owner, or any of its duly authorized auditors or representatives including the State Auditor's Office, shall during regular business hours and upon reasonable notice have access to and the right to examine, and be permitted to audit and copy, any directly pertinent books, documents, papers, and records of Contractor, including, without limitation, complete documentation supporting accounting entries, books, correspondence, instructions, drawings, receipts, subcontracts, Subcontractor's quotes, proposals, purchase order, vouchers, memoranda, schedules, electronic data, pictures, videos, logs, minutes, notes, reports and other data relating to the Project. Further, Contractor or Design Professional agree to include in all subcontracts a provision to the effect that Subcontractor agrees that Owner or any of its duly authorized representatives shall have access to and the right to examine any directly pertinent books, documents, papers, and records of such Subcontractor relating to any claim arising from the Contract and subcontract, whether or not the Subcontractor is a party to the claim. The period of access and examination described herein shall continue until the later of seven (7) years after Final Payment or final disposition of any disputes, claims, litigation, or appeals arising out of the Contract.
- 19.2 <u>Records and Inspection.</u> Owner's representatives may (without limitation) conduct verifications such as counting employees at the construction site, witnessing the distribution of payroll, verifying information and amounts through interviews and written confirmations with Contractor employees, Subcontractors and vendors. Contractor's "records" as referred to in this contract shall include any and all information, materials and data of every kind and character, including without limitation, records, books, papers, documents, subscriptions, recordings, agreements, purchase orders, leases contracts, commitments, arrangements, notes, daily diaries, emails, superintendent reports, drawings, receipts, vouchers and memoranda and any and all other agreements, sources of information and matters that may in the Owner's judgment have any bearing on or pertain to

any matters, rights, duties or obligations under or covered by any Contract Documents. Such records shall include written policies and procedures; time sheets; payroll registers; payroll records; cancelled payroll checks; subcontract files (including proposals of successful and unsuccessful bidders, bid recaps, negotiation notes, etc.); original bid estimates; estimating work sheets; correspondence; change order files (including documentation; invoices and related payment documentation; general ledger, information detailing cash and trade discounts earned, insurance rebates and dividends; and any other contractor records which may have a bearing on matters of interest to the Owner in connection with the contractor's dealings with the Owner (all foregoing hereinafter referred to as "records" to the extent necessary to adequately permit evaluation and verification of any or all of the following:

- 19.2.1 Deliverables: Compliance with contract requirements for deliverables
- 19.2.2 Plans and Specifications: Compliance with approved plans and specifications
- 19.2.3 Ethics Expectations: Compliance with Owner's business ethics expectations
- 19.2.4 <u>Change Order Pricing</u>: Compliance with contract provisions regarding the pricing of Change Orders
- 19.2.5 <u>Invoice Accuracy</u>: Accuracy of Contractor representations regarding the pricing of invoices
- 19.2.6 <u>Claims:</u> Accuracy of Contractor representations related to claims submitted by the Contractor or any of his payees.
- 19.3 <u>Audit of Subcontractor:</u> Contractor shall require all payees receiving \$10,000 or more in connection with this contract to comply with the audit requirements herein by including the requirements hereof in a written contract agreement.
- 19.4 <u>Overpricing or Overcharges:</u> If an audit inspection or examination discloses overpricing or overcharges to the Owner (of any nature) by the Contractor and/or Subcontractors in excess of \$100,000, in addition to adjusting for overcharges, the reasonable actual cost of the Owner's audit shall be reimbursed to the Owner by Contractor. Any adjustments and/or payments which must be made as a result of any such audit or inspection of Contractor's records shall be made within a reasonable amount of time (not to exceed 90 days) from presentation of Owner's finding to Contractor.
- 19.5 <u>Documentation Requirements:</u> In addition to the normal paperwork documentation the Contractor typically furnishes to the Owner, in order to facilitate efficient use of Owner resources when reviewing and/or auditing the Contractor's billings and related reimbursable cost records, Contractor agrees to furnish upon request the following types of information in the specified computer (PC) readable file format(s), as applicable:

Type of Record	PC Readable File Format
Monthly Job Cost Detail_	.pdf and Excel_
Detailed Job Cost History To Date_	.pdf and Excel_
Monthly Labor Distribution Detail (if not already separately detailed in the Job Cost Detail)	.pdf and Excel_
Total Job To Date Labor Distribution Detail (if not already separately detailed in the Job Cost History To Date)_	.pdf and Excel_
Employee Timesheets Documenting Time Worked By All Individuals Who Charge Reimbursable Time To The Project_	.pdf_
Daily Foreman Reports Listing Names And Hours And Tasks Of Personnel Who Worked On The Project_	.pdf_
Daily Superintendent Reports_	.pdf_
Detailed Subcontract Status Reports (showing original subcontract value, approved subcontract change orders, subcontractor invoices, payments to subcontractors, etc.)_	.pdf and Excel_
Copies Of Executed Subcontracts With All Subcontractors	.pdf_
Copies Of All Executed Change Orders Issued To Subcontractors	.pdf_
Copies Of All Documentation Supporting All Reimbursable Job Costs (subcontractor payment applications, vendor invoices, internal cost charges, etc.)	.pdf_

- 19.6 <u>Supplementary or Special Conditions.</u> When the Work contemplated by Owner is of such a character that the foregoing Uniform General Conditions of the Contract cannot adequately cover necessary and additional contractual relationships, the Contract may include Supplementary General or Special Conditions as described below:
  - 19.6.1 <u>Supplementary Conditions.</u> Supplementary Conditions may describe the standard procedures and requirements of contract administration. Supplementary Conditions may expand upon matters covered by the Uniform General Conditions, where necessary, provided the expansion does not weaken the character or intent of the Uniform General

Conditions. Supplementary Conditions are of such a character that it is to be anticipated that Owner may normally use the same, or similar, conditions to supplement each of its several projects.

- 19.6.2 <u>Special Conditions.</u> Special Conditions shall relate to a particular Project and be unique to that Project but shall not weaken the character or intent of the Uniform General Conditions.
- 19.7 <u>Federally Funded Projects.</u> On federally funded projects, Owner may waive, suspend, or modify any provision in these Uniform General Conditions which conflicts with any federal statue, rule, regulation, or procedure, where such waiver, suspension, or modification is essential to receipt by Owner of such federal funds for the Project. In the case of any Project wholly financed by federal funds, any standards required by the enabling federal statute, or any federal rules, regulations, or procedures adopted pursuant thereto, shall be controlling.
- 19.8 <u>Internet-based Project Management Systems.</u> At its option, Owner may administer its design and construction management through an Internet-based management system. In such cases, Contractor shall conduct communication through this media and perform all Project related functions utilizing this database system. This includes correspondence, submittals, Requests for Information, vouchers, or payment requests and processing, amendment, Change Orders, and other administrative activities.
  - 19.8.1 Accessibility and Administration.
    - 19.8.1.1 When used, Owner will make the software accessible via the Internet to all Project team members.
    - 19.8.1.2 Owner shall administer the software.
  - 19.8.2 <u>Training</u>. When used, Owner shall provide training to the Project team members.
- 19.9 <u>Computation of Time.</u> In computing any time period set forth in this Contract, the first day of the period shall not be included, but the last day shall be.
- 19.10 <u>Survival of Obligations.</u> All representations, indemnifications, warranties and guarantees made in accordance with the Contract Documents will survive final payment, completion and acceptance of the Work, as well as termination for any reason. All duties imposed upon the Contractor by reason of termination, including without limitation the duty to assign subcontracts and contracts with vendors and suppliers, shall likewise survive the termination of the Contract.
- 19.11 <u>No Waiver of Performance.</u> The failure of either party in any instance to insist on the performance of any of the terms, covenants or conditions of the Contract Documents, or to exercise any of the rights granted thereunder, shall not be construed as waiver of any such term, covenant, condition or right with respect to further performance.
- 19.12 <u>Governing Law and Venue.</u> The Contract shall be governed by the laws of the State of Texas. Venue for any suit arising from the Contract will be in a court of competent jurisdiction subject to

the mandatory venue statute set forth in § 105.151 of the Texas Education Code, or if mandatory venue is not applicable in the county in which the Project is located.

- 19.13 <u>Captions and Catch Lines.</u> The captions and catch lines used throughout the Uniform General Conditions and elsewhere in the Contract Documents are for ease of reference only and have no effect on the meaning of the terms and conditions set forth herein.
- 19.14 <u>Independent Contractor Status.</u> The Contract Documents create an independent contractor relationship between the Owner and Contractor and neither party's employees or contractors shall be considered employees, contractors, partners or agents of the other party.
- 19.15 <u>No Third-Party Beneficiaries.</u> The parties do not intend, nor shall any clause be interpreted to create in any third party, any obligations to, or right of benefit by, such third party under these Contract Documents from either the Owner or Contractor.
- 19.16 <u>Child Support Obligor</u>. Notwithstanding anything to the contrary within the Contract Documents, it is understood and agreed between the parties that in accordance with the laws of the State of Texas, a child support obligor who is more than thirty (30) days delinquent in paying child support, and a business entity in which an obligor is a sole proprietor, partner, shareholder, or owner with an ownership interest of at least twenty-five percent (25%), is not eligible to receive payments from state funds under a contract to provide property, materials or services until all arrearages have been paid or the obligor is in compliance with a written repayment agreement.
- 19.17 <u>Buy America Requirements for Iron and Steel Used in Construction.</u> In accordance with Texas Government Code 2252, Section 2252.202, all iron or steel products (i.e., rolled structural shapes including wide flange beams and columns, angles, bars, plates, sheets, hollow structural sections, pipe, etc.) shall be produced, manufactured and fabricated in the United States.
- 19.18 <u>No Assignment.</u> This Contract may not be assigned by either party without the prior written consent of the other, except either party may, upon notice to the other party but without the other party's consent, assign this Contract to a present or future affiliate or successor, provided that any such assignment by Contractor shall be contingent on Owner's determination that the assignee is qualified to perform the Work, is in good standing with the State of Texas and otherwise eligible to do business with the State of Texas.
- 19.19 <u>Severability.</u> If any provision, sentence, clause or article of this Contract is found to be invalid or unenforceable for any reason, the remaining provisions shall continue in effect as if the invalid or unenforceable provision were not in the Contract. All provisions, sentences, clauses and articles of this Contract are severable for this purpose.
- 19.20 <u>Parties Bound.</u> Execution of this Contract by each party binds the entity represented as well as its employees, agents, successors and assigns to its faithful performance.
- 19.21 <u>Public Information.</u> Owner shall release information to the extent required by the Texas Public Information Act and other applicable law. If requested, Contractor shall make public information available to Owner in an electronic format.

#### 19.22 Business Ethics Expectations

- 19.22.1 <u>Contractor</u>: During the course of pursuing contracts with the Owner and while performing the Work in accordance with the Contract, Contractor agrees to maintain business ethics standards aimed at avoiding any impropriety or conflict of interest which could be construed to have an adverse impact on the Owner's best interests
- 19.22.2 <u>Reasonable Action</u>: Contractor shall take reasonable actions to prevent any actions or conditions which could result in a conflict with the Owners' best interests. These obligations shall apply to the activities of Contractor employees, agents, subcontractors, subcontractor employees, consultants of Contractor, etc.
- 19.22.3 <u>Gifts and Other Considerations</u>: Contractor and its employees, agents, subcontractors, and material suppliers (or their representatives) should not make or cause to be made any cash payments, commissions, employment, gifts, entertainment, free travel, loans free work, substantially discounted work, or any other considerations to the Owner's representatives, employees or their relatives.
- 19.22.4 <u>Subcontractors</u>: Contractor and its employees, agents or subcontractors (or their relatives) should not receive any cash payments, commissions, employment, gifts, entertainment, free travel, loans, free work, or substantially discounted work or any other considerations from subcontractors, or material suppliers or any other individuals, organizations, or businesses receiving funds in connection with the Project.
- 19.22.5 <u>Other Jobs</u>: Contractor shall not receive the benefit of discounted bids or reduced payments on other jobs as an offset to bids, base subcontracts, and/or change orders on the Project.
- 19.22.6 <u>Owner Notification</u>: It is expected that the ODR be notified as soon as possible whenever anyone aware of these business ethics expectations believes there has been a failure to comply with the provisions herein or an attempt to have someone violate the business ethics expectations.
  - Notifications may be made anonymously.
  - Contractor representatives and/or subcontractor representatives familiar with the Project shall provide upon request a Certified Management Representation Letter in a form agreeable to the Owner stating that they are not aware of any situations violating the business ethics expectations outlined herein or any similar potential conflict of interest situations in connection with the Project.
- 19.22.7 <u>Subcontractor Contracts:</u> Contractor agrees to include the Business Ethics Expectation clause in all contracts with Subcontractors, subconsultants and material suppliers receiving more than \$10,000 in funds in connection with the Project.
- 19.22.8 <u>Interviews and Audits</u>: Contractor and any other third party receiving more than \$10,000 in connection with the Project shall permit interviews of employees and audits of its records by ODR to evaluate compliance with business ethics expectations. Such reviews and audits

will encompass all dealings and activities of Contractor's employees, agents, representatives, vendors, subcontractors, and other third parties paid by Contractor.

19.23 <u>Entire Agreement.</u> The Contract Documents supersede in full all prior discussions and agreements (oral and written) between the parties relating to the subject matter hereof and constitute the entire agreement.